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TRANSPORT SCOTLAND
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Road Asset Management Plan for Scottish Trunk Roads

January 2016

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Foreword

A well maintained and managed transport infrastructure is vital to Scotland.

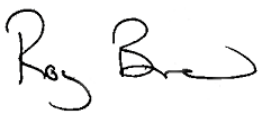
The transport infrastructure supports all facets of our society. It supports economic stability and growth at a local and national level, connects communities providing access to vital services such as hospitals and schools, and enables us to make the most of our free time.

The motorways and trunk roads in Scotland form a fundamental part of the transport network. Transport Scotland, an executive agency of the Scottish Government, is responsible for the operation, maintenance and management of the motorways and trunk roads, known as the trunk road network.

In order to provide the service that Scotland requires from the trunk road network, while at the same time providing best value for public money, we apply recognised best practice in asset management. Our asset management practices include road user surveys (aiding our understanding of your concerns and priorities), tools and techniques for identifying and planning works that provide best value for money, procedures for assessing and mitigating risk, and tools and techniques for assessing the short (1 to 3 year) and long term (up to 20 years) maintenance needs of the trunk road network.

This Road Asset Management Plan (RAMP) is one of our key asset management documents. The RAMP sets out the level of service we intend to provide on the trunk road network alongside the work and investment required to achieve this.

I hope that you find the contents of the RAMP interesting and would be very happy to receive your comments.



Roy Brannen
Chief Executive of Transport Scotland
January 2016

Executive Summary

Maintaining a Vital Asset

The Scottish trunk road network is estimated to have a construction value of £20bn (April 2015 valuation). Its value to Scotland's economy and way of life is many times greater. The operation and maintenance of this vital national asset must support the country by delivering the required service to road users and by using public money wisely.

Scotland's trunk road network includes around 3,400 route kilometres of motorways and trunk roads and 1,874 bridges, including major estuarial crossings of strategic importance. It carries over 35% of all traffic and over 60% of all Heavy Goods Vehicles, but accounts for only 6% of the total Scottish road network.

Transport Scotland is the national transport agency responsible for operating and maintaining the trunk road network on behalf of Scottish Ministers.

Applying Best Practice – Asset Management

Transport Scotland, like all public bodies, is being placed under increasing scrutiny in the way that it meets road user expectations, justifies investment and demonstrates that best use is being made of resources. This has been fully recognised and Transport Scotland has been embedding asset management in its business in accordance with best practice. This however does not mean we can stand still, instead the organisation will be continually challenging and improving practices and actively engaging in national and international best practice working groups.

Listening to You

The majority of us, in one form or another, are road users. As road users we expect safe and reliable journeys. These are not unreasonable expectations.

We welcome this, and in response we are actively engaging with road users and other interested parties to understand their views about the service they expect from the trunk road network. This relates to road condition, winter maintenance, journey reliability or lighting provision, to name but a few. We undertake annual surveys, with a representative cross section of road users, to identify trunk road issues that are important to them and the service they expect or desire. The findings are used to inform our activities and performance measures.

Making Best Use of Resources

A key function of the RAMP is to set out what we do to deliver the best possible service with the resources available. Our lifecycle plans cover a wide range of activities, from inspections, to routine and cyclic maintenance, to structural maintenance and more substantial refurbishments and improvements.

The lifecycle activities are set out in this RAMP for the main asset types. A number of these reflect recognised good practice (for example, inspection and routine maintenance intervals) and are designed to manage risk levels. Other activities, such as structural maintenance of the carriageway, are periodic in nature and dependent on a wide range of criteria. To estimate these maintenance needs, computerised models have been developed that reflect how our assets behave and deteriorate over time, thereby informing financial planning and investment decisions.

Setting out the lifecycle plans in this manner provides full visibility of the activities required to deliver a safe and reliable road network. It also enables us, and other interested parties, to openly assess and challenge current practices, helping to identify areas where improvements and efficiencies can be made.

Financial Plans

The RAMP sets out financial plans over a 10-year period required to deliver the lifecycle activities. The financial plans provide an indication of the level of expenditure that would be required to provide our desired level of service. However it is fully recognised that, especially at this time, there are considerable strains on public finances which impact on these financial plans. As a result of this we have developed maintenance strategies for our major asset types in order to make best use of available funds and ensure that the trunk road network remains safe and fit for purpose.

Updating the RAMP

Considerable advances have been made in our asset management practices since the publication of the first Road Asset Management Plan (RAMP) in 2007. Transport Scotland is committed to continually improving asset management practices and these will be reflected in future periodic updates of the RAMP.

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Glossary

Asset – Physical road infrastructure and other items that have a distinct value to the organisation. Assets owned include carriageway, footway, structures, lighting and drainage.

Asset Management – Asset management is the coordinated activities we use to manage our assets in order to maximise customer satisfaction, maintain high levels of safety, improve journey time reliability, manage risks, and enable delivery of our outcomes and priorities in the most efficient and sustainable manner.

Asset Management Improvement Programme – A formal programme of activities that seeks to make positive improvements to management practices.

Asset Management Objectives – High level objectives that reflect our business responsibilities, and are aligned with our strategic objectives and priorities.

Asset Valuation – The calculation of the current monetary value of an asset or group of assets. The calculated value is the Net Asset Value but it is normally referred to as the Asset Value.

Backlog – The monetary value of work required to close the gap between the current performance provided by an asset and the required performance.

Business Key Performance Measures – The asset maintenance and management business measures used by Transport Scotland.

Deflectograph – A self-contained lorry-mounted system, where a loaded wheel passes over the pavement, the pavement deflects and the size of the deflection is related to the strength (residual life) of the pavement layers and subgrade.

Information Management – A formal approach to the identification of information needs and the associated collection, storage, usage and maintenance of the information.

Investigatory Level – The point at which more detailed monitoring or investigation is appropriate, and to establish if and when remedial measures are required.

IRIS – Transport Scotland's Integrated Road Information System which contains data on the physical characteristics and condition of the trunk road network.

Lifecycle Plan – A considered strategy for managing an asset, or group of similar assets, from construction to disposal.

Maintenance – Collective term used to describe all the activities and operations undertaken to manage and maintain road assets, for example, inspection, assessment, renewal, upgrade etc.

Operating Company – Private sector company who is contracted by Transport Scotland on behalf of the Scottish Government to manage and maintain the trunk road network.

Performance Management Framework – A robust, transparent and repeatable process for recording, monitoring, analysing and reporting performance across a wide range of criteria. Links strategic and operational criteria.

Performance Measure – A generic term used to describe a measure or indicator that reflects the condition and/or performance of an asset.

Road Asset Management Plan – Document specifying activities and resources for implementing the asset management strategy and delivering the Asset Management Objectives.

Road Asset Management Policy – Demonstrates commitment to asset management and summarises the principles adopted in applying asset management to achieve strategic objectives.

Road Asset Management Strategy – Long-term approach to management of the assets, derived from, and consistent with, the asset management policy.

Road User Satisfaction Measures – Road user surveys undertaken annually to identify priority areas for improvement and determine levels of satisfaction with the service.

SCANNER – A machine-based survey that employs the use of an electronic 'scanner' to make a number of measurements that describe the condition of the road surface.

Scottish Government – Is the devolved government for Scotland, responsible for most of the issues of day-to-day concern to the people of Scotland, including health, education, justice, rural affairs and transport.

SCRIM – The SCRIM vehicle measures the friction between a tyre and the road under controlled slip conditions.

Stakeholder – An individual, group, body or organisation with a vested interest in the management of the transport network, for example, authority, owner, public, users, community, customers, shareholders and businesses.

Structural Maintenance (Carriageways) – Structural maintenance of carriageways rejuvenates the pavement by treating either the surface layers (for example, surface dressing) or the surface and sub layers (for example, strengthening or reconstruction).

Structural Maintenance (Structures) – Structures structural maintenance is defined as schemes that include the repair, renewal and replacement of structural elements or components that have become unserviceable through wear and tear or deteriorated with time and usage, or which have been damaged. Also the upgrading or replacement of structures to bring them up to current requirements.

Structures Workbank – A schedule of works and programmes that require action, having reached or close to their intervention point.

Transport Scotland – An agency of the Scottish Government with responsibility for the operation and management of the trunk road network.

Trunk Roads – The main strategic routes, including motorways.

Trunk Road Network – The system of motorways and trunk roads in Scotland.

Value Engineering – The development of optimal solutions for prioritised maintenance needs using option appraisal, whole life costing, scheme development, and synergies with other road schemes.

Value Management – A formalised process for assessing the benefits of undertaking work and the associated risks of not undertaking work, allowing competing needs to be objectively prioritised.

Whole Life Cost – The total cost of the asset over the term of its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal.

Abbreviations

BCI	Bridge Condition Indicator
BIM	Building Information Management
CCAP	Climate Change Adaption Programme
CCARP	Climate Change Adaptation and Resilience Plan
CCMS	Contract Control and Management System
DBFO	Design, Build, Finance and Operate
DMRB	Design Manual for Roads and Bridges
DRC	Depreciated Replacement Cost
FReM	Financial Reporting Manual
GIS	Geographical Information System
GRC	Gross Replacement Cost
IRIS	Integrated Roads Information System
ISO	International Organisation of Standardisation
ITS	Intelligent Transport System
KPI	Key Performance Indicator
L-CMS	Lighting – Central Management System
OC	Operating Company
PAG	Performance Audit Group
PMF	Performance Management Framework
PMS	Pavement Management System
PVA	Potentially Vulnerable Areas
RAMM	Road Asset Management Manual
RAMP	Road Asset Management Plan
RAVS	Roads Asset Valuation System
RCI	Road Condition Index
RMMS	Routine Maintenance and Management System
SCANNER	Surface Condition Assessment of the National Network of Roads

SCOTS	Society of Chief Officers for Transportation in Scotland
SCRIM	Sideways Force Coefficient Routine Investigation Machine
SEPA	Scottish Environment Protection Agency
SMS	Structures Management System
SRRB	Scottish Road Research Board
SRTDb	Scottish Roads Traffic Database
SRWC	Scottish Road Works Commissioner
TRBO	Trunk Road and Bus Operations Directorate
TS	Transport Scotland
VM	Value Management
VMS	Variable Message Sign
WLC	Whole Life Cost

1 Introduction

1.1 Scotland's Transport Network

An effective transport system is crucial to supporting the Scottish Government's purpose *to create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth*. Scotland's transport network includes trunk roads, local roads, railways, airports and ports. The trunk road network is one of the largest and most visible community assets for which the Scottish Government is responsible. It is used daily for hundreds of thousands of journeys and is fundamental to the economic, social and environmental wellbeing of Scotland. It connects economic centres and remote communities while making a contribution to the wealth of the nation.

In order for the trunk road network to fulfil its potential, it is vital that it is appropriately maintained. This includes not just carriageways and footways, but also bridges, lighting, traffic signs, drainage networks and much else besides. It is widely acknowledged that inadequate maintenance of the road network will only store up problems for the future. The Scottish Government is committed to ensuring the trunk road network is maintained in a manner that supports its vision, aims and objectives.

Trunk Roads and Local Roads

The Scottish Government sets the overall policy framework for roads and road transport, including trunk and local roads policy, road safety policy, and bus and taxi policy. The public bodies responsible for day-to-day operation and management can be categorised by the road types they look after, namely, local or trunk.

- *Trunk Roads* – the trunk road network is comprised of roads that are considered to be of strategic importance to Scotland's economy, primarily motorways and other major route corridors, ranging from the ten-lane M8 in the centre of Glasgow, to single carriageways in rural areas. The operation, maintenance and improvement of the Scottish trunk road network is the responsibility of Scottish Ministers, delivered via Transport Scotland.
- *Local Roads* – all other roads, except private roads, on the Scottish road network, including the A class roads that are not trunk roads, B and C class roads and unclassified roads, which range from multi-lane dual carriageways to single line rural roads, are the responsibility of individual local authorities.

1.2 Transport Scotland Road Asset Management Plan

The Road Asset Management Plan (RAMP) sets out how Scotland's trunk road network is maintained strategically and efficiently in order to protect our assets and provide the best possible service with the resources available. The RAMP presents the type and number of trunk road assets that we are responsible for, including carriageways, footways, structures, lighting and drainage. For each asset type, the RAMP describes its current condition and the range of activities used to manage and maintain it throughout its life.

The RAMP describes the asset management techniques that we use to assess outcomes against investment, prioritise maintenance and ensure cost-effective use of resources. It also describes how we engage with road users to understand their views about the service they expect from the trunk road network and how the findings are used to monitor the performance of our maintenance activities.

The RAMP is available on the Transport Scotland website. It is used by us and our service provider staff to provide full visibility of trunk road management and maintenance activities and to drive continual improvement. It may also be of interest to those who wish to know more about the service we propose to deliver and how we intend to do so.

This is the second version of the Scottish Trunk Road Network's RAMP. We have made considerable advances in our asset management practices since the first publication in 2007, however we will strive to refine and continually improve our asset management practices.

1.3 Document Hierarchy

Figure 1.1 summarises the context within which our RAMP has been developed. Our starting point is to ensure alignment with, and thereby support, the Scottish Government's Purpose and Strategic Objectives and Transport Scotland's Corporate Delivery Priorities. This is articulated in our Asset Management Policy and given substance in our Asset Management Strategy.

The RAMP sets out how our Asset Management Strategy is currently delivered. Delivery of the Strategy is supported by our Performance Management Framework and our Road Asset Management Manual.

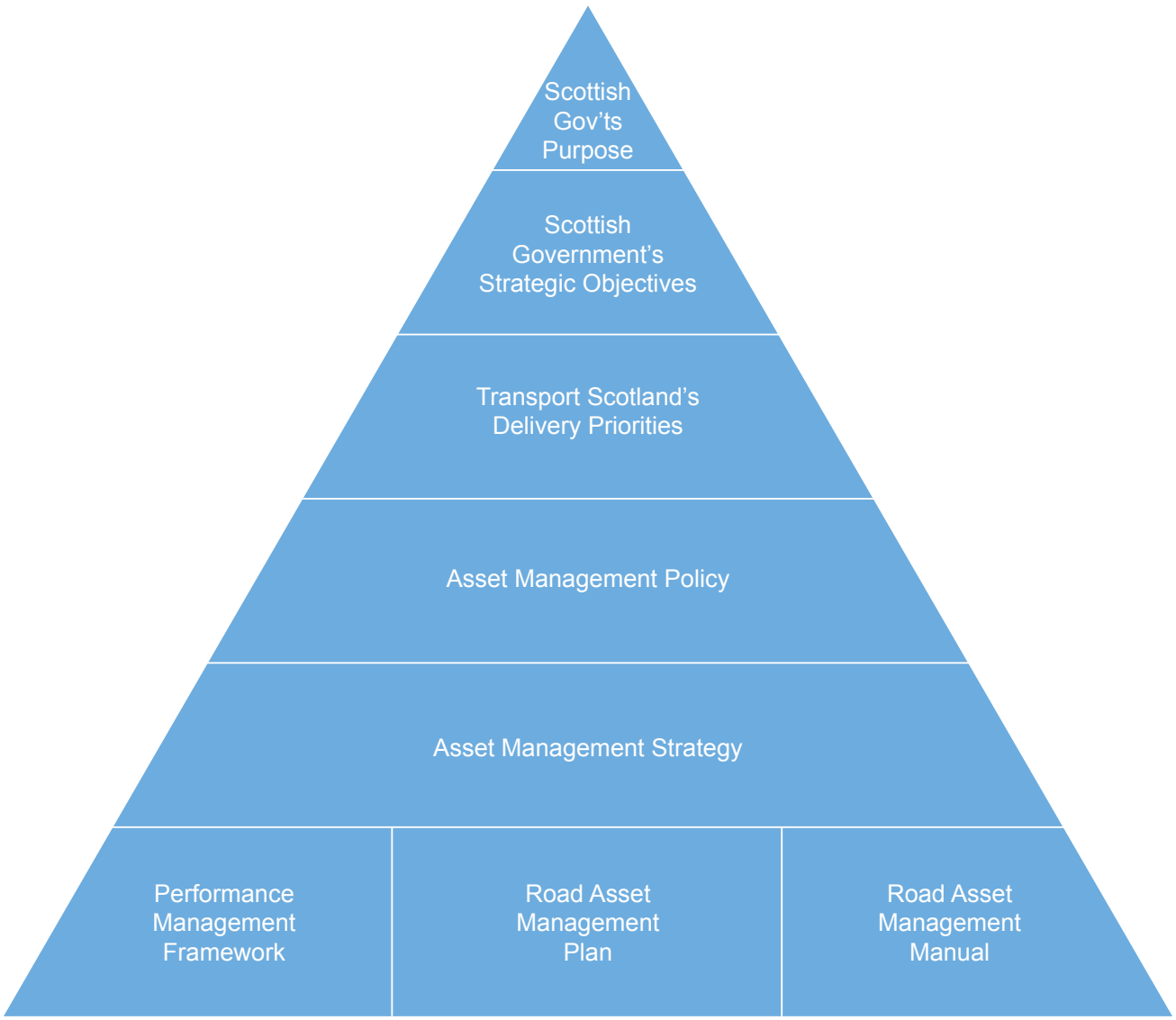


Figure 1.1: Document Hierarchy

1.4 Our Asset Management Framework

In Transport Scotland we recognise that effective management of all our assets relies on good asset management processes and practices that are fully embedded in all parts of the organisation and our supply chain. Our Asset Management Framework follows best practice to define the **context** in which we operate, our **planning** tools, our **enablers** and our **delivery** priorities. The Framework is shown in Figure 1.2 and subsequent chapters of this RAMP discuss how the different elements of the Framework influence and contribute to our processes.

Figure 1.2: Asset Management Framework

Chapter 2 **(Leadership and Organisation)** outlines our approach to asset management and describes the organisational structure of Transport Scotland, specifically focusing on governance, roles and responsibilities in relation to trunk road asset management duties and accountabilities.

Chapter 3 **(Asset Management Policy, Strategy and Objectives)** presents our Asset Management Policy, Strategy and Objectives that provide the overall context and direction for asset management planning.

Chapter 4 **(Measuring Performance)** explains how our Asset Management Objectives are translated into Performance Measures and Targets that will be used to monitor performance and drive improvement in our management and maintenance activities.

Chapter 5 **(Lifecycle Planning)** describes the asset lifecycle activities that are common across asset types.

Chapter 6 **(Programmed Maintenance)** sets out how our commitments will be delivered via our road maintenance contracts.

Chapter 7 **(Risk Management and Network Resilience)** explains how we identify, analyse, assess and manage risks associated with service delivery and how we plan for responding to network disruptions.

Chapter 8 **(Asset Management Systems and Data)** provides an overview of the asset data used to support our asset management practices and our asset management systems.

Chapter 9 **(Performance Monitoring and Continuous Improvement)** outlines our approach to monitoring performance and driving continual improvement in asset management, including gap analysis and benchmarking activities used to identify our programme of asset management improvement tasks.

Chapter 10 **(Financial Management and Valuation)** outlines the financial context within which we are required to maintain the trunk road network.

The Appendices describe, in more detail, the lifecycle activities for each asset type.

1.5 Improvement and Innovation

We are committed to the development and implementation of good practice to gain benefits from lessons learnt at national, regional and local levels and we are committed to the sharing of knowledge and experiences in implementing asset management with other road authorities across the country.

We will measure and monitor the performance of our assets and asset management regime and report in a manner that is beneficial to the organisation and supports continual review and monitoring using our Performance Management Framework. Lessons learnt provide feedback for future planning and implementation to achieve continual improvement in asset performance.

We will review our strategy regularly and update it as required to ensure its continuing alignment with the Scottish Government's Purpose and Strategic Objectives and our Delivery Priorities. The RAMP will be updated to reflect changes in our strategy and/or improvements in the way that we manage our assets.

2 Leadership and Organisation

2.1 Transport Scotland

As the national transport agency for Scotland our purpose is to deliver a safe, efficient, cost-effective and sustainable transport system for the benefit of the people of Scotland, playing a key role in helping to achieve the Scottish Government's Purpose of increasing sustainable economic growth with opportunities for all of Scotland to flourish. Further information is available from our website www.transportscotland.gov.uk.

Transport Scotland is organised into six Directorates:

Rail	Delivering commitments on rail services, infrastructure and improvements and leading policy development.
Trunk Road & Bus Operations	Undertaking management and operational duties and delivering maintenance, improvements and Special Projects on the trunk road network. Delivery of Concessionary Travel and development of Integrated Ticketing. Providing Procurement Policy, Environment and Sustainability advice, IT, Media and Communications Strategy.
Aviation, Maritime, Freight & Canals	Overseeing and developing port, canal, ferry, freight and aviation policy and legislation.
Transport Policy	Strategic transport policy development, high-level engagement with external partners and associated legal and policy frameworks.
Major Transport Infrastructure Projects	Delivering improvements to the trunk road network, e.g. new roads and road widening.
Finance, Corporate & Analytical Services	Financial management, accounting, reporting of Agency budgets and provision of analytical support and advice. Providing HR and facilities support services, performance monitoring and corporate strategy.

This document focuses on the trunk road responsibilities of Transport Scotland's Trunk Road and Bus Operations Directorate (TRBO). TRBO is responsible for the operation and maintenance of the Scottish trunk road network and the delivery of asset management.

2.2 Transport Scotland's Trunk Road Assets

The Trunk Road Network

The trunk road network is comprised of route corridors that are considered to be of strategic importance to the economic stability and growth and social wellbeing of Scotland. The trunk road network is vital because it connects our cities, rural communities and the ports that serve the islands. Key trunk road network statistics are:

- 3,429 route kilometres of motorways and main roads.
- 1,874 bridges and footbridges including major estuarial crossings of strategic importance, and 2,347 other structures.
- Accounts for 6% of the total road network in Scotland, but carries over 35% of all traffic and over 60% of all HGV traffic.
- Has a gross Asset Value of over £20bn.

Summary of Transport Scotland Trunk Road Assets

The trunk road network comprises a wide range of asset types (for example, carriageway, structures, lighting and drainage) which together provide a service to road users. Table 2.1 summarises the main types of trunk road assets that we manage and maintain.

Table 2.1: Summary of Transport Scotland's Trunk Road Assets

Asset Type	Definition	Quantity
Carriageway	Part of the road constructed for use by vehicular traffic. Includes turning lanes, bus lanes, crawler lanes and acceleration/ deceleration lanes.	Motorway 596 km Dual C/way 518 km Single C/way 2,315 km
Footways & Cycle Facilities	A part of the road exclusively for the use of pedestrians or pedal cycles.	912 km footway 66 km cycle facility

Asset Type	Definition	Quantity
Structures	A bridge or other structure that impinges in any way within the footprint of the trunk road boundary or that materially affects the support of the road or land immediately adjacent to it.	1,874 bridges/ footbridges 569 culverts 916 retaining walls 535 high mast lights/ CCTV 327 gantries
Road Lighting	Lighting specifically provided to illuminate the road.	20,263 lighting points
Road Markings	Longitudinal lines, hatched lines, transverse lines and special lines and markings.	Over 12,580 km
Technology Equipment	Variable message signs, cabinets, detector loops, emergency telephones and weather stations.	10,256 units
Fences & Barriers	Vehicle restraint systems, pedestrian barriers and boundary fencing.	4,894 km
Drainage	A system of gullies, drains and pumping stations that capture and transport water away from the carriageway/footway.	86,387 gullies 3,682 km linear drainage 6,471 culverts 53,086 manholes
Geotechnical	An area where the carriageway is below existing ground level within an excavation or has been raised above existing ground level.	2,054 km
Signs & Signals	A sign for the purpose of regulating, warning, guiding or informing traffic, or a system of lights for controlling traffic flow.	109,453 signs 1,833 signals
Landscaping	Trees, hedges, grassed areas and verges.	7,925 km hedges & verges 12,376 trees 35,984 km^2 of grassed areas

2.3 Maintaining our Assets

Transport Scotland is responsible to the Scottish Ministers for overseeing the management and maintenance of the trunk road network. To assist with this, we employ Operating Companies, works contractors, concession companies and the Performance Audit Group.

Operating Companies

Most of our asset management improvements have been embedded into and are delivered through our Operating Company Contracts. The Operating Companies (OCs) are private sector companies responsible for delivering our programmes of maintenance on the trunk road network, working under term maintenance contracts to Transport Scotland. These contracts are divided into four regional units (North West, North East, South West and South East) and the Forth Bridges unit. The contracts have been running in some form since 1995, are currently in their 4th Generation, and have the following delivery objectives:

- *Sustainable Delivery* – to deliver OC services in a sustainable manner and aid carbon emission reduction.
- *Reliable Journey Times* – to assist in the provision of journey time information to Traffic Scotland and allow a 'customer orientated' approach to be further developed in the way roads are managed and maintained.
- *Continuous Improvement* – to deliver continuous improvement, skilful management and innovation including in safety.
- *Value for Money* – to achieve the maximum efficiency in the use of the substantial sums of money expended on the maintenance of the network.
- *Flexibility* – to accommodate changes to the trunk road network and future policy changes.

The Operating Companies oversee, coordinate and undertake cyclic and routine maintenance, winter service and emergency response. In addition, they undertake structural road maintenance, bridge strengthening and maintenance, safety and condition inspections, road safety and minor improvement schemes. Further information on the Operating Company contracts can be found at www.transportscotland.gov.uk/road/maintenance/operating-companies.

As well as the Operating Companies there are currently six individual Design, Build, Finance and Operate (DBFO) contracts. These contracts require that the Commissionaires take

responsibility for all maintenance activities over 30-year concession period. Consequently, all DBFO activities are excluded from the lifecycle plans presented in this RAMP.

Performance Audit Group

The Performance Audit Group (PAG) is an independent private sector organisation, employed by Transport Scotland, that monitors the performance of the Operating Companies. PAG audits, monitors and reports on the financial, technical and performance aspects of the Operating Companies to a plan agreed with Transport Scotland. It also reviews payment requests from the Operating Companies, carries out inter-Unit comparisons and investigates if they are providing value for money when asked to do so by Transport Scotland. PAG's objectives are to:

- Make the most of public resources by delivering value for money.
- Ensure the needs of road users are met.
- Enable effective management of the trunk road asset.
- Facilitate continuous improvement.
- Encourage sustainability and reduce the impact on the environment.

The partnering ethos between Transport Scotland, the Operating Companies and PAG continues to pay dividends in terms of a mature and constructive working relationship between the parties. Further information about PAG can be found at www.performanceauditgroup.co.uk.

2.4 Investing in Transport Scotland's Assets

To maintain an asset stock the size of the Scottish trunk road network takes a considerable investment, of both time and money. Figure 2.1 presents a distribution of how the trunk road asset management budget is spent across the main asset management activities. These asset management activities cover a wide range of maintenance activities, from inspections, to routine and cyclic maintenance, to structural maintenance and more substantial refurbishments and improvements.

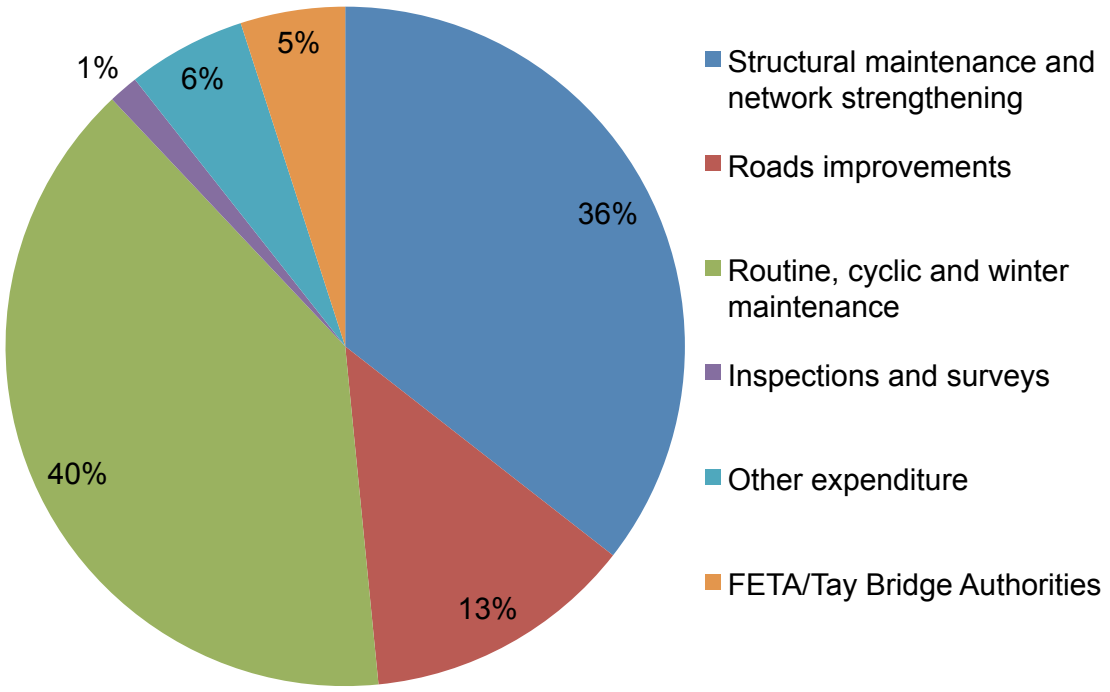
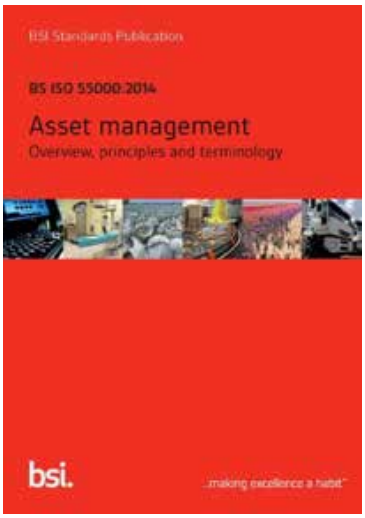


Figure 2.1: 2014/15 Expenditure Grouped by Main Asset Management Activities

Further details of our lifecycle activities for the main asset types and associated funding requirements to deliver them are given in Section 5 Lifecycle Planning, and Section 10 Financial Management and Valuation.

2.5 Developing our Approach to Asset Management

What is Asset Management?



We fully embrace the principles of asset management and the requirements set down in an international standard (International Organisation of Standardisation ISO 55001). Our definition of asset management is:

Asset management is the coordinated activities we use to manage our assets in order to maximise customer satisfaction, maintain high levels of safety, improve journey time reliability, manage risks, and enable delivery of our outcomes and priorities in the most efficient and sustainable manner.

Put more simply, asset management is doing the right things, at the right time and at the right price.

Importance of Asset Management

We see asset management as a means to deliver a more efficient and effective approach to the management of trunk road assets through longer-term planning. Such an approach enables more efficient and effective use of resources, while fulfilling legal obligations, delivering stakeholder needs and ensuring that the trunk road network remains safe.

The significant challenges we face have reinforced the view that a systematic process is needed to manage the trunk road asset. These include:

- Increasing customer expectations for an accessible and available trunk road network and for safe and reliable journeys.
- Managing and maintaining a road network that is resilient to damage from wear and tear and which is ageing and increasingly subjected to more traffic and severe weather.
- Financial constraints placing more emphasis on the preservation of existing assets for the long-term with clear messages of ‘more for less’, ‘sweating the asset’ and ‘make the most of what you have’ that create a culture for making best use of existing assets.
- Providing improved financial accountability and transparency and demonstrating that decisions made, and the resulting work, provide tax payers with good value for money.

- Maximising the contribution of road maintenance to sustainability and the environment through appropriate material and construction choices.
- Training and retaining staff in a competitive market and recruiting from a limited pool of skilled, experienced and qualified engineers and other specialist personnel.

Asset management provides a means to face these and similar challenges through the development of a coordinated and systematic approach that seeks to deliver the most efficient and effective approach over the long term. The full benefits of asset management will only be realised when it is embedded as our recognised and accepted way of working. To achieve this we continue to implement a long-term plan of asset management learning, development, implementation and continuous improvement as outlined in Section 9.

2.6 Asset Management Steering Group

In order to ensure appropriate governance and ownership of asset management within Transport Scotland, an Asset Management Steering Group has been set up to promote good practice, ensure continued commitment to asset management and review and update our planned programme of asset management improvements as required (see section 9.7). The remit of the group includes:

- Endorse the current Asset Management Policy, Strategy and Plan, and set the direction of future policy/strategy.
- Ensure that asset management processes are properly understood and embedded through effective training and communication.
- Discuss annual customer survey findings and identify priorities for improvement.
- Endorse regular ISO 55000 gap analyses of the organisation, review progress against the planned programme of improvements and endorse changes to the plan, if appropriate.

3 Asset Management Policy, Strategy and Objectives

3.1 Background

We first published our Asset Management Policy and Strategy in the 2007 version of the Road Asset Management Plan (RAMP) and since then we have significantly improved our asset management capabilities within the organisation and our supply chain.

The Scottish trunk road network is a fundamental part of the transport system in Scotland and it is essential that it is effectively maintained and efficiently managed. That means adopting an approach to road maintenance with the aim of improving the condition of the road network, whilst meeting the needs of its community, and supporting the changing needs of businesses and local economic growth. In order to achieve this we have updated our trunk road network Asset Management Policy and Strategy so that it aligns with the current strategic objectives of the Scottish Government, overall delivery priorities for Transport Scotland and current best practice in asset management.

Although standalone documents our policy and strategy should be read in conjunction with several other publications including our Corporate Business Plan, this Road Asset Management Plan and relevant current legislation.

3.2 Policy

Our Trunk Road Network Asset Management Policy aligns our asset management processes and procedures with our corporate Delivery Policies. It demonstrates our commitment to asset management and summarises the principles adopted in applying asset management to achieve our strategic objectives.

3.3 Strategy

The trunk road network is one of the most visible community assets for which the Scottish Government is responsible. It is used daily for thousands of journeys and must be appropriately maintained in order to ensure the journeys we make are safe and reliable. Our Asset Management Strategy builds on the progress we've made to date and sets out how our Asset Management Policy will be delivered. It is informed by the adoption of asset management principles, understanding asset management as part of a framework with local and national influences, and establishing specific performance standards which align to our corporate Delivery Policies.

3.4 Our Asset Management Framework

We have developed our Asset Management Framework to help us manage our trunk road assets. The Framework sets out the activities and processes that are necessary to develop, document, implement and continually improve our approach to asset management.

Our starting point was to undertake a series of Gap Analyses, most notably in 2010 using the Institute of Asset Management PAS 55[1] Maturity Assessment Toolkit, which has allowed us to develop and prioritise an action plan which we have been using to develop all components in our asset management framework. Regular updates of the gap analysis are required to ensure we continue to develop our asset management strengths and capabilities (see Section 9.3).

As stated in Section 1.4 our Asset Management Framework follows world's best practice to define the **context** in which we operate, our **planning** tools, our **enablers** and our **delivery** priorities.

Context

The context for road infrastructure asset management on the trunk road network in Scotland encapsulates a variety of factors that we need to take into consideration when setting the expectations for the trunk road network. The Scottish Government's Strategic Objectives, Transport Scotland's Delivery Priorities, expectations of our stakeholders and the legal and financial constraints within which we operate all need to be embedded into the Framework to ensure that they are aligned with our delivery priorities.

Planning

The key activities that we undertake as part of the asset management planning process include the following activities:

- *Policy* – Our published commitment to road asset management.
- *Strategy* – Our published statement on: how the policy will be implemented; the Asset Management Framework; the strategy for each asset type; our network hierarchy and priorities; and our commitment to continuous improvement.
- *Measuring Performance* – Our Performance Management Framework, the service delivery standards to be provided and how the performance measures will be measured and reported.
- *Lifecycle Planning* – Lifecycle plans for individual asset types which when combined with funding levels and desired levels of service enable informed decisions to be taken.
- *Programmed Maintenance* – Our scheme identification process which leads to one and three-year programmes of work.

[1]PAS 55-1 Asset Management: Part 1: Specification for the optimized management of physical infrastructure assets, The Institution of Asset Management and BSI, 2008.

Our Enablers

These are a series of activities that support us in the implementation of our Asset Management Framework and provide:

- a means of developing organisational leadership and the adoption of an asset management culture including a means of effectively communicating and collaborating with all stakeholders;
- the development of the competencies and skills of all staff (including our supply chain);
- an effective means of managing risk;
- a strategy for the use of asset management IT systems; and
- a means of measuring the performance of the asset management framework, including benchmarking progress and collaborating with others, and above all, fostering a culture of continuous improvement and innovation.

Delivery

We are committed to providing the best network condition for the available investment. The delivery component of the framework sets out how our commitments will be delivered via our road maintenance contracts for which a series of service delivery and contract delivery objectives have been established respectively.

3.5 Trunk Road & Bus Operations Asset Management Objectives

The TRBO asset management objectives reflect our business responsibilities and activities and align with Transport Scotland's five delivery priorities, the Scottish Government's Strategic Objectives and Purpose. The linkages are presented in Figure 3.1 and these objectives will enable us to present a consistent and meaningful picture of changing performance over time.

Each of the TRBO asset management objectives identified in Figure 3.1 will be supported by a number of service delivery standards which are measured using quantifiable performance measures. Further details of the performance measures can be found in Section 4 of this document.

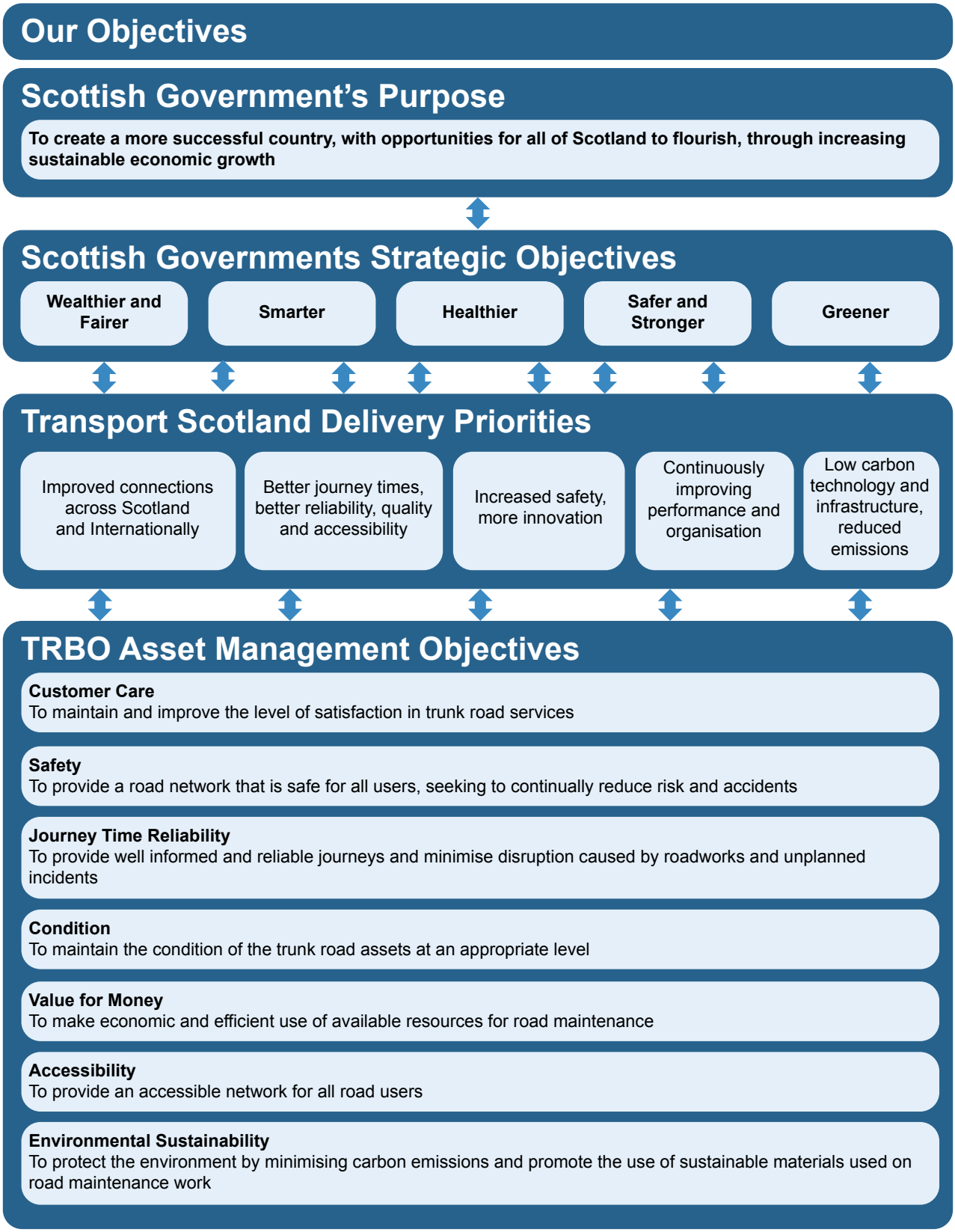
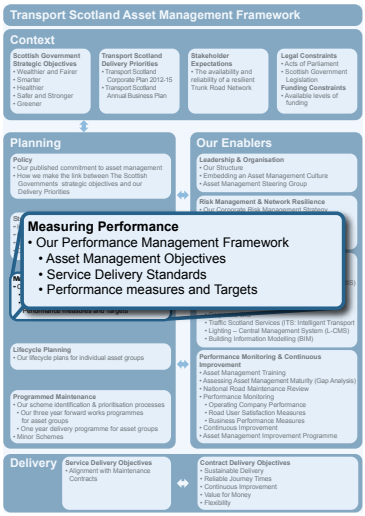


Figure 3.1: The relationship between our objectives

4 Measuring Performance



The purpose of the Performance Management Framework (PMF) is to support us in achieving our delivery priorities through a robust, transparent and repeatable process for recording, monitoring, analysing and reporting performance across a wide range of criteria.

A PMF, that links strategic and operational criteria, is fundamental to a holistic asset management approach. It enables us to assess and demonstrate the impact that different investment strategies have on the performance of our network, road user satisfaction and engineering/contract measures and targets. In particular the PMF:

- Facilitates effective communications with stakeholders by demonstrating performance against their requirements.
- Demonstrates how funding is used effectively.

4.1 Supporting Corporate Vision

In Transport Scotland we have produced an asset management policy and strategy setting out what we intend to do to manage the country's strategic road infrastructure assets. This strategy aligns with the corporate vision and demonstrates the contribution that asset management makes towards achieving this vision.

The alignment between corporate vision, asset management objectives and performance measures in accordance with international best practice, is shown schematically in Figure 4.1.

Our asset management objectives are broad statements that describe the performance requirements of trunk road infrastructure assets in terms that all stakeholders can understand. These relate to outcomes and cover key aspects of asset performance such as user satisfaction, safety, serviceability and sustainability. Our asset management objectives are focused on the performance of the whole network rather than the performance of individual assets.

Each asset management objective is supported by a number of service delivery standards and performance measures which enable both overall achievement of the objective and individual aspects of performance to be measured.

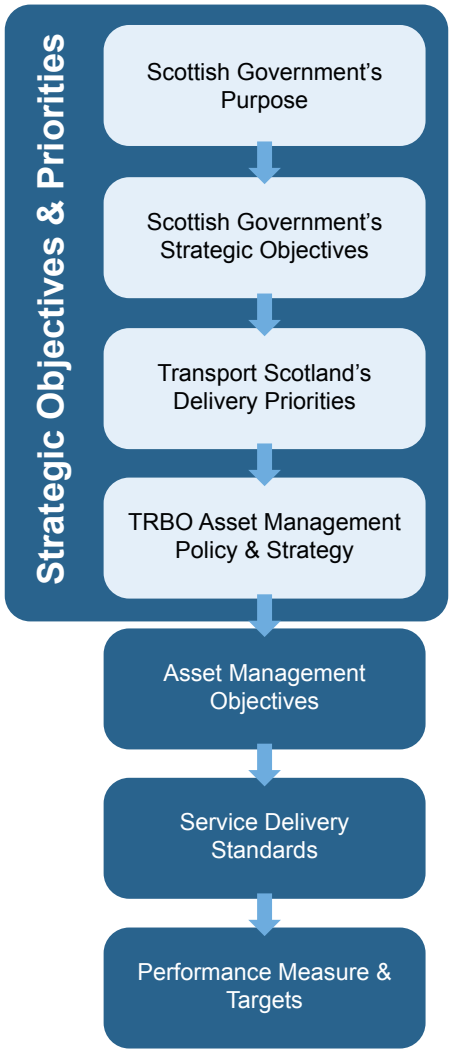


Figure 4.1: Aligning Performance Measures with Corporate Vision

4.2 Our Performance Management Framework

Asset Management Objectives

Our asset management objectives, shown in Figure 4.2, are our high level objectives that reflect our business responsibilities, and can be aligned with our strategic objectives and priorities. Performance measures related to the objectives through our service delivery standards enable us to present a consistent and meaningful picture of changing performance over time, i.e. to present trends of improving, steady state or declining performance.

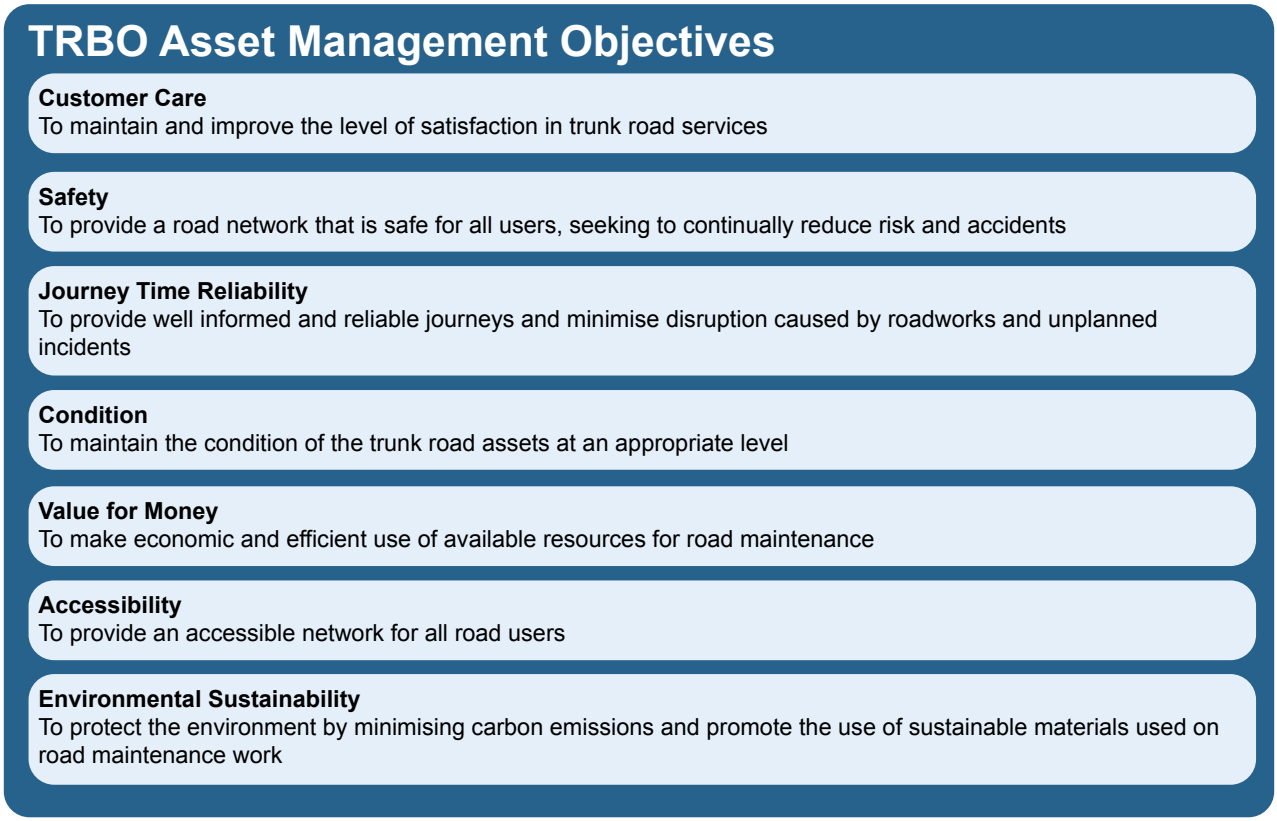


Figure 4.2: Asset Management Objectives

Service Delivery Standards

Our service delivery standards are measures that support our asset management objectives and describe what each asset management objective actually means in terms of the service to be delivered. The service delivery standards, currently in the PMF, are embedded in the way our Operating Companies deliver their work.

Performance Measures

Central to asset management is actively engaging with road users to understand their views about the service they expect from the trunk road network. Our performance measures are focused on areas of genuine interest to road users and other stakeholders, enabling their levels of satisfaction and expectations to be recorded (see Section 9.5). As further development of the PMF we will review how the existing performance measures align with our current delivery priorities and Scottish Government's strategic objectives.

One of the considerations in our review of the performance measures will be to maximise the use of data that is already collected, minimising the need for the collection of additional data.

We already have a number of sources of relevant performance measures, including:

- *Road User Satisfaction Measures* – road user surveys are undertaken annually to identify priority areas for improvement and determine levels of satisfaction with the service.
- *Business Key Performance Measures* – asset maintenance and management business measures used by Transport Scotland.
- *Service Provider Key Performance Indicators* – the key performance measures compiled to monitor the performance and delivery of the Service Provider Contracts, as defined in the 4G Operating Company contract.

Performance measures have been selected that align with our asset management objectives through consultation with responsible individuals in the organisation. Each of the current performance measures is supported by a one-page specification that details its description, purpose and measurement metrics.

The transition of the term maintenance contracts from 3rd Generation (3G) to 4th Generation (4G) has meant that some originally identified performance metrics have evolved and datasets across contract generations are not always comparable. In addition successive Scottish Government Spending Reviews will define our levels of funding and allow us to develop appropriate targets. As a result our review of the PMF will look to facilitate the setting of updated measures once the direction of travel in performance scores and impact of the transition in contracts and affordability is understood. The identification and subsequent updating of targets will be through consultation with senior Transport Scotland officers and analysis of road user feedback exercises.

Consideration will need to be given to the short, medium and long -term cost of achieving each target, within our available budgets, and the costs of meeting these targets will be periodically reviewed by the Transport Scotland board.

The link between our current asset management objectives and supporting service delivery standards and performance measures are as follows:

Customer Care

To maintain and improve the level of satisfaction in trunk road services. This objective is supported by the following **Service Delivery Standards** & *Draft performance measures*

Safety

To provide a road network that is safe for all users, seeking to continually reduce risk and accidents. This objective is supported by the following **Service Delivery Standards** & *Draft performance measures*

Journey Time Reliability

To provide well informed and reliable journeys and minimise disruption caused by roadworks and unplanned incidents.

Condition

To maintain the condition of the trunk road assets at an appropriate level.

Value for Money

To make economic and efficient use of available resources for road maintenance.

Accessibility

To provide an accessible network for all road users.

Environmental Sustainability

To protect the environment by minimising carbon emissions and promote the use of sustainable materials used on road maintenance work.

1. **Respond effectively to customer enquiries within specified timescales**
   - *Percentage of customer enquiries replied to within 5 working days*
   - *Percentage of calls answered in person within 2 minutes of first receipt*
2. **Consider customer requirements when planning winter service operations**
   - *Customer satisfaction with gritting roads in winter*
   - *Customer satisfaction with clearing roads in winter*
3. **Consider customer requirements when planning maintenance**
   - *Customer satisfaction with frequency of road works*
   - *Customer satisfaction with diversions at road works*
   - *Customer satisfaction with restrictions at road works*
   - *Customer satisfaction with condition of road surface*
   - *Customer satisfaction with condition of footways*
   - *Customer satisfaction with condition of cycle lanes*
   - *Customer satisfaction with provision of road lighting*

1. **Carry out regular inspections to ensure the safety of the network**
   - *Percentage achieved within prescribed timescales*
   - *Percentage of bridge inspection programme achieved within prescribed timescales*
2. **Quickly repair defects that present an immediate or imminent hazard to road users**
   - *Percentage of Category 1 defects made safe within 24 hours*
3. **Keep the network free from ice and snow, as far as is reasonably practicable**
   - *Percentage of treatment times achieved within contractual response time of 2 hours*
4. **Reduce the numbers of those killed or seriously injured to meet the targets set by the Scottish Government**
   - *Percentage reduction in number of people killed*
   - *Percentage reduction in number of people seriously injured*

Customer Care

To maintain and improve the level of satisfaction in trunk road services.

Safety

To provide a road network that is safe for all users, seeking to continually reduce risk and accidents.

Journey Time Reliability

To provide well informed and reliable journeys and minimise disruption caused by roadworks and unplanned incidents.

This objective is supported by the following **Service Delivery Standards &** *Draft performance measures*

1. Minimise disruption and inconvenience caused by essential planned maintenance
- *Road occupations and the percentage of the network available to road users*
- *Accurately using the Scottish road works register*

2. Implement strategies and plans to reduce the risk of unplanned events on the network
- *Number of lane kilometres hours when unprogrammed Operations and Works are on the network*

3. Respond to emergencies as quickly as possible and within specific maximum timescales
- *Percentage of incident responses within the required timescales*
- *Road occupations and the percentage of the network available to road users*

Condition

To maintain the condition of the trunk road assets at an appropriate level.

This objective is supported by the following **Service Delivery Standards & *Draft performance measures***

1. Maintain the trunk road assets in a state of good repair.
- *Percentage of carriageway where structural maintenance should be considered*
- *Bridge Condition Indicator (BCI)*
- *Percentage of pedestrian and cycle facilities in poor or very poor condition*
- *Percentage of road markings, studs and kerbs in poor or very poor condition*
- *Percentage of technology equipment in poor or very poor condition*
- *Percentage of fences and barriers in poor or very poor condition*
- *Percentage of road lighting in poor or very poor condition*
- *Percentage of drainage assets in poor or very poor condition*
- *Percentage of geotechnical assets in poor or very poor condition*
- *Percentage of traffic signs and signals in poor or very poor condition*
- *Percentage of landscaping assets in poor or very poor condition*

Value for Money

To make economic and efficient use of available resources for road maintenance.

Accessibility

To provide an accessible network for all road users.

Environmental Sustainability

To protect the environment by minimising carbon emissions and promote the use of sustainable materials used on road maintenance work.

Customer Care
To maintain and improve the level of satisfaction in trunk road services.

Safety
To provide a road network that is safe for all users, seeking to continually reduce risk and accidents.

Journey Time Reliability
To provide well informed and reliable journeys and minimise disruption caused by roadworks and unplanned incidents.

Condition
To maintain the condition of the trunk road assets at an appropriate level.

Value for Money
To make economic and efficient use of available resources for road maintenance.
This objective is supported by the following **Service Delivery Standards & *Draft performance measures***

Accessibility
To provide an accessible network for all road users.
This objective is supported by the following **Service Delivery Standards & *Draft performance measures***

Environmental Sustainability
To protect the environment by minimising carbon emissions and promote the use of sustainable materials used on road maintenance work.
This objective is supported by the following **Service Delivery Standards & *Draft performance measures***

1. Monitor performance of the delivery team to ensure value for money
- *Average percentage by which outturn varies from tender*
- *Percentage of total spend on schemes as a proportion of profiled total spend*
- *Accuracy of Works Contracts cost estimates*
- *Success in delivering schemes at the awarded tender value*
- *Orders against budget*
- *Accuracy of Operations cost estimates*

2. Encourage and promote innovation and collaborative working
- *Financial value of innovations introduced by the Operating Company*
- *Value of collaborative services provided by the Operating Company*

3. Deliver efficiency savings in line with the Scottish Government's Efficiency Programme
- *Percentage of Efficiency gains against those predicted*

1. Monitor provision of infrastructure for all road users
- *Provision of cycle lanes*
- *Provision of footways*
- *Physical barriers to cyclists*
- *Availability of dropped kerbs for cyclists*
- *Availability of cycle crossing points*
- *Physical barriers to pedestrians*
- *Availability of dropped kerbs for pedestrians*
- *Availability of pedestrian crossing points*
- *Provision of VMS (temporary and permanent)*
- *Suitability of signage*
- *Experience of congestion*

1. Monitor performance of the delivery team in reducing carbon emissions year on year
- *Annual carbon emissions (tonnes) produced by the Operating Company as recorded by the Carbon Management System*

2. Encourage and promote the use of sustainable practices and materials
- *Percentage of raw materials used sourced from reused, recycled or renewable sources*
- *Percentage of waste materials reused or recycled*

Monitoring Performance

In refreshing the PMF each asset management objective will be rated on an excellent, good, fair and poor scale and each supporting measure is also rated on the same scale. Appropriate weightings, determined based on the importance of the measure, will be updated, as required, to allow a rating for the asset management objective to be calculated. This will be defined for each measure and the following are provided as the overarching principles that we will adhere to.

Poor:

- Does not meet minimum standard required in contract.
- Does not meet the perceived minimum acceptable standard.
- Unable to determine performance due to insufficient or substandard information and/or data.
- Road users are, on average, dissatisfied or very dissatisfied.

Fair:

- Meets minimum standard required in contract but below targets.
- Meets the perceived minimum acceptable standard.
- Road users are, on average, neither satisfied nor dissatisfied.

Good:

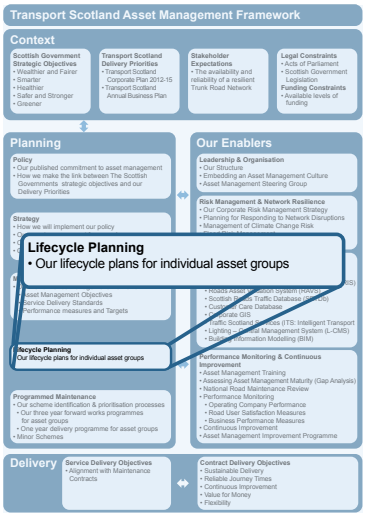
- Meets recognised good practice as identified through national guidance.
- Meets the contract requirements/targets.
- Meets perceived good performance standards.
- Road users are, on average, fairly satisfied.

Excellent:

- Exceeds recognised good practice as identified through national guidance.
- Exceeds the contract requirements/targets.
- Exceeds perceived good performance standards.
- Innovates, sets and achieves challenging targets that will improve service.
- Road users are, on average, very satisfied.

As part of the update to the PMF we will be reviewing the existing measures and weightings to ensure they are still appropriate as well as determining how any new measures will be measured and the contribution they should make to the overall asset management objective.

5 Lifecycle Planning



5.1 Long-Term Approach to Managing Assets

A lifecycle plan is defined as a long-term strategy for managing an asset, or group of similar assets, with the aim of providing the required levels of service while minimising whole life costs.

Our asset management strategy sets out how we intend to manage the trunk road network in order to deliver a service that aligns to our delivery priorities and the Scottish Government's strategic objectives. Key to achieving this is how we approach the long-term management of the assets. By adopting a lifecycle planning approach we are able to focus on the long-term needs of our three main asset types:

- carriageways;
- structures; and
- ancillary assets.

Individual lifecycle plans, for carriageways, structures and ancillary assets, represent the output of our lifecycle planning process. These plans are at the core of our approach to trunk road asset management planning and contain the detail that enables asset management practices, such as long-term cost projection, performance management and risk management to be applied consistently.

This chapter describes asset lifecycle activities that are common to all three asset groups. Lifecycle activities that are specific to each asset group are described in Appendices A to C. We will continue to develop the RAMP to ensure that it is consistent across further asset groups, in particular focusing on Intelligent Transport System (ITS) assets.

5.2 Inspections and Surveys

We specify requirements for regular surveys and inspections to ensure that the network is safe and fit for purpose, and to provide appropriate information to support maintenance decisions.

Inventory Surveys

Good quality information is fundamental for asset management. A detailed trunk road inventory is an essential prerequisite of establishing a cost effective and adequate maintenance regime. It is the foundation on which asset management is built and when analysed in combination with other data, provides crucial decision support information.

In 2011 we commissioned an independent audit of our inventory data, which highlighted issues with the accuracy and completeness of the data being maintained. As a result, in 2012 we commissioned a spatially referenced video survey to ensure that our Operating Companies were given a more accurate inventory dataset to build upon and maintain throughout the life of their contract.

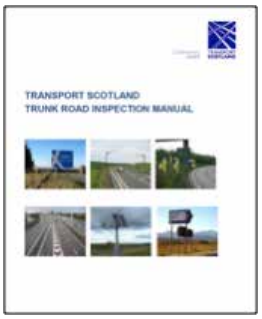
The Operating Companies are responsible for validating and updating inventory items during the first annual period of the contract and for maintaining the accuracy and integrity of the inventory data thereafter in line with the requirements of the Transport Scotland *Trunk Road Inventory Manual*. The manual supports the Operating Company's inspection team in collecting high quality inventory data in a consistent and repeatable manner. It describes the inventory data to be collected/updated, the conventions to be adopted, and provides clear instructions and photographs.

Safety and Serviceability Inspections

In accordance with recognised good practice, our inspection regime is designed to ensure the trunk road network is safe for use and fit for purpose; and to provide the data required to support asset maintenance planning and management. The inspection regimes summarised below are specified in Schedule 7: Part 1 of the Operating Company contracts (www.transportscotland.gov.uk/road/maintenance/operating-companies). These regimes are based on past experience, recognised good practice and risk assessment.

Our Operating Companies are required to carry out Safety Inspections, Safety Patrols, night time Safety Patrols, Detailed Inspections and Condition Surveys. All are carried out using GPS enabled mobile devices running customised software. The mobile devices and software ensure that information is accurately located, validated and directly entered into our Integrated Roads Information System (IRIS). Information relating to urgent safety defects will immediately enter the workflow to ensure that they are promptly dealt with. All data remains in the system with an audit trail and is readily available to identify the need for maintenance and to justify schemes on a priority basis.

Safety Inspections are walked visual inspections (or from a slow-moving vehicle) designed to identify defects likely to create a danger to the public and therefore require immediate or urgent attention (Category 1 defects). They are undertaken at intervals not exceeding seven days on all trunk roads.



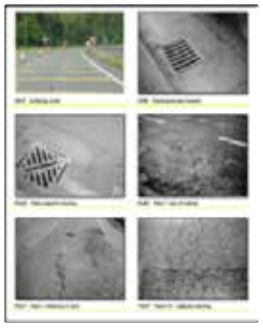
Safety Patrols are visual inspections from a slow-moving vehicle designed to supplement Safety Inspections by providing a more frequent surveillance of the road network to identify serious defects. They are undertaken on selected trunk roads at intervals not exceeding seven days midway between Safety Inspections.

Night time Safety Patrols of illuminated signs, illuminated bollards and lighting points (including but not limited to road lighting, flood lighting, underpass lighting, architectural lighting, navigational lighting, pedestrian lighting, bus shelter lighting and festive lighting) are undertaken to ensure all assets which provide light have the correct visibility. They are carried out at intervals not exceeding 14 days from 1 October to 31 March and at intervals not exceeding 28 days from 1 April to 30 September.

Detailed Inspections are walked visual inspections designed primarily to establish programmes of routine maintenance tasks not requiring urgent attention (Category 2 defects). The frequency of inspection varies according to the asset but are generally undertaken annually on all trunk roads (or biennially if the asset is within or adjacent to a central reserve on a motorway or dual carriageway and requires a lane occupation).

Additional guidance on safety and detailed inspections is provided in Transport Scotland's *Trunk Road Inspection Manual* which sets out the procedure for undertaking safety and detailed inspections, and provides guidance on inspection frequencies and the types of defects to be recorded in the Asset Management System described in Section 8. Where appropriate, examples of defects that may constitute a safety risk are given for each asset type. However, the manual does not contain an exhaustive compendium of defects and the Operating Company is required to adhere to the principles of a system of defect risk assessment as set out in Chapter 9 of *Well Maintained Highways – Code of Practice for Highway Maintenance* (www.ukroadsliaisongroup.org/en/utilities/document-summary). Each Operating Company is required to provide clear guidance and training to their employees in the conduct of safety inspections.

Condition Surveys are walked visual survey introduced in 2013/14 and used to grade the condition of selected ancillary road assets (e.g. signs, footways and road markings). The surveys are generally undertaken annually on all trunk roads alongside Detailed Inspections. Guidance on the surveys is provided in Transport Scotland's *Trunk Road Condition Manual* which details the procedures



for rating the condition of assets according to five levels of service or condition categories. This information will be used to inform maintenance strategies and assess how these assets are performing over time.

The data will also greatly assist in the identification and prioritisation of renewal schemes for ancillary assets. Condition data for assets such as safety fences and line markings can be mapped alongside carriageway and structures data to support the development of schemes on different assets at the same location.

5.3 Routine and Cyclic Maintenance

Routine and cyclic service operations include cyclic, reactive and planned activities that enable us to keep the trunk road network safe and serviceable, and are needed to preserve the value of the asset. These activities include reactive repairs and winter, flood and emergency responses but exclude preventative and programmed renewals maintenance. Information from routine activities, however, makes an important contribution to the planning of these other works. The three main types of activity are:

- Cyclic maintenance.
- Reactive and planned routine maintenance.
- Winter Maintenance.

Full details of the routine and cyclic maintenance requirements are provided in Schedule 7: Part 1 and Part 2 of the Operating Company contracts and summarised below.

Cyclic Maintenance

Cyclic maintenance is undertaken at regular intervals to maintain the safety, condition and functionality of an asset and reduce the need for other, normally more expensive, maintenance. Examples of cyclic activities include cutting of vegetation, cleaning of drainage systems, replacement of lighting lamps, and litter picking.

Reactive and Planned Routine Maintenance

Reactive maintenance covers a range of unplanned activities that may arise on the trunk road network, including essential maintenance to fix a defect. When a defect has been identified, normally through the safety and detailed inspections outlined in

Section 5.2, the Operating Company is required to take account of contract requirements, applicable regulations and engineering judgement in deciding when remedial action will be necessary, and to make recommendations on the type of work required. There are two categories of defect with different response times, namely Category 1 and Category 2.

- *Category 1 Defects* – are corrected or made safe at the time of inspection if reasonably practicable. In this context, making safe may constitute displaying warning notices/signs, coning off or fencing to protect the public from the defect. If it is not possible to correct or make safe the defect at the time of inspection, repairs of a temporary or permanent nature are carried out as soon as possible and no later than:
    - 06:00 on the day following identification of the Category 1 Defect on carriageways; or
    - within 24 hours of identification for all other Category 1 Defects.

Where a temporary repair has been carried out, the deferred permanent repair period for the following defect types shall be:

- 28 days for carriageway surface;
- 56 days for bridge parapets; or
- all other Category 1 Defects repaired permanently within the specific period referred to in Schedule 7 Part 1 of the Transport Scotland Operating Company Contract, or no later than 28 days after identification where no specific period is stated.

Category 1 defects will often need to be dealt with immediately due to the high risk to public safety or risk of further rapid deterioration. Examples include potholes, flooding, vandalism, vehicle impacts, and diesel/oil spills.

- *Category 2 Defects* – all other defects, that is, following a risk assessment, are deemed not to represent an immediate or imminent hazard or risk of short-term structural deterioration. Response times to Category 2 defects are not specified and are undertaken within a planned programme of works and scheduled on a needs basis.

Winter Maintenance

Transport Scotland undertakes steps it considers reasonable to prevent snow and ice endangering the safe passage of pedestrians and vehicles on the trunk road network. These services are provided by the Operating Companies in accordance with contract requirements.

Each Operating Company will undertake a 'snow desk' winter scenario exercise at the start of the winter period, to test and challenge the robustness of their Winter Service Plans to the full. When conditions require, roads are salted to prevent ice forming and are ploughed to clear snow.
From 1 October to 15 May, a 24-hour dedicated winter maintenance service operates on all Scotland's trunk roads. From 1 November to 31 March, routes most at risk from winter conditions are patrolled. Patrols operate from early morning through to the end of the morning peak period and at other times of the day when severe wintry weather is forecast. Our trunk road Operating Companies have winter control rooms that operate 24/7, and constantly review conditions and deploy necessary resources.

Together Transport Scotland and our Operating Companies have made a significant investment in our winter maintenance equipment including the roll-out of larger gritters with the ability to carry more salt supplies, and other innovative equipment including icebreakers from Scandinavia, inverted V-ploughs and footway snow blowers.

During severe weather conditions, we endeavour to keep the public informed in a variety of ways, including the Traffic Scotland website (which is also available through mobile telephone applications), our Traffic Scotland Customer Care Line (0800 028 1414), roadside electronic variable message signs (VMS), twitter and radio travel information broadcast.

Further details on winter maintenance can be found at:
www.transportscotland.gov.uk/road/winter-service-ready-winter-and-severe-weather

5.4 Asset Investment Planning

Maintaining the trunk road network in a good condition helps to provide faster and more reliable journeys which improve opportunities for business, leisure and tourism. It also aids Scotland's move towards a low carbon economy by improving traffic flows and avoiding stop-start travelling conditions; and

ensures regions and individuals are well connected to economic opportunities, creating a more cohesive Scotland with increased social equity.

A long-term look ahead can provide visibility of any significant increases or decreases in funding needs and annual work volumes. We regularly identify, develop and analyse a number of different investment scenarios for each of our major asset types, including the following:

- the budget required to maintain current condition both now and in the future;
- the budget required to achieve optimum condition targets;
- the forward work plan associated with current levels of investment; and
- the impact of maintaining current levels of investment on future network condition.

Based on our budgets and asset management objectives identified from our policy and strategy, the following sections present two such scenarios for each asset type.

Carriageways

We have developed a financial model which we use for lifecycle planning on carriageways. This model has been specifically developed to perform predictive modelling, utilising existing survey data, to allow us to estimate the future maintenance requirements over a number of years for differing levels of funding or different road condition targets. The model has been used to assess the following scenarios:

- *Scenario 1:* Determine the budget required to maintain the trunk road network in its current condition (87% in good or fair structural condition).
- *Scenario 2:* Determine the volume of work that can be undertaken with the current expenditure on structural maintenance being approximately £34.5m per annum.

The model uses information from the routine road condition surveys that we undertake to assess the condition of our network. These include:

- SCANNER traffic speed surveys to measure surface condition covering 50% of the road network annually to identify surface characteristics and defects, which would be visible to road users;

- Deflectograph surveys on one fifth of the network annually to measure structural condition, which is reported as the remaining or 'residual life' of the road, in order to maintain engineering integrity. Structural condition surveys assess the condition of all layers in the road construction and the defects are not always visible to road users.

The carriageway condition for each road type is expressed as a combined index termed the Transport Scotland Road Condition Index (TS RCI). The TS RCI takes account of both the surface and structural (full depth) condition of each individual road type. The structural condition carries a relatively high weighting reflecting the importance of maintaining engineering integrity on the trunk roads and motorways, which carry high traffic flows and a high proportion of heavy goods vehicles. The condition of our carriageways is categorised using a three point condition banding; good, fair or poor.

Our network is diverse with significant variations in traffic ranging from urban motorways to rural single carriageway roads. Hence each road type varies in the rate of deterioration, the defects that occur, when it will require maintenance and the type of maintenance required. Consequently, in order to ensure a well maintained trunk road network we have adopted different maintenance targets for motorways, dual and single carriageways.

Structures

We are developing a computerised model to inform our lifecycle planning requirements for structures and are using it to assess the following scenarios:

- *Scenario 1:* Determine the budget required to maintain the trunk road structures stock at current condition levels.
- *Scenario 2:* Determine the volume of work that can be undertaken with the current expenditure on structural maintenance being approximately £24.5m per annum.

In 2009/10 we adopted the Bridge Condition Index (BCI) inspection standard which is calculated from General and Principle Inspection data and allows us to analyse and trend condition information. This is a valuable tool in helping us determine overall deterioration rates and sits alongside the planned inspection regimes, which more accurately determine actual defects, deterioration and remedial works. From these inspections the BCI is determined. The following condition indicators are calculated for each structure:

- *BCI_{av}:* The average BCI for a structure taking into account the condition of all structural elements on the structure. The weighted average of the individual BCI_{av} scores provides an overview of the average stock condition ($SSCI_{av}$).
- *BCI_{crit}:* The condition score of the load bearing element which is in worst condition, this score provides an indication of the criticality of the structure with regards to the load bearing capacity. The weighted average of the BCI_{crit} scores provides an indication of the criticality of the stock with regards to load carrying capacity ($SSCI_{crit}$).

The condition of our structures is categorised using a five point condition banding that ranges from excellent to very poor. Based on the defects recorded in the condition inspection surveys, a workbank of treatments is created for structures and the maintenance target for these structures is to be defect free.

Our investment scenarios are then run from this information, and the outcomes of the planned inspections, with works being prioritised based on condition and importance.

Ancillary Assets

In this version of the RAMP ancillary assets cover all trunk road asset types with the exception of the carriageway and road structures. Our ancillary asset decision support tool is a customised tool that has been developed so that we can undertake effective lifecycle planning analysis for our ancillary assets. The model has been used to assess the following scenarios:

- *Scenario 1:* Determine the budget required to replace all ancillary assets which have been assessed as being in very poor condition, beyond economic repair and at the end of their serviceable life.
- *Scenario 2:* Determine the volume of work that can be undertaken with the current expenditure on ancillary assets being approximately £11m per annum.

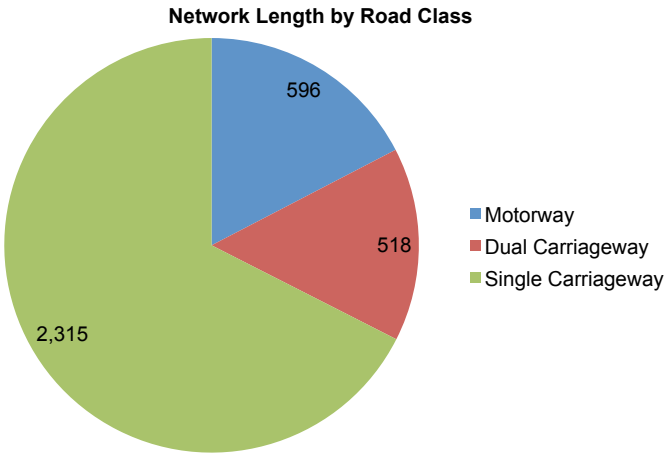
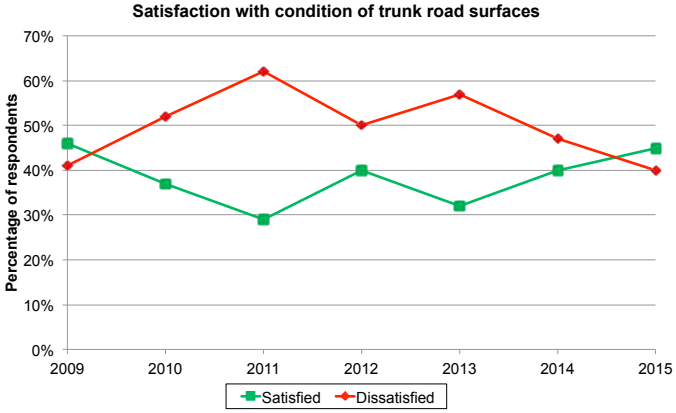
In order to ensure that our ancillary assets are maintained to the highest standards, and to ensure they are safe for use and fit for purpose, it is essential that their visual and structural condition are reviewed and monitored on a regular basis. This responsibility rests with our Operating Companies who are required to undertake Condition Inspections as part of the 4G Operating Company Contract. Additional guidance is provided in our Trunk Road Condition Manual, which details the procedures for categorising

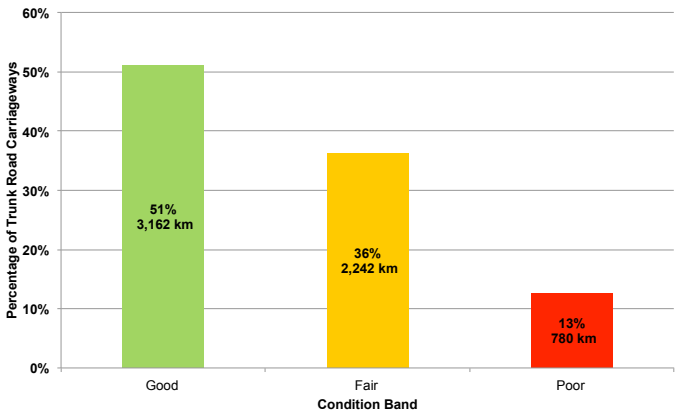
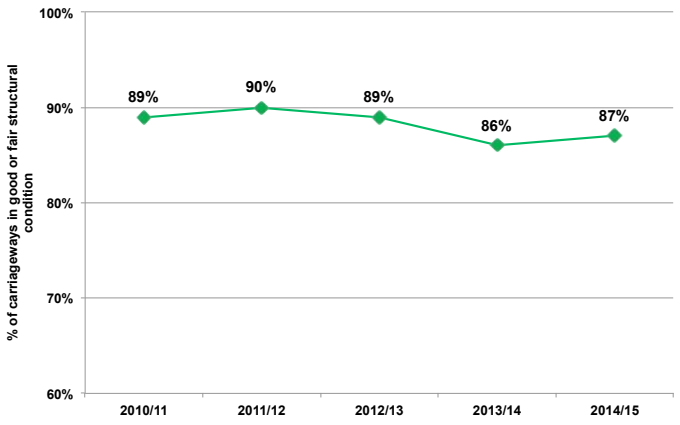
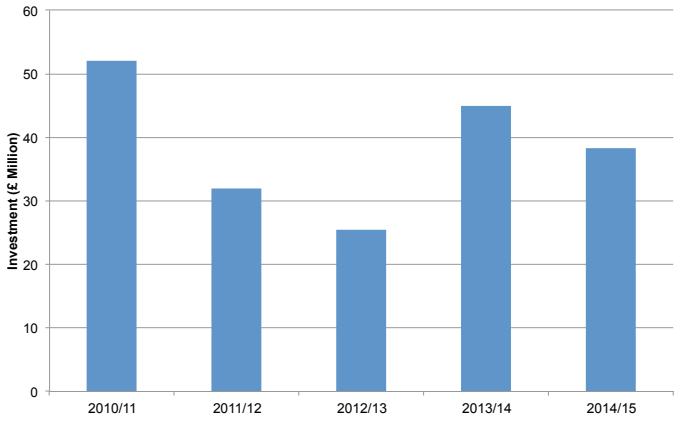
selected ancillary assets (e.g. signs, footways and road markings) by the severity of their defects according to five levels of service or condition categories.

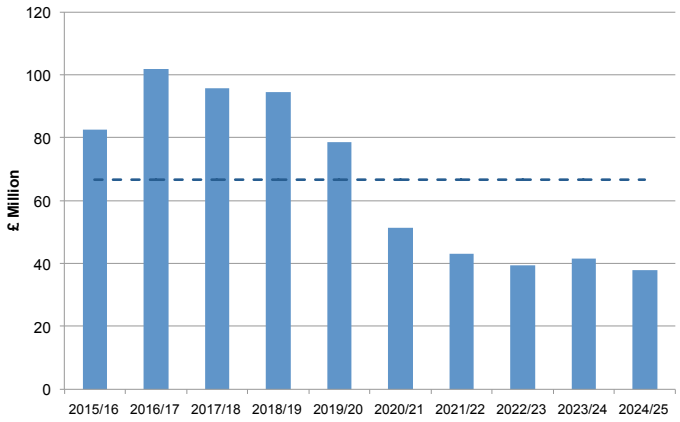
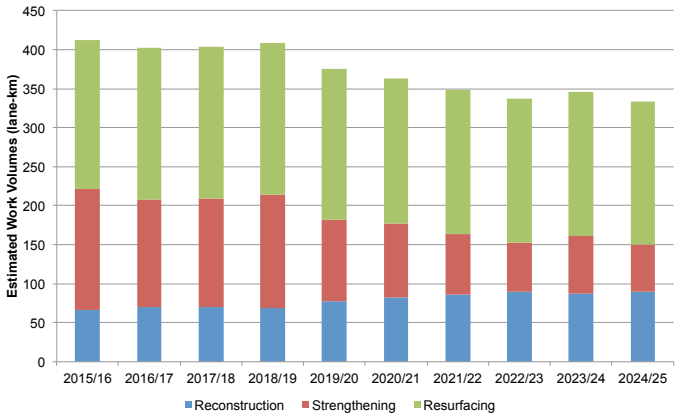
This information is then fed into our ancillary assets decision support tool and is used to inform maintenance strategies and assess how these assets are performing over time, for any defined scenario.

5.5 Summary of Lifecycle Plans

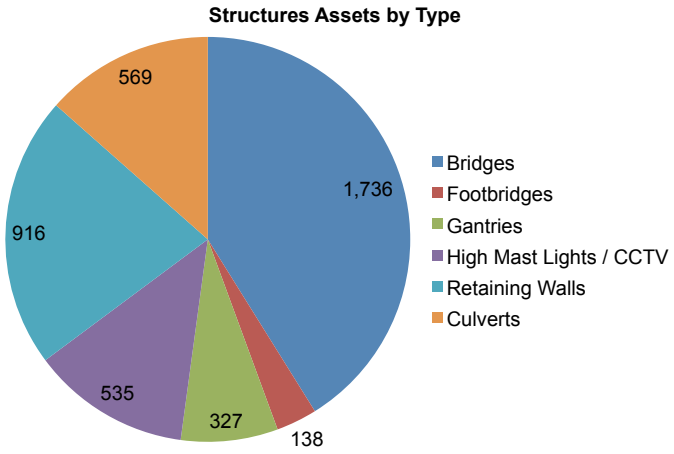
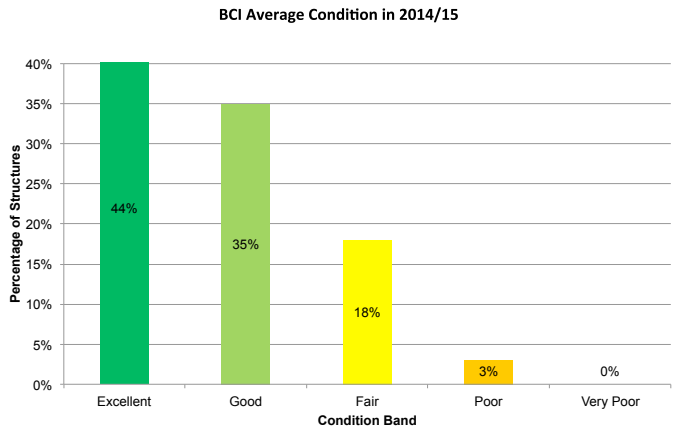
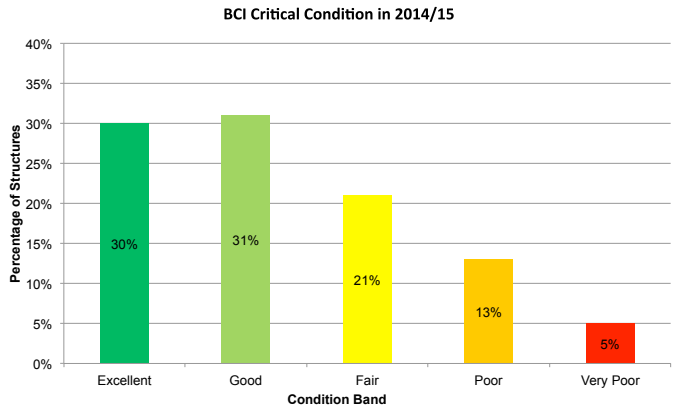
Carriageways

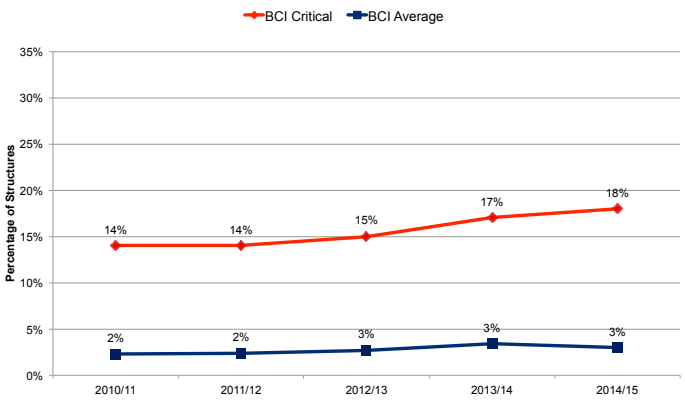
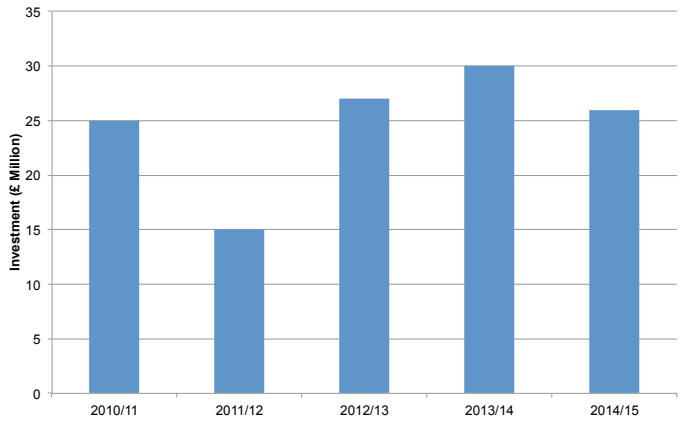
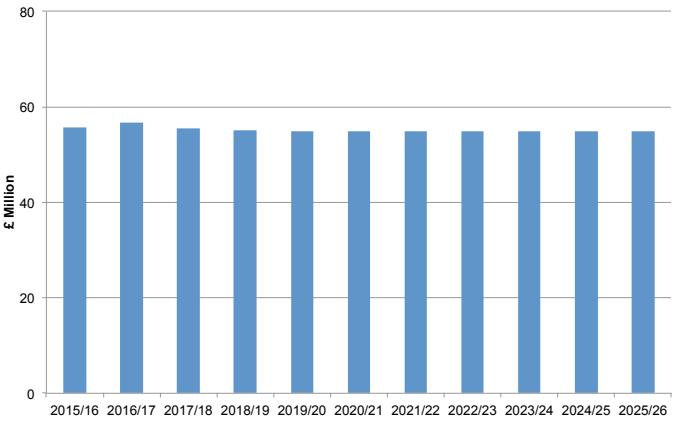
	Details	Commentary
Our Asset		The total length of the trunk road network is 3,429 route km.
Customer		Satisfaction with the condition of trunk road surfaces has reached its highest level since 2009, at 45% (an increase of 5% since 2014). Reflecting this, the proportion of respondents dissatisfied with road surfaces has decreased, from 47% in 2014 to 40% in 2015. For the first time since 2009, a higher proportion of respondents were satisfied than dissatisfied.

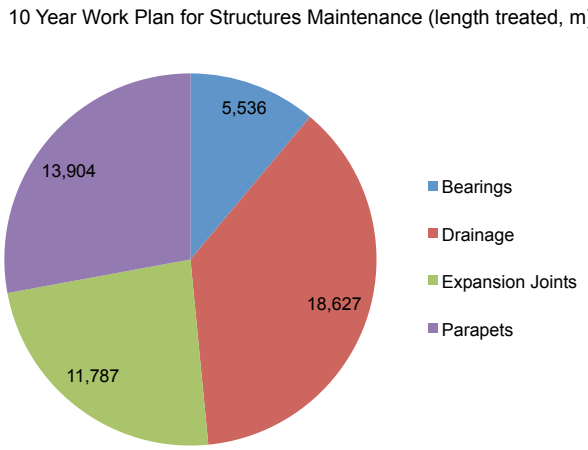
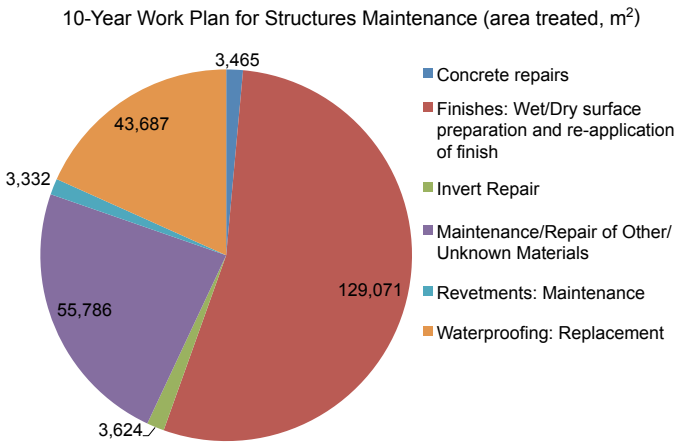
	Details	Commentary
Current Condition		Currently 87% of trunk road carriageways are in good or fair condition.
Historical Condition		The condition of trunk road carriageways has declined from 89% in 2010/11 to 87% in 2014/15.
Historic Investment		Spend on roads' structural maintenance has ranged from £26m per annum to £52m per annum.

	Details	Commentary
Future Investment		An average investment of £66m per annum (excluding inflation) would be required to maintain the condition of carriageways at their current level (87% good or fair) over the next 10 years. The 2015/16 budget is approximately £34.5m.
Indicative Forward Work Plan		Assuming that funding will remain at 2015/16 levels (£34.5m per annum), an estimated 3,729 lane-km of carriageways will be reconstructed, strengthened or resurfaced (789, 1,052 and 1,888 lane-km respectively) over the next 10 years.
Discussion	We will continue to implement our *Roads Structural Maintenance Strategy* and work with our supply chain to make best use of available resources. Implementation of this strategy, alongside other efficiency saving initiatives and asset management improvements will enable us to continue to manage trunk road carriageways in a safe and serviceable condition.	

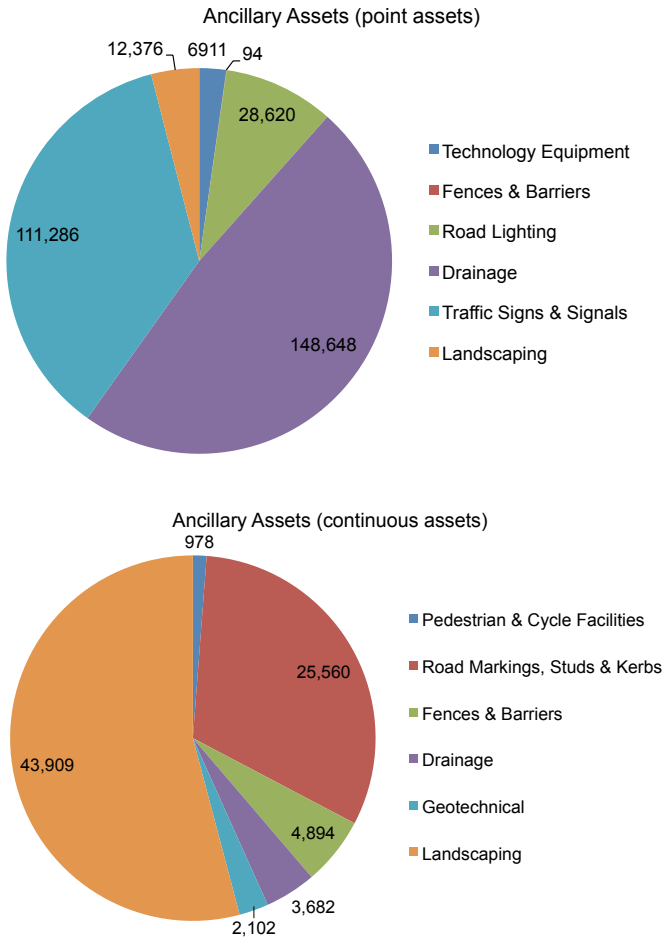
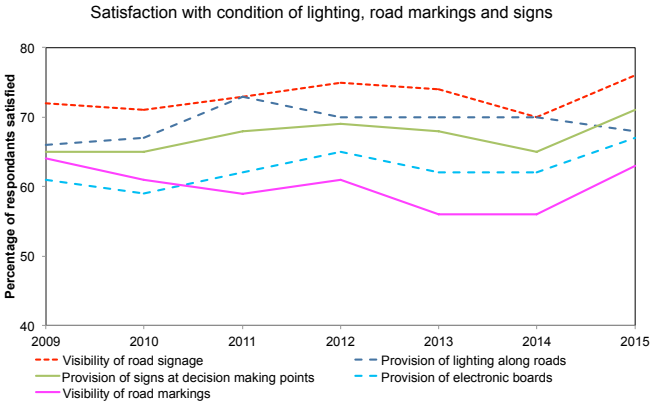
Structures

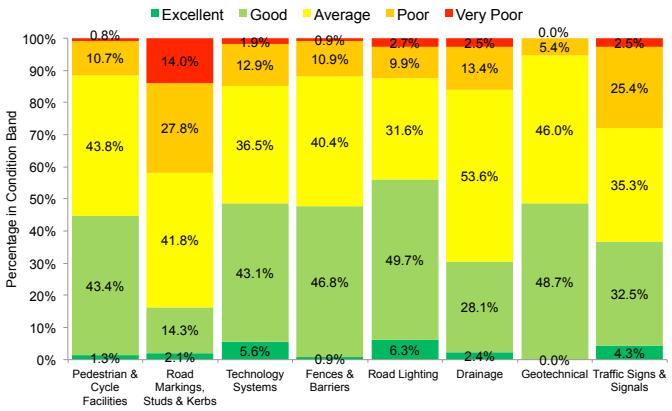
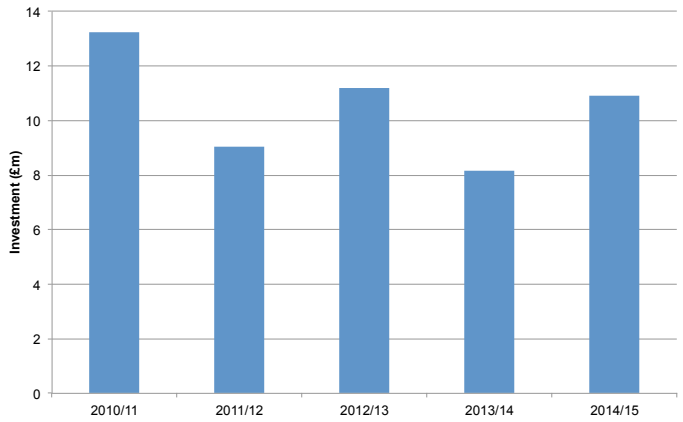
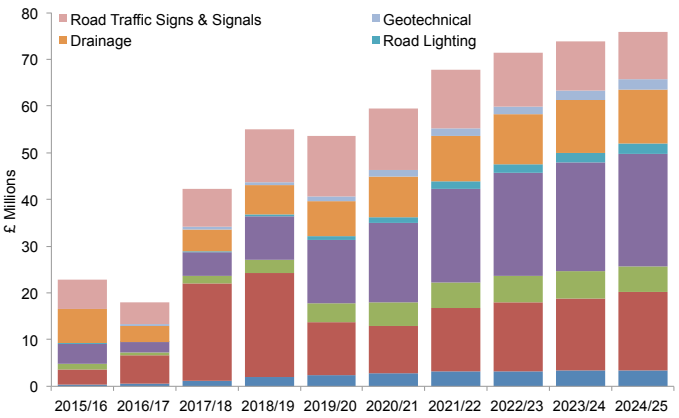
	Details	Commentary
Our Asset		The total number of structures is held within our Integrated Roads Information System (IRIS). We currently have 1,874 bridges and footbridges, and 2,347 other structures.
Current Condition	 	The majority of trunk road structures have a BCI average condition rating of excellent or good (79%). The SSCIav score for the structures stock is 86%. The majority of trunk road structures currently have a BCI critical element condition rating of excellent or good (61%). The SSCIcrit score for the structures stock is 76%.

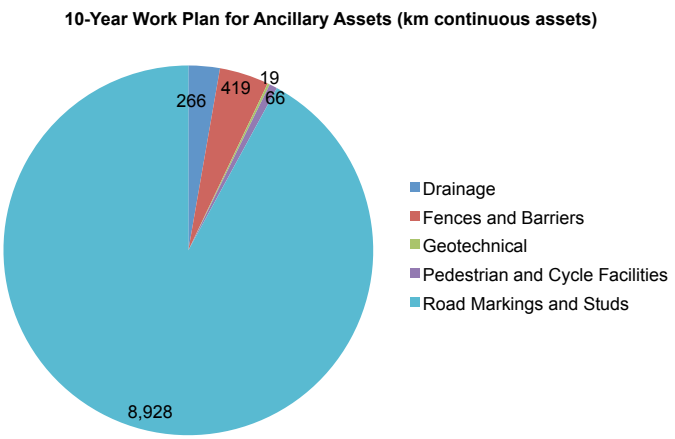
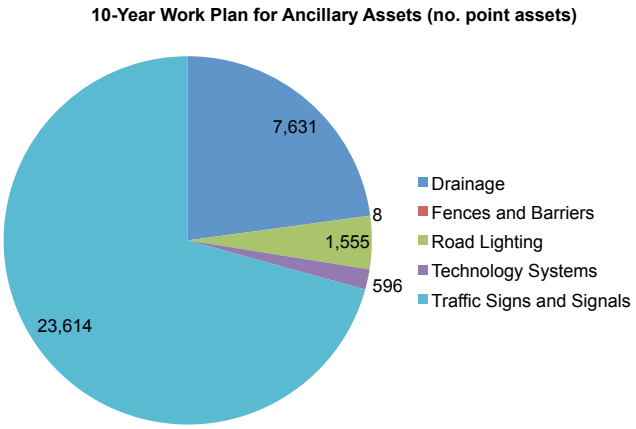
	Details	Commentary
Historical Condition		The percentage of structures in poor or very poor BCI average condition has remained relatively stable, increasing from 2% in 2010/11 to 3% in 2014/15. The percentage of structures with poor or very poor critical element condition has increased from 14% to 18%.
Historic Investment		Spend on maintenance of trunk road structures has ranged from £15m per annum to £30m per annum.
Future Investment		An average investment of £55m per annum (excluding inflation) would be required to maintain the condition of the structures stock at their current level over the next 10 years. The 2015/16 budget is approximately £24.5m.

	Details	Commentary
Indicative Forward Work Plan	 	Assuming that funding will remain at 2015/16 levels (£24.5m per annum), an estimated 50,000m of bearings, joints, drainage or parapets will be maintained or replaced over the next 10 years. Approximately 240,000m^2 of concrete repairs, waterproofing, and finishes will also be undertaken.
Discussion	We will continue to develop and implement our strategy for managing trunk road structures and work with our supply chain to make best use of available resources. This, alongside other efficiency saving initiatives and asset management improvements, will enable us to continue to manage trunk road structures in a safe and serviceable condition.	

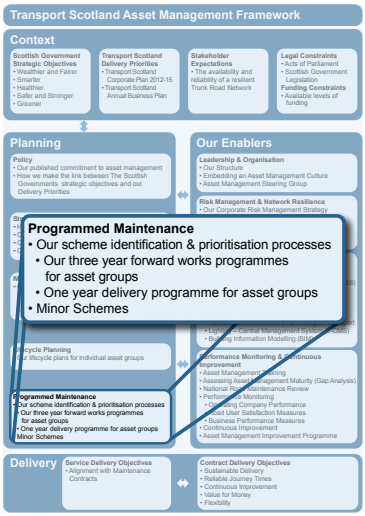
Ancillary Assets

	Details	Commentary
Our Asset	 	The total number of ancillary assets is held within our Integrated Roads Information System (IRIS). We currently have 307,935 individual point assets (e.g. lighting columns) and 81,125 km of continuous assets (e.g. safety barriers).
Customer		Customer perception of those ancillary assets included in the customer survey (signs, road markings, lighting and electronic message boards) have remained mainly positive since 2009. Levels of satisfaction were generally higher than in 2014.

	Details	Commentary
Current Condition		Approximately 41% of ancillary assets are categorised as excellent or good condition. Approximately 18% is categorised as poor or very poor condition.
Historic Investment		Spend on ancillary asset renewals has ranged from approximately £8m per annum to £13m per annum over the last five years.
Future Investment		An average investment of £54m per annum (excluding inflation) is required to replace all ancillary assets that fall into the very poor condition band over the next 10 years. The 2015/16 budget is approximately £11m.

	Details	Commentary
Indicative Forward Work Plan	 	Assuming that funding will remain at 2015/16 levels (£11m per annum), an estimated 33,400 individual point assets and 9,700 km of continuous assets will be replaced over the next 10 years.
Discussion	We will continue to develop and implement our strategy for managing ancillary assets, and work with our supply chain to make best use of available resources.	

6 Programmed Maintenance



Programmed Maintenance is moderate to major work which aims to improve the condition and functionality of the asset, and is planned one or more years in advance. There are normally long time intervals between programmed maintenance activities on a given asset (e.g. carriageway resurfacing and replacement of bridge components).

6.1 Scheme Identification & Prioritisation Process

Scheme Identification

Currently our programmed maintenance work plans are developed largely based on asset condition data including results from inspections and condition surveys including Deflectograph, SCANNER, SCRIM, Detailed Inspections and Principal Inspections to structures. Each asset type has defined thresholds or triggers that when reached indicates that structural maintenance or strengthening may be required. The actual need for maintenance is assessed through further site inspections and appropriate testing which are used to validate initial findings and refine appropriate treatment options. The outcome of this is a one-year implementation programme and a further two-year planning programme which is updated and prioritised annually.

Whole Life Costing

To assist in determining the most appropriate treatment option for an identified maintenance scheme we have developed a Whole Life Costing model. This model is used to assess the economic efficiency of various potential treatment options for an individual scheme to assist us in determining the most advantageous treatment option that delivers the best value for money over the lifecycle of the asset. The use of the Whole Life Cost model provides us with the mechanism to ensure that the most appropriate maintenance is delivered at the right time whilst reducing the whole life costs of maintenance.

Scheme Prioritisation

It is not unusual that programmed maintenance budgets are unable to address all of the maintenance that we would ideally like to undertake. This means different maintenance needs are competing for the same money. It is important to ensure that the available budget is spent on the most deserving sites with demonstrable maintenance needs in a manner that is consistent with Transport Scotland's maintenance policies and objectives.

We have developed and implemented a formal value management process for roads structural maintenance schemes for assessing the benefits of undertaking maintenance and the associated risks of not undertaking maintenance. Additionally, we have developed a value management process for trunk road structures which aligns with best practice within the UK, ensuring that our investment is both effective and efficient. Each scheme in the one-year maintenance programme is scored against a range of criteria:

- *Safety* – to maintain a safe network and assess the level of risk to the road user. Those schemes that are safety critical or have a high level of risk will have the highest priority scoring.
- *Journey Time Reliability/Functionality* – to assess the level of risk to the service, e.g. route availability.
- *Environment/Sustainability* – to assess the impact of a scheme on the environment, noise reduction, recycling and sustainability.
- *Value for Money* – to consider the economic efficiency of the scheme and seek to minimise the whole life costs (i.e. invest now to deliver savings later).

The scores are being used to determine which schemes should remain in the current year and which can be deferred until the following year. This ensures that those parts of the network with the greatest need are addressed and that the available funds are allocated in a fair, objective and transparent manner.

6.2 Minor Schemes

Transport Scotland's Major Transport Infrastructure Projects Division is responsible for delivering improvements to the trunk road network, e.g. new roads and road widening. Where considered appropriate, minor improvement schemes are funded and managed by the Trunk Roads and Bus Operations Division, the most recent of which is the A83 Improvement Programme.

Following a number of landslides on the A83, Transport Scotland commissioned a study which developed a programme of progression for improvement works, targeting a number of issues along the route. The objectives of the A83 Route Study and programme were to:

- Reduce accident rates and severity on the A83.
- Improve pedestrian and cycling amenities in the settlements along the A83.

- Improve journey time reliability by reducing the frequency and impact of road closures.
- Reduce the economic impact on the A83 study area by reducing the frequency and duration of road closures caused by landslides.

Transport Scotland is progressing a number of the improvements identified over the period of this RAMP. Further information can be found at:
www.transportscotland.gov.uk/project/a83-improvements

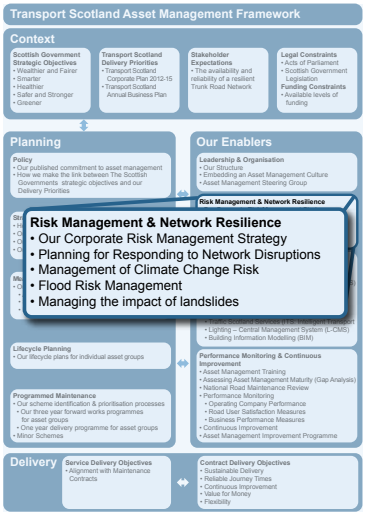
6.3 Network Operations

Road users expect reliable journey times, preferably on roads that are congestion free. Increased journey times, exacerbated by unexpected congestion, are frustrating, even more so when it is the result of road works. At the same time, no one wants their roads to be in poor condition, and in some cases, maintenance operations may lead to unavoidable delays at road works. To minimise disruption, we programme work to take place during quieter periods whenever possible.

Due to the strategic importance of Scotland's trunk road network, our Operating Companies are required to minimise the potential disruption and inconvenience to road users caused by essential maintenance by planning works, combining activities and coordinating with all stakeholders, including statutory undertakers (e.g. utilities and telecoms companies). We also continue to demonstrate a strong ethos in the communication of timely and consistent information on upcoming road works.

Transport Scotland is responsible for managing the Traffic Scotland service which enables the collection and distribution of real-time traffic information relating to incidents and events taking place on the Scottish trunk road network. The Traffic Scotland website (trafficscotland.org/roadworks) provides up-to-date information on current and planned road works, and advance warnings are also displayed to road users on variable message signs. We also work closely with the Scottish Road Works Commissioner, established to oversee the planning and coordination of works on Scotland's roads by all roads authorities and statutory undertakers.

7 Risk Management and Network Resilience



7.1 Overview

Risk management is the process of identifying, analysing, assessing and managing risk, where risk is 'the chance of something happening that will impact on safety or service'. In more quantitative terms, risk is the combination of the frequency or probability of occurrence and the consequences of a specific hazard being realised.

The Cabinet Office has defined resilience as *'the ability of the community, services, area or infrastructure to detect, prevent, and, if necessary to withstand, handle and recover from disruptive challenges'.* This definition fits well with the risk-based approach that we adopt to manage the trunk road network and provides a good overview of what network resilience we should aim to deliver.

7.2 Transport Scotland Corporate Risk Management Strategy

Risk is relevant to all parts of our business and as such it is important that a consistent and joined up approach is used across all Transport Scotland Directorates. We have developed a Corporate Risk Management Strategy to align with and provide synergy between the directorate's approach to risk management, the strategy sets out a clear system for identifying, managing and mitigating risk and incorporates:

- Existing risk management arrangements.
- An up-to-date Corporate Risk Register.
- Appropriate measures in place to mitigate risk.
- Regular reviews by the senior management team of the risk register.
- Prioritised risks in order to escalate them to appropriate levels within Transport Scotland, the wider Scottish Government and Scottish Ministers so that any necessary action can be taken.
- An annual review and updating if appropriate of the risk management strategy.

Our Corporate Risk Register sits above and is informed by the risk registers held by each directorate. We have a number of risk management practices for trunk roads, all of which form part of our asset management approach, these are summarised in the following sections.

7.3 Resilient Network

Our network is made up of several route corridors that are of strategic importance to the economic stability and growth and social wellbeing of Scotland. The network is vital because it connects our cities, rural communities and the ports that serve the islands.

Having such a diverse network makes it impractical to either assess or build resilience across the entire network. As a result we have focused our resilience risk assessments and plans on individual subsets of our network. These risk assessments are developed and reviewed when required to ensure that it provides:

- connectivity between our major communities;
- links to key transport interchanges;
- access to emergency facilities including fire and rescue, police, ambulance services and hospitals;
- links to critical infrastructure (ports, power stations, water treatment works etc);
- principal public transport routes and access to stations, bus garages and depots;
- other important facilities; and
- connectivity with the local road network where appropriate.

When defining our resilient network, consideration is given to engaging with local resilience partnerships, key businesses and interest groups to jointly identify routes which are critical to the economic and social wellbeing of Scotland. Local road authorities are also consulted to ensure continuity of the resilient network throughout Scotland.

7.4 Planning for Responding to Network Disruptions

Disruption Risk Management Plan

Our resilience planning is not just about the physical resilience of the trunk road network but also about how disruption is managed and the speed of recovery. Our Operating Companies are required to prepare and maintain a Disruption Risk Management Plan which brings together the range of processes, tools, records and operational plans that collectively describe the activities undertaken to enable timely and effective action to mitigate the effects of emergencies, as they affect the trunk road network. Further information on responding to incidents is available in Schedule 7 Part 3 of our Operating Company Contract.

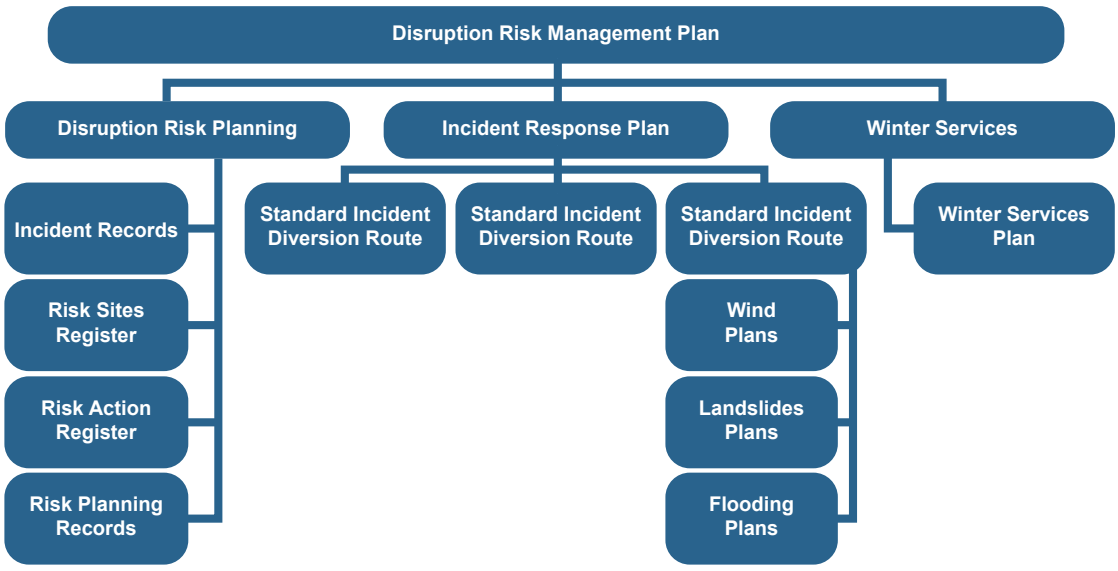


Figure 7.1: Overview of Disruption Risk Management Planning

Our Operating Companies are also required to undertake a series of activities aimed at improving journey time reliability by minimising the risk of unplanned disruption to the operation of the trunk road network. The Transport Scotland Manual for the *Management of the Risk of Unplanned Network Disruption* provides direction to Operating Companies on managing and mitigating the effects of disruptive events, such as those caused by weather events. The manual requires Operating Companies to develop and implement disruption risk processes which are informed by the formal recording of all previous events, as they occur. This includes severe weather related events such as high winds, flooding, snow and ice. The ongoing recording of events and subsequent revisions to the plans provides a platform for early detection of changing conditions that may have an impact on the network. Furthermore, the manual includes a *Disruption Risk Assessment Tool* which provides a robust and objective framework within which to analyse patterns of events, and their locations, in order to support decision-making and identify particularly vulnerable locations and assets. This will be used to drive investment to address disruption events that already occur and also those which might emerge or increase in frequency and severity in the future.

Partnership Response

We work in partnership with other transport operators, for example Scotrail, and agencies such as the Met Office and Police Scotland as part of our Multi-Agency Response Team (MART) arrangements. These can be activated for planned events like the Commonwealth Games or unplanned like a weather event. MART enables a more effective response to large-scale trunk road issues and forms part of our wider 'all modes response' which also feeds into the Scottish Government's resilience response arrangements.

7.5 Management of Climate Change Risk

A Changing Climate

Various studies have been conducted into how climate change might impact on the transport sector and on the Scottish trunk road network in particular. These reports generally conclude that Scotland can expect to experience a general rise in average temperatures resulting in milder winters with fewer days of frost, ice and snow and warmer summers with more frequent, and extended, periods of hot weather. Reports also conclude that average annual rainfall will remain largely unchanged, but with summers expected to become drier and winters expected to become wetter. It is also, and most importantly, predicted that extreme weather events will become more frequent and more severe. This includes prolonged and heavy precipitation events, high wind occurrences, storms and periods of drought. Furthermore, sea levels are projected to rise and storm surges are expected to become more severe.

If not understood and prepared for, these changing weather patterns are likely to result in increased disruption to road users. Increased surface water flooding has been identified as a primary risk, with journeys also being increasingly at risk of disruption from landslides and high winds. There will also be an increased risk of scour affecting bridge footings where they are present within rivers and estuaries. Some of our key initiatives aimed at identifying and minimising the risk of climate change disruption are outlined in the following sections.

Climate Change Adaptation

To minimise future disruption and ensure that the Scottish trunk road network is resilient to the impacts of a changing climate action must be taken to understand where, how and when the impacts are likely to be felt, and also how effective adaptation and resilience building can be achieved. The challenges of adapting to a changing climate cannot be considered in isolation. Climate change needs to

be a routine consideration, factored into Transport Scotland's day-to-day decision-making processes rather than a discrete risk to be managed independently. Although, many of Transport Scotland's activities are affected by climate, few decisions can be made taking only climate considerations into account.

Addressing climate change is not simply about preparing for and managing increased disruption. Consideration must also be given to the adaptation of network design, construction, operation and maintenance processes and procedures to reduce vulnerability and the potential impact of these effects.

The Scottish Climate Change Adaptation Programme (CCAP) was developed in response to Section 53 of the Climate Change (Scotland) Act 2009 and to address the impacts identified for Scotland in the UK Climate Change Risk Assessment (2012). The CCAP aims to provide:

A Scotland with well-managed, resilient infrastructure and buildings providing access to the amenities and services we need.

The programme identifies three high level objectives in order to deliver this:

- *Objective B1:* Understand the effects of climate change and their impacts on buildings and infrastructure networks.
- *Objective B2:* Provide the knowledge, skills and tools to manage climate change impacts on buildings and infrastructure.
- *Objective B3:* Increase the resilience of buildings and infrastructure networks to sustain and enhance the benefits and services provided.

There are numerous actions and recommendations which fall under these three broad objectives, several of which are directly focussed on the Scottish trunk road network. Full details are set out within the CCAP report laid before the Scottish Parliament in May 2014, which can be obtained via:
www.gov.scot/Resource/0045/00451392.pdf

Transport Scotland's Climate Change Adaptation and Resilience Plan

The Scottish CCAP report requires Transport Scotland to consider aspects such as high winds, flooding and landslides and to develop appropriate strategies. These strategies are being incorporated into a Climate Change Adaptation and Resilience Plan (CCARP) currently being developed for the Scottish trunk road network in order to support continuing improvement and effective adaptation.

The CCARP will build on the output from the Disruption Risk Management Plans and take a fresh look at the nature of the trunk road asset to identify where the greatest vulnerabilities currently exist. The study then considers where the risk might be further increased due to changing weather patterns and allows the development of mitigation plans to support future investment decisions.

The CCARP will also draw on the outcome of an international study commissioned by the World Road Association which is due to be published by the end of 2015. Work on the CCARP is well advanced with completion expected by the end of 2015 and will lead to the production of an inventory of vulnerable assets and road sections which are considered to be at risk from the effects of changing weather patterns. It will also include a series of asset-specific, operational and network-wide recommendations for increasing resilience and supporting investment decisions.

7.6 Flood Risk Management

Transport Scotland has identified surface water flooding as a primary risk to the smooth operation of the trunk road network and is closely aligned with the ongoing activities in the Flood Risk Management Programme, itself borne out of the Water Framework Directive and the Flooding Risk Management (Scotland) Act 2009. The Scottish Environment Protection Agency (SEPA) coordinates this work on behalf of the Scottish Government, with Local Authorities taking the lead on the development of Local Action Plans with a view to developing Local Flood Risk Management Plans.

As Local Flood Risk Management Plans are developed, Transport Scotland will aim to provide information on how trunk road drainage assets might impact on Potentially Vulnerable Areas (PVAs), as well as understand how flooding in the PVAs might impact on trunk road operations. This will be augmented by our Disruption Risk Management process which will improve understanding of known flooding locations, and deliver mitigation plans and improvement programmes.

Transport Scotland is fully engaged in this process and will continue to contribute to the framework and the development of action plans and management plans.

7.7 Managing the Impact of Landslides

Scotland's scenery of high mountains and steep valleys can be particularly prone to landslides during periods of extended heavy rainfall. Landslides are natural events involving the movement of a mass of rock, earth or debris and can occur above or below sections of the trunk road network with consequential effects on the function or stability of the road. Landslides such as these are difficult to prevent but steps are being taken to manage the consequences and to reduce the impact of landslides on trunk roads as well as keeping road users fully informed when events occur.

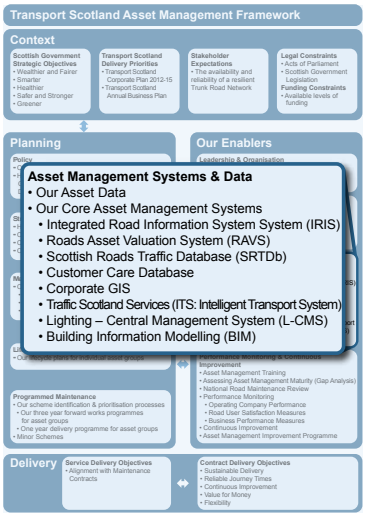
The implications of landslides on the operation of the road network were brought into sharp focus in August 2004, when very heavy rainfall led to a series of debris flows, causing a number of disruptive trunk road closures, primarily in the Argyll and Perthshire areas of Scotland. Following these events, a program of detailed research was initiated with a view to managing the hazard of potential landsides, in terms of the risks presented to road users.

The research set out to develop a method of identifying lengths of the trunk road network most prone to the hazard of debris flows and to categorise these sections in terms of the degree of hazard that they present to the physical road asset. By taking cognisance of traffic flow and length of diversion route, the system also allows the prioritisation of preventative or management actions, dependent on available or allocated budget. As a result of work, Transport Scotland can identify areas with the potential for disruptive debris-flow and ensure that suitable exposure-management contingency plans are in place, including:

- Monitoring of slopes prone to landslides, including remote sensing and the use of drones.
- Liaison with weather forecasters for weather warnings.
- Landslide patrols during weather events.
- Road-side warning signs during periods of increased risk.
- Providing travel warnings, information and advice to road users.
- Landslide risk reduction measures, e.g. physical engineering measures.

Further information on the Landslides Study and how we manage the impact of landslides can be found at www.transportscotland.gov.uk/road/maintenance/about-landslides

8 Asset Management Systems and Data



8.1 Overview

Data and information sit at the heart of Transport Scotland's asset management decisions which rely on appropriate and up-to-date information to support them. Transport Scotland has made considerable advances in recent years to understand and accurately describe the trunk road assets we are responsible for, as well as assess their condition, safety, and value.

We are adopting a more formal approach to information management that seeks to provide accurate, reliable, trustworthy and useful information that fully supports asset management and reduces the whole life costs of information collection and maintenance. We recognise that data is expensive to collect and maintain and we continue to undertake regular reviews of our data requirements to ensure that the data continues to support our legal requirements and aligns with the requirements of our business.

8.2 Asset Data in Transport Scotland

Supporting Asset Management

The information needed to support Transport Scotland's asset management practices can be grouped into the four main types as listed below:

Inventory – This is the primary information we need to support asset management planning and implementation. In broad terms Transport Scotland's inventory data includes location, hierarchy, asset owner, quantity, dimensions, materials, asset manufacturer and maintenance history. Inventory data is needed for all aspects of asset management, but is also essential in ensuring accurate asset valuations. Transport Scotland recognises that inventory data is dynamic by nature and keeping it up to date is a challenge that must be shared with our service providers.

Safety – A statutory obligation exists for us to maintain our assets in a safe condition and so it is essential that a basic level of data is collected to ensure statutory compliance. This typically includes public enquiries, accident records, safety inspection reports, machine-based carriageway condition surveys, and other specialist inspections such as electrical testing and structures inspections.

Performance – We require a sound understanding of the performance of our assets in order to identify current and required performance. The information typically required includes:

- Condition information related to aspects of performance, developing lifecycle plans for all asset groups, identifying maintenance strategies and programmes of work, and to financial requirements such as those listed below.
- Public satisfaction, public enquires, third party claims, traffic flows, accident records, maintenance history, energy consumption and environmental impact.

Finance – We require financial information for many aspects of asset management, including supporting budgets, developing lifecycle plans to determining optimum levels of service, prioritising maintenance activities and determining the value of the trunk road asset. Transport Scotland's financial data typically includes itemised construction and itemised maintenance costs (unit rates); historic capital and resource spend and current and estimated future capital and resource budgets. The financial data is generally stored and managed in relation to assets, asset groups or geographical locations.

Ownership of Data

The responsibility for developing and enforcing information management processes is centralised, and given to the TRBO Head of Asset Information. This ensures that Transport Scotland realise the benefits that can be gained through adopting common processes and practices across different departments/disciplines and asset groups. The Head of Asset Information is the person with ultimate responsibility for the definition of data and for ensuring that it meets the business needs of Transport Scotland.

Check, Review and Validation of Data

Our Operating Companies produce substantial quantities of information, including financial records, defect reports, and inspection and maintenance records. The Operating Companies are required to validate all data for completeness and accuracy before entering them into our asset management systems in accordance with the contract. In addition PAG regularly audit this information to ensure it meets contractual requirements. Contract performance indicators (KPIs) are used to measure compliance, and financial payments can be adjusted based on performance.

Data Gap Analysis

Transport Scotland recognises that technology is moving quickly and recent developments in good practice have moved the emphasis from collecting data to understanding information. Like most organisations, Transport Scotland's information management

practices have evolved over time. This resulted in an approach that, whilst mostly adequate, required a number of improvements. It was for this reason that we reviewed best practice and developed and implemented formal information management practices through our Asset Management Improvement Programme.

It is generally accepted that to collect every piece of asset data is neither practical nor financially sensible. In 2010/11 we undertook a series of detailed gap analysis of our data, systems and processes and examined the following:

- What data is currently held and how current and up-to-date is it?
- Who is responsible for collecting the data?
- How is the data collected and managed and how much does it cost?
- To what level of quality is it/should it be collected and maintained?
- Who owns the data i.e. is responsible for the quality and currency of the data and for making it available to others?
- How relevant is the data to fulfil statutory requirements?
- How relevant is the data to the core activities of Transport Scotland, and which decisions and business processes does it support?
- What is the risk of not collecting the data?

The gap analysis resulted in a series of improvements to the way we currently manage our data, including comprehensive procedures for data collection and maintenance requirements, and new a condition inspection for trunk road ancillary assets.

Regular reviews of data requirements and data strategy are undertaken to ensure that data continues to support asset management. The data gap analysis will be revisited in 2015/16 to assess progress and identify further areas of improvement (see Section 9).

8.3 Asset Management Systems

Integrated Road Information System (IRIS)

Transport Scotland has for many years, in common with UK good practice, been developing and using a number of asset management systems to provide information on location and performance of trunk road assets and ultimately support decision making and reporting. Discussion between Transport Scotland and the Welsh Government identified that procuring future contracts in collaboration could provide better value for money to both organisations, as the requirements for asset management systems are very similar.

A single contract for the supply of an Integrated Road Information System (IRIS) was procured in 2012 for a seven-year period. The contract successfully brought asset management systems under one supplier, replacing various existing contracts as they expired, providing greater integration and delivering significant cost savings.

IRIS assists us in managing our data more efficiently and allows us to make better investment decisions. It is a fully integrated Geographical Information System (GIS) map-based asset management system, which links condition data with inventory, accidents, structures, drainage, construction, customer services, routine maintenance, works ordering/payment and street lighting to name but a few. It is a bespoke flexible system with 25 core functions that are regularly reviewed and adapted to support current and future business needs. The full list of IRIS functions currently utilised by Transport Scotland is given in Table 8.1, along with other core systems used to manage and maintain the trunk road network.

As part of IRIS we have developed and implemented a new Whole Life Cost Module for use in assessing roads structural maintenance schemes. This has been embedded into our value management process for carriageways and the current 4G Operating Company Contracts.

Core Asset Management Systems

The core information technology enablers currently used by Transport Scotland and our Operating Companies are listed in the table below, along with details of the provider and the Transport Scotland custodian(s) who are responsible for the day-to-day control of the data and for overseeing its acquisition, update and quality.

Table 8.1: Transport Scotland Asset Management Systems

System Name	Purpose	System Provider	Transport Scotland Custodian
IRIS Pavement Management System (PMS)	A database and management system used to record and view road condition and construction records of the trunk road network.	WDM Limited	Head of Asset Management
IRIS Scheme Manager	A database and management system used to record and manage all structural maintenance schemes.		
IRIS Routine Maintenance and Management System (RMMS)	A database and management system used to record and report on inventory, defects, inspections and maintenance records related to the assets on the trunk road network.		
IRIS Management of Incidents	A database used to record details of defects which have the potential to cause disruption on the trunk road network.		

System Name	Purpose	System Provider	Transport Scotland Custodian
IRIS Performance & Reporting module	An analysis and reporting system used to monitor the effectiveness of the Operating Companies against the contract requirements.	WDM Limited	PAG
IRIS Development Control	A database to record details of all planning applications and pre applications which may impact on the trunk road network.		Development Management and Strategic Road Safety Manager
IRIS Collisions	A database used to record and analyse information relating to road traffic accidents on the trunk road network.		Road Safety Manager
IRIS Road Orders	A database used to record details of permanent Road Traffic and Road Scotland Orders.		Asset Systems Engineer
IRIS Lighting Management Function	A database and management system used to record and report on inventory, defects, inspections and maintenance records related to electrical assets on the trunk road network.		Operations Services Manager

System Name	Purpose	System Provider	Transport Scotland Custodian
IRIS Structures Management System (SMS)	A database and management system used to record inventory, defects and inspection/ maintenance records related to the bridges & structures on the trunk road network.	WDM Limited	Network Bridges Manager
IRIS Contract Control and Management System (CCMS)	For issuing and monitoring work programmes and orders and controlling the operation of the Operating Companies in performing their duties.		Head of Management Information Systems
Roads Asset Valuation System (RAVS)	To evaluate and provide the annual asset valuation returns for the trunk road network.	Atkins	
Scottish Roads Traffic Database (SRTDb)	A database holding vehicle count information for the trunk road network.	IBI	Operations Service Manager
Customer Care Database	A database used to record and monitor complaints, road defects/spillage/ debris reported by the public and third party claims.	Teleperformance	Travel Information Manager

System Name	Purpose	System Provider	Transport Scotland Custodian
Corporate GIS	A tool to allow all of TS to view geographic information against background mapping.	Transport Scotland	Head of MIS
Traffic Scotland Services (ITS: Intelligent Transport System) Host	To deliver Traffic Scotland Services function, provide managed motorways – monitor, control and inform.	CUBIC	Network Operations Manager
Lighting – Central Management System (L-CMS)	To monitor and control road lighting and other illuminated assets on the trunk road network – and deliver variable lighting.	Suppliers via Road Operators (e.g. ZODION, Harvard Engineering, Philips)	Operations Service Manager

Building Information Modelling (BIM)

The Building Information Management (BIM) system is being introduced into the construction industry. It is a process by which information is created, stored, shared and used in a fully collaborative environment throughout the project and asset lifecycle. It involves creating and using an intelligent three dimensional digital model to inform and communicate project decisions and to hold information for maintenance purposes. It is anticipated that adopting a BIM approach will deliver cost savings, inform delivery and drive improvements in data quality by:

- improving the tools we need to do the job;
- reducing design iterations and re-works;
- enabling early identification of potential construction issues and clashes;
- ensuring all parties are working to common data standards;
- supporting better asset lifecycle decisions; and
- enabling easier sharing, access to and use of project and asset information.

The Scottish Government has identified BIM as a vital enabler for reducing the capital cost and carbon burden from the construction and operation of the built environment and have recommended that 'where practicable, the Scottish Government and the Agencies shall be BIM Level 2 compliant by April 2017'. In response to this we have appointed a BIM Champion to drive implementation across our organisation.

We are also investigating the use of BIM on a number of trunk road projects to assess our data and information needs to allow us to fully understand what BIM Level 2 compliance means for its application to trunk road operation, inspection, management and maintenance. We will use these trials to develop an improvement plan to allow us to improve our decision making and provide efficiency in the delivery of all trunk road projects.

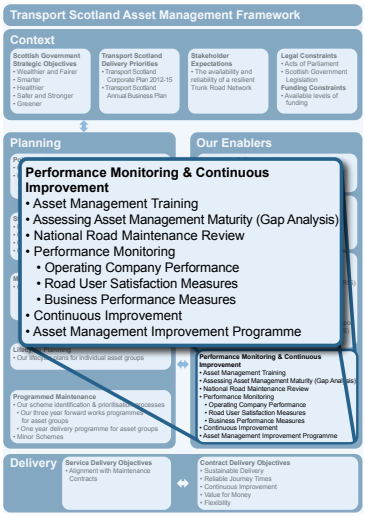
8.4 Training and Skills

Those involved in data management need to have the knowledge and capability to specify and/or undertake data collection and assess the quality of the information collected. We also need to ensure that the asset management system is accessible to all staff involved in managing the trunk road assets to ensure they have the information and data required to undertake their role effectively. The key components of Transport Scotland's information training and skills programme are:

- *Roles and responsibilities in relation to management of information are defined and incorporated into job descriptions*. Several Transport Scotland posts are dedicated to information management, including *Head of Asset Information, Business Systems Manager, IRIS Manager and IRIS Support Engineer*. Our Operating Company Contracts also include role profiles for key information management posts, including *Operations Manager* and *IRIS Co-ordinator*.
- *We have a formal and ongoing programme of training*. A series of training sessions are provided to Transport Scotland and supply chain staff at the commencement of any new contract and at regular intervals throughout. This includes training on data collection, recording, analysis, reporting and interpretation of data, and the use of asset management systems and tools. We also ensure that User Manuals/Guides are available, maintained and up-to-date and provide ongoing support through our Asset Management Systems Support Contract.

- *Training provision is periodically evaluated and adapted to respond to changing needs*. We monitor our Asset Management System mailbox and coordinate a number of User Group Meetings in order to understand the current and future training needs of Transport Scotland and supply chain staff. We also provide additional training/guidance as a result of issues identified from PAG audits as required.

9 Performance Monitoring and Continuous Improvement



9.1 General

Asset management, like any business activity or process, is continually evolving and innovating. In Transport Scotland we use formal gap analysis and benchmarking techniques to drive continual improvement alongside regular liaison and sharing with similar organisations. We also aim to align with the latest good practice guidance and provide our staff with appropriate training to continually improve asset management capabilities across the organisation.

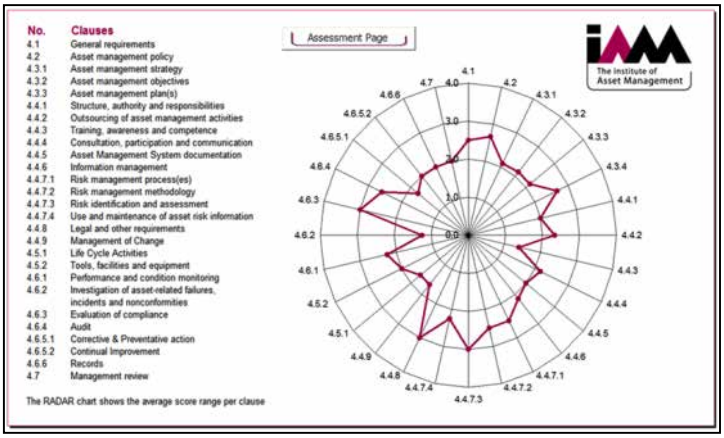
9.2 Asset Management Training

Recognising the importance of competent staff to deliver our asset management aspirations, we continue to review the skills available within our organisation and identify potential gaps. We continue to develop and roll-out asset management training courses across our organisation to address these gaps and ensure that our asset management capabilities are continually improved and aligned with the latest good practice. We are currently working with an Institute of Asset Management Endorsed Training Provider to develop and undertake a series of formal asset management training courses including:

- *Executive Briefings* – introduction to the benefits, principles and implementation of asset management.
- *Asset Management Briefing Workshops* – introduction to the benefits, principles and implementation of Asset Management, with key concepts for best practice maintenance and renewals.
- *Asset Management Principles* – targeted at specific areas of asset management, enhancing knowledge and developing a set of discipline experts across Transport Scotland.
- *Asset Management eLearning Courses* – designed for those who have had some exposure to asset management and want to gain a solid understanding of its key systems and approaches, while limiting the time spent away from their day to day duties.

9.3 Assessing Asset Management Maturity

We commenced our formal approach to Road Asset Management in 2005, when we undertook our first gap analysis of our asset management activities. This resulted in our first Asset Management Improvement Programme which was implemented between 2006 and 2010.



In April 2009 the Institute of Asset Management launched the PAS 55[2] Assessment Methodology (PAM) Toolkit to allow organisations to assess their asset management maturity. In recognition of this, we carried out further gap analyses in May 2010 and August 2013 using the toolkit. A key outcome was the identification of a number of areas of improvement that we must focus on to further improve and embed asset management as our way of working. The gaps identified formed the basis of our current Asset Management Improvement Programme (see Section 9.7).

A new suite of Asset Management Standards describing asset management and asset management systems (ISO 55000/1/2) were published by the International Standards Organization (ISO) in January 2014. We are currently undertaking a task to map our existing PAS 55 assessment to the ISO 55000 maturity assessment. Going forward Transport Scotland will be undertaking future gap analysis using this latest methodology, ensuring we continue to develop our asset management strengths and capabilities and providing a common approach for comparison with similar organisations.

9.4 National Roads Maintenance Review

The National Roads Maintenance Review focused on exploring what could be done to improve efficiency within available maintenance budgets, and identifying opportunities for innovation, collaborative working and shared services. The review was jointly led by those responsible for maintaining all of Scotland's road network – Transport Scotland, COSLA, SCOTS, SOLACE and the Scottish Road Works Commissioner. Issues considered by the review included:

[2]PAS 55-1 Asset Management: Part 1: Specification for the optimized management of physical infrastructure assets, The Institution of Asset Management and BSI, 2008.

- How the Scottish Government can work better with local authorities.
- Lessons from international road management practice.
- Productivity and technology innovation.
- Resourcing.
- Standards and prioritisation.
- Wider economic issues, impacts, costs and benefits.

The National Road Maintenance Review was completed in July 2012, resulting in a process being put in place to deliver recommendations on improving the management and maintenance of Scotland's roads. The review has:

- Identified a strategic framework to change which will embed best practice, ensure value for money and assist road authorities optimise the delivery of road maintenance services.
- Established 30 evidence based initiatives which are estimated to deliver up to 10% efficiency savings.
- Recommended that a central resource is established to encourage councils to design and deliver a package of shared service initiatives.

A Strategic Action Group has been set up to oversee the partnership working on road maintenance; the development of collaborative approaches on strategic issues; and ensure delivery of all outputs flowing from the National Road Maintenance Review. The group meets bi-annually and is co-chaired by the Minister for Transport and Islands and COSLA, and includes representatives from Transport Scotland, local authorities and the Scottish Road Works Commissioner.

Further information on the National Roads Maintenance Review and the 30 initiatives can be found at: www.transportscotland.gov.uk/road/maintenance/national-roads-maintenance-review

9.5 Performance Monitoring

A key component of the Performance Management Framework described in Chapter 4, is the identification of performance measures that align with our asset management objectives. We already have a number of sources of relevant performance measures, including Service Provider Key Performance Indicators,

Road User Satisfaction Measures and Business Key Performance Measures.

Monitoring the Performance of our Operating Companies

PAG are responsible for monitoring and reporting on the performance under the contract of the Operating Companies who manage and maintain the trunk road network on our behalf.

	Excellent
	Good
	Fair
	Poor
	Very Poor

▲	Performance better than last year
=	Performance unchanged from last year
▼	Performance worse than last year
	Activity not reviewed in 2012/13

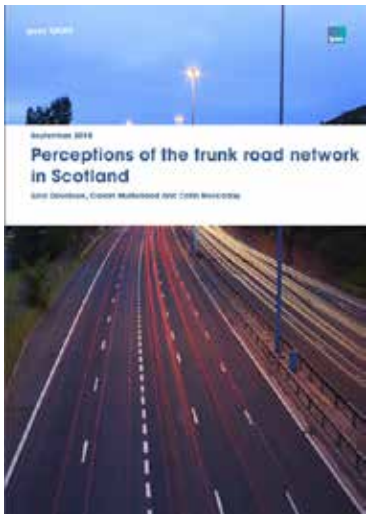
	NE	SE	NW	SW
Chapter 2 Network Management **2.1 Network reliability**				
2.1.2 Availability of the network to road users	=	=		
2.2 Network safety				
2.2.1 Safety inspections and patrols	▼	▼		
2.2.2 Detailed inspections – roads	▼	=		
2.2.3 Inspecting structures		=		
2.3 Inventory management				
2.3.1 RMMS/RMMF	▼	=		
2.3.2 SMS				
2.3.3 Electrical assets	=	▲		
2.4 Traffic Management				
2.5 Sustainability	▲	▲		

FIGURE 9.1: EXTRACT FROM 2013/14 PAG ANNUAL REPORT

PAG uses a rating system to assist in benchmarking performance against the 21 Performance Indicators, 20 Monitoring Indicators and 14 Payment Adjustment Factors specified in the Operating Company Contract. Performance is reviewed and discussed at monthly progress meetings. PAG also publish an annual report on the performance of the Scottish trunk road Operating Companies in their service delivery. The rating system is applied throughout the report to reflect overall Operating Company performance for the various areas reviewed and provides a comparison with OC performance in previous years.

The latest PAG annual public report on the performance of the Operating Companies can be found at www.performanceauditgroup.co.uk/publicat.htm

Road User Satisfaction Measures



Since 2009 we have been undertaking annual surveys of a representative sample of road users to identify trunk road issues that are important to them and the levels of service they expect or desire. This allows us to gauge current levels of satisfaction and compare and trend current and past levels of satisfaction in order to identify areas for improvement. The questions cover a variety of topics such as:

- *Asset condition* – opinion of the condition of the trunk road network and associated assets.
- *Road works* – opinion on how these are informed and operated in order to try and keep disruption to the travelling public to a minimum.
- *Severe weather planning* – opinion on Transport Scotland's performance in keeping routes open and in communicating the risk of severe weather.
- *Communications* – information from customers on how they access information on the status of trunk roads and their opinion of this service.

In order to express the survey findings in a way that stakeholders can understand, the results have been translated into four level of service bandings; namely poor, fair, good and excellent. The majority of provisions were rated as good or excellent in the 2015 survey.

Area of Provision	2009	2010	2011	2012	2013	2014	2015
Condition of road surface		▼	=	=	=	=	▲
Speed of road repairs		=	=	=	=	=	=
Quality of road repairs		▼	=	=	=	=	=
Drainage of water from road		=	▼	▲	=	=	=
Management of vegetation		=	=	=	=	=	▲
Amount of litter and debris		=	▲	=	=	=	=
Amount of congestion		=	=		=	=	=
Frequency of roadworks		=	=	=	▲	=	=
Diversions at roadworks		=	=	=	▲	▼	▲
Restrictions at roadworks		=	=	=	=	=	▲
Clearing roads in winter		▼	=	▲	=	▲	=
Gritting roads in winter		▼	=	▲	=	▲	=
Provision of road signs		▼	▲	=	=	▼	▲
Visibility of road signs		=	=	=	=	=	=
Provision of electronic message boards		▼	=	▲	▼	=	▲
Visibility of road markings		=	=	=	=	=	=
Provision of road lighting		=	=	=	=	=	▼

Excellent
Good
Fair
Poor

Performance better than last year ▲
Performance unchanged from last year =
Performance worse than last year ▼

FIGURE 9.2: SUMMARY OF ROAD USER SATISFACTION FINDINGS

We are currently undertaking a study, with consultant support, to establish if any correlation exists between our engineering condition measures and customer satisfaction results. Further information on the surveys and their findings can be found in the link: www.transportscotland.gov.uk/road/maintenance/road-asset-management-plan

In our recent 2015 survey, we also asked a series of customer standards questions. We asked our road users when they think Transport Scotland must intervene for number of typical carriageway defects such as flooding, cracking, rutting and fretting[3]. The findings from these questions will be used to better understand the carriageway condition range that is acceptable to road users.

Figure 9.3: Customer standards question for fretting

[3]Questions and pictures were selected from Transport for London's *Customer Standards Survey.*

Business Performance Measures

The Trunk Road and Bus Operation Directorate has a number of other roles and responsibilities that are not fully covered by the aforementioned OC contract KPIs and road user measures. A number of engineering measures (such as road condition measures, bridge condition, asset value, backlog etc.) are also evaluated, monitored and reported at set intervals.

We regularly provide Scottish Ministers with an overview of the trunk road assets we manage and maintain, their condition, backlog and current pressures, and financial forecasts covering a 5- to 10-year period to ensure that decisions are taken with an understanding of their medium to long-term implications.

9.6 Continuous Improvement

In Transport Scotland we are driving continual improvement in our asset management practices through:

- Regular liaison and sharing of information with other road authorities, both formal and informal, nationally and internationally. We have regular knowledge sharing exercises with the other three UK strategic roads authorities; Highways England, Welsh Government and Transport NI.
- Encouraging both our own staff and our supply chain to challenge practices on an ongoing basis, looking for areas for improvement and efficiencies. In April 2015 we launched our *innovation fund* to encourage our Operating Companies to submit proposals for studies, trials or research aimed at delivering innovation and improvement.
- Being actively involved in key research and development work, for example, through the UK Roads Liaison Group. We annually commission research and development work to deliver improvements in safety, construction, operation and maintenance of the Scottish road network through the Scottish Road Research Board (SRRB). The SRRB is a partnership between Transport Scotland and the Society of Chief Officers for Transportation in Scotland (SCOTS) and the Scottish Road Works Commissioner (SRWC).
- Keeping abreast of latest issues, sharing information and experiences, reviewing innovations and developing and informing advice on best practice through involvement in appropriate groups and national forums (such as the World Road Association, SCOTS Groups, UK Roads Liaison Group and UK Bridges Board) and attendance at conferences and seminars.

9.7 Asset Management Improvement Programme

We see our commitment to asset management as a long term investment in the Scottish trunk road network and have an ongoing improvement plan to ensure that we remain a world class network operator. To support this we have identified a number of improvement tasks, as shown in Figure 9.2, that we are delivering with external consultant support through our Multiple Framework Agreement for Asset Management.

Figure 9.4: Planned Improvement Tasks

We will continue to ensure that our asset management improvements are embedded into and delivered through our Operating Company Contracts. We are currently developing our 5th Generation Contracts. Through our Asset Management and Procurement Newsletter, we will continue to disseminate information to both Transport Scotland and supply chain staff regarding the latest advances in the field of roads asset management, and how these are being implemented.

9.8 Management and Control of the Plan

The RAMP is a controlled document with named individuals responsible for endorsing the plan, communicating the plan, monitoring of improvement actions and authorising updates as and when required. Within Transport Scotland, the Trunk Road and Bus Operations Directorate is responsible for managing and maintaining the assets described in the RAMP. The persons with responsibility for the delivery of this RAMP and their roles within the process are as detailed below in Table 9.1.

Table 9.1: RAMP Ownership Details

Role	Position in Transport Scotland
Approval of the RAMP	Transport Scotland Board Asset Management Steering Group
RAMP Sponsorship within Trunk Road and Bus Operations. Allocate and prioritise trunk road resources to facilitate implementation of asset management strategies.	Head of Asset Management & Procurement Head of Engineering & Commercial Services
Implementation of the RAMP and monitoring of improvement actions, development and updating of the RAMP and associated documentation.	Head of Asset Management Head of Network Maintenance Chief Bridge Engineer – Head of Structures
Day-to-day implementation of appropriate lifecycle plan, identifying asset specific investment requirements and updating of procedures and documentation as required.	Asset Owners/Champions
Ensuring data management procedures are followed and continued development of information management systems for all assets.	Head of Asset Information

Considerable enhancements have been made to Transport Scotland's asset management practices since the publication of the first RAMP in 2007. Transport Scotland is committed to continually improving asset management practices and these will be reflected in future periodic updates of the RAMP.

10 Financial Management and Valuation

This chapter outlines the financial context within which we are required to maintain the Scottish trunk road network. We believe that adopting an asset management-based approach to these activities will deliver to our customers the maximum benefit for the available funding.

10.1 Scottish Government Spending Plans

Scottish Ministers undertake a detailed examination of portfolio budgets and set forward three-year spending plans through a process known as the spending review. The spending review in Scotland is normally undertaken every two or three years, scheduled around the timeframe of UK spending reviews.

The Scottish Budget Spending Review 2012-13 to 2014-15 (www.gov.scot/Publications/2011/10/04153155/0) and *Draft Budget 2015-16* (www.gov.scot/Publications/2014/10/2706) provide details of how our spending plans will help deliver sustainable economic growth. Trunk road maintenance spending lies within the Scottish Government's Infrastructure and Capital Investment Portfolio.

The asset investment models described in Section 5.4, allow us to predict our future maintenance requirements over a number of years for differing levels of funding or different road condition targets. These investment scenarios support the transport proposals considered as part of the Scottish Government spending review process, with a focus on the strategic objectives set out in the Government Economic Strategy. Through our asset management planning we continue to drive out efficiencies from existing activities, and look for innovative ways to deliver as much as possible for the public pound.

10.2 Historical and Budgeted Spend

Table 10.1 presents the historic levels of investment on trunk road maintenance and the current 2015/16 budget. In addition to road reconstruction and bridge strengthening and replacement, the maintenance budget delivers minor road improvements, as well as routine, cyclical and winter maintenance to maintain the safety, environment and amenity of the trunk road network. It includes road safety improvement programmes, information for road travellers and an emergency response facility to deal with emergencies and incidents on the network. It also includes the construction of the Forth Replacement Crossing (FRC) and our DBFO payment commitments. The DBFO row has been greyed out and is included for completeness, however justification of the DBFO financial requirements are outside the scope of this RAMP.

Table 10.1: Maintenance Expenditure on the Trunk Road Network

Budget Heading	Annual Spend (£ millions)					
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (draft)
Structural repairs – roads	52.0	32.0	25.5	45.0	38.3	34.5
Network strengthening – roads & bridges	25.0	15.0	27.0	30.0	26.0	24.5
Routine, cyclic & winter maintenance AND Inspections & surveys	69.4	68.0	68.5	70.5	74.0	71.6
Roads improvements[4]	26.5	24.2	24.7	16.2	23.3	12.7
Other expenditure[5]	6.0	6.4	5.4	9.8	10.2	10.2
FETA/Tay Bridge Authorities[6]	16.5	24.2	18.0	11.2	9.0	12.3
DBFO payments	48.0	62.0	74.5	76.8	84.7	84.7
Total	243.4	231.8	243.6	259.5	265.5	250.5

4. Includes network operations, strategic road safety and minor improvement schemes.

5. Includes safety camera partnership, travel information, traffic counts, motorway telephones and compensation.

6. FETA were dissolved as an entity of 1 June 2015 and their duties now fall to the Scottish Ministers through the new Forth Bridges Unit Term Operating, Management and Maintenance Contract.

Further breakdown of expenditure required to deliver the lifecycle activities for each major asset group is provided in the relevant Appendix.

10.3 Trunk Road Maintenance Backlog

In response to Audit Scotland's recommendation to monitor and report maintenance backlog (*Maintaining Scotland's roads: A follow-up report*), Transport Scotland has been calculating trunk road maintenance backlog figures annually since 2010. The maintenance backlog is defined as the level of investment required to bring the network up to the optimal level (defined as above the threshold requiring close monitoring).

Figure 10.1 shows that the overall trunk road maintenance backlog is increasing and remains challenging. The most recent December 2014 figures are £1.2bn backlog for the total asset, of which £513m is carriageways, £615m bridges and £75m ancillary asset[7].

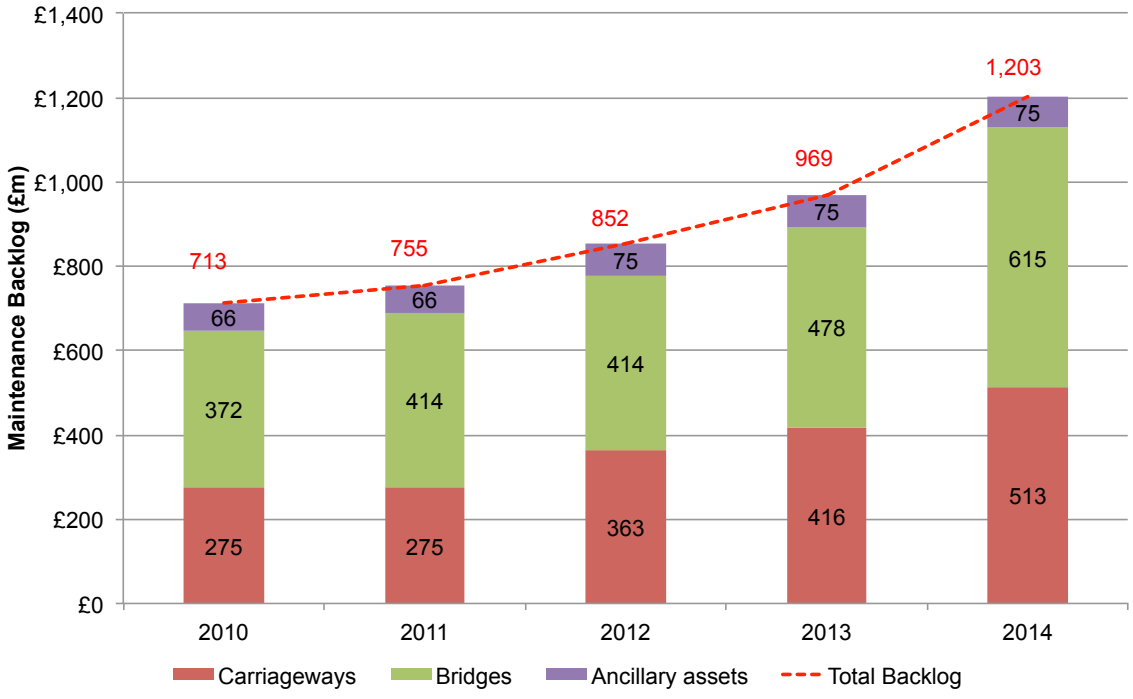


Figure 10.1: Trunk Road Maintenance Backlog

10.4 Trunk Road Future Needs

Our predictions of long-term funding needs, presented in the Lifecycle Planning Chapter of the RAMP, are based on adopting appropriate levels of service that we believe best meet the needs of the trunk road network at this time.

[7]Carriageways: based on 6 per cent of motorways, 8 per cent of dual carriageways and 10 per cent of single carriageways requiring maintenance each year. Road Structures: removal of the known backlog of high priority (safety critical), but unfunded commitments. Ancillary assets: replacement of all assets which have been assessed as being in very poor condition and beyond their serviceable life.

In order to minimise the impact of reduced budgets we will continue to develop and implement our maintenance strategies for the major asset groups, and work with our supply chain to make best use of available resources. Implementation of these strategies, alongside other efficiency saving initiatives and asset management improvements set out in our RAMP will enable us to continue to manage trunk road carriageways in a safe and serviceable condition.

We are committed to work with Ministers on a long-term vision to tackle trunk road maintenance backlog.

10.5 Trunk Road Asset Value

All government departments are required to operate their finances using resource accounting with their accounts reflecting the value of the assets under their management. Asset valuation is the calculation of the current monetary value of an asset, in this case the trunk road network.

The gross replacement cost (GRC) is defined as the cost of rebuilding the asset from new. The depreciated replacement cost (DRC) is the value of the asset in its current condition, normally calculated as the GRC minus depreciation to take account of the condition of the network. It is a truer calculation of the value of the asset as it takes into account the fact that assets will not always require full reconstruction/replacement.

We have been party to a collaborative procurement contract for the calculation of asset value with the other three National Road Authorities in the UK since 1998. This ensures a level of consistency is achieved in respect to valuation methodology and provides us with an economy of scale and unity of direction in a range of common strategic interests. The methodology adopted complies with the International Financial Reporting Standards as expressed in the Financial Reporting Manual (FReM). The FReM requires all central government departments and their agencies to value their assets and include them in their annual accounts.

The asset value of the trunk road network is calculated annually using the Roads Asset Valuation System (RAVS). As of April 2015, the gross replacement cost of the trunk road network was £20.6bn, whilst the depreciated replacement cost was £17.4bn.

Appendix A – Carriageways

A1 Overview

The trunk road carriageway is one of the most visible community assets for which the Scottish Government is responsible. It is used daily for hundreds of thousands of journeys and must be appropriately maintained in order to ensure the journeys we make are safe and reliable. Transport Scotland has contracts in place with Operating Companies to ensure that our trunk road carriageways are appropriately inspected, monitored, managed, maintained and repaired. This section of the RAMP describes the lifecycle plan for trunk road carriageways.

A2 The Carriageway Asset

Table A.1 provides an overview of the trunk road carriageway assets, their definitions and quantities. The inventory records held for the carriageway comply with the requirements set down in Transport Scotland's *Trunk Road Inventory Manual*, and are held within the Routine Management and Maintenance Function of Transport Scotland's Integrated Roads Information System.

Table A.1: Carriageway Asset Group and Quantities

Asset Type	Definition	Quantity
Carriageway 	Part of the road constructed for use by vehicular traffic. Carriageway includes turning lanes, bus lanes, crawler lanes and acceleration/deceleration lanes.	Motorway 596 km Dual C/way 518 km Single C/way 2,315 km
Hard Shoulder 	A surfaced strip usually of one traffic lane width adjacent to and abutting a carriageway intended for use by vehicles in the event of an emergency or during obstruction of the carriageway.	501 km
Layby 	A part of the road set aside for vehicles to draw out of the traffic lanes and wait for short periods.	196 km

Asset Type	Definition	Quantity
Crossover 	A pedestrian or vehicular crossing of a footway/cycleway, verge, central island or central reserve. This includes minor junctions, driveways, field entrances and central reserve crossovers.	244 km
Central Island 	An obstruction built in the road to split traffic into lanes and/or to provide a pedestrian refuge.	44 km
Central Reserve 	An area that separates the opposing carriageways of a dual carriageway road or motorway.	882 km

A3 Carriageway Standards

Transport Scotland adheres to a number of UK and Scotland specific standards related to the management and maintenance of trunk road carriageways, such as those provided below:

- HD28/04 Skidding Resistance, Design Manual for Roads and Bridges, Volume 7 Section 3 Part 1.
- HD29/08 Data for Pavement Assessment, Design Manual for Roads and Bridges, Volume 7 Section 3, Part 2.
- HD30/08 Maintenance Assessment Procedure, Design Manual for Roads and Bridges, Volume 7 Section 3, Part 3, HD36/06 Surfacing Materials for new and Maintenance Construction, Volume 7 Section 5, Part 1.
- Scanner Surveys for Local Roads – User Guide and Specifications, 2007, UK Roads Board.
- Guidance Document for Implementing a Skid Resistance Policy for Transport Scotland.
- Well-maintained Highways: Code of Practice for Highway Maintenance Management, July 2005, TSO, ISBN 0115526439.
- 4th Generation Term Contract for Management and Maintenance of the Scottish Trunk Road Network, Transport Scotland, 2001.

- Annual Process for Roads Structural Maintenance v 1.L October 2012.
- The Value for Money Manual, Transport Scotland, Revision C, January 2001.

A4 Inspections and Surveys

In addition to the surveys described in Section 5.2 the following machine-based road condition surveys are carried out annually on trunk road carriageways to ensure that best value is achieved from our structural maintenance programme. All the road condition data is held in the Pavement Management Function of Transport Scotland's Integrated Roads Information System (IRIS).

Deflectograph

Transport Scotland has used the Deflectograph survey vehicle for over 20 years to provide an indication of road strength. The Deflectograph is a self-contained lorry-mounted system, where a loaded wheel passes over the road, the road deflects and the size of the deflection is related to the strength of the road layers. This provides reliable estimates of the remaining useful life of the road and identifies areas requiring strengthening. One-fifth of the network is surveyed annually, giving full network coverage every five years.

SCANNER (Surface Condition Assessment for the National Network of Roads)

This vehicle uses an electronic 'scanner' to make a number of measurements that describe the condition of the road surface, including rutting, cracking and ride quality. From this Transport Scotland can assess the lengths of road which require resurfacing or overlaying of the surface layer. Half of the network is surveyed annually, giving full network coverage every two years.

The Deflectograph and SCANNER surveys are used to calculate the condition scores discussed in Section A7.

SCRIM (Sideways Co-efficient Routine Investigation Machine)

Transport Scotland undertakes an annual condition survey to measure the wet skidding resistance of all trunk road surfaces. Each section of road is assigned a skid resistance threshold known as an Investigatory level. Sections that are at or below the Investigatory Level are investigated in accordance with UK-wide road standards (HD28/04) and *Transport Scotland's Skid Resistance Policy.*

Griptester

The Griptester is a trailer-based device for measuring skidding resistance and gives instant readings of the skid resistance of the road surface being driven on. All four Operating Companies operate Griptesters supplied by Transport Scotland to measure the early skid resistance of road surfacing materials.

Our Operating Companies analyse the information obtained from all of the above surveys and use this, alongside other condition and inspection data, to identify sections of the network that should be considered for structural maintenance.

A5 Routine and Cyclic Maintenance of Carriageways

Full details of the routine and cyclic maintenance requirements for carriageways are provided in Schedule 7: Part 1 and Part 2 of our Operating Company contracts. Routine and cyclic maintenance activities undertaken for carriageways typically include:

Reactive maintenance – unplanned work that takes place between structural maintenance interventions. Reactive maintenance is normally identified through the inspections described in Section 5.2 or reports from members of the public. The requirements for defect repairs for all categories of defects are described in Section 5.3.

Cyclic Maintenance – minor work carried out on a regular or cyclic basis that helps to maintain the appearance or effective operation of the carriageway and reduce the need for other, normally more expensive, maintenance works. Examples include, grass cutting, gully cleaning, road sweeping, removal of debris and scrub cutting.

Winter Maintenance – preventative maintenance also includes winter maintenance for protecting the carriageways from ice and snow. The requirements for winter maintenance are covered in Section 5.3.

A6 Programmed Maintenance

Identifying Carriageway Structural Maintenance Schemes

Structural maintenance of carriageways rejuvenates the pavement by treating either the surface layers (for example, surface dressing) or the surface and sub layers (for example, strengthening or reconstruction). Table A.2 presents the main structural maintenance activities and their typical renewal frequency on the trunk road network.

Table A.2: Carriageway Maintenance Activities

Treatment Type	Treatment Description	Typical Renewal Frequency*
Surface Dressing	Application of a bituminous emulsion to the carriageway upon which one or more layers of stone chippings are applied.	Up to 10 years
Strengthening	Addition of new surfacing materials on top of existing construction, or removal of existing surfacing materials and replacement with new.	10 to 20 years
Reconstruction	Removal of existing carriageway construction, full or partial depth, and replacement with new.	20 to 40 years

*Frequencies vary for roads of different traffic loadings and construction form.

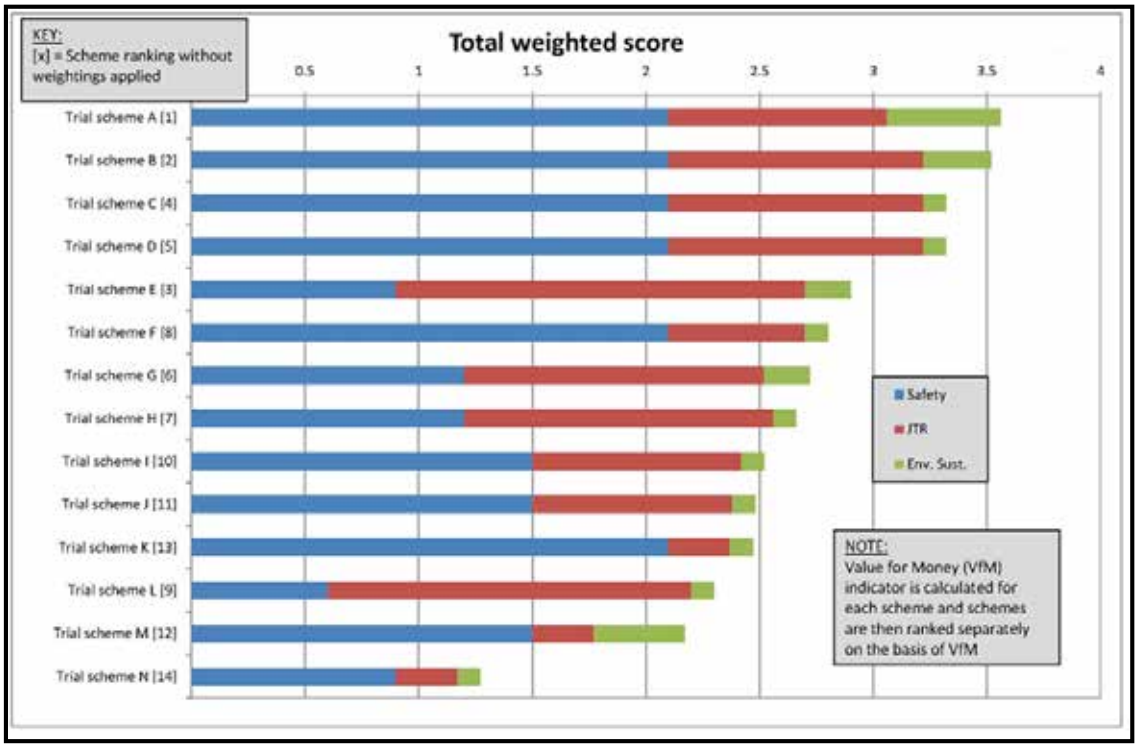
The majority of carriageway structural maintenance undertaken on the Scottish trunk road network is strengthening as intervention at the appropriate time avoids the need for more costly reconstruction. This reflects our current *Roads Structural Maintenance Strategy*, described in Section A9 which aims to ensure that we make best use of available resources.

The identification of structural maintenance schemes is largely informed by the Deflectograph and SCANNER condition surveys described in Section A4, supplemented by a programme of visual inspections. The actual need for maintenance is assessed through further site inspections and appropriate testing which are used to validate initial findings and refine appropriate treatment options. The outcome of this is a one-year implementation programme and a further two-year planning programme which is updated annually.

Sections that are at or below the SCRIM Investigatory Level are investigated in accordance with UK-wide road standards (HD28/04) and *Transport Scotland's Skid Resistance Policy*. A section of road with skid resistance values below the Investigatory Level does not in itself mean that the road surface is deficient, sub-standard or unsafe. It is merely a trigger for a more detailed investigation. Following a detailed investigation, sections that are considered in need of treatment are added to the structural maintenance programme. All schemes in the programme are reviewed and prioritised using Transport Scotland's value management process.

Prioritising Structural Maintenance Schemes

The reality of managing a transport network is that funding is limited and normally not sufficient to allow all the work identified to be carried out in any given year. Given this constraint it is necessary to prioritise schemes in the programme by adopting a formal value management approach. Each scheme in the one-year maintenance programme is scored against the Safety, Journey Time Reliability, Environmental Sustainability, and Value for Money criteria described in Section 6.1.



A7 Monitoring Performance

Transport Scotland measures and monitors the performance of trunk road carriageways by undertaking and analysing annual road condition surveys and road user satisfaction surveys. This helps us to understand and prioritise the needs of our network.

Carriageway Condition

Transport Scotland has developed a condition performance measure to identify sections of carriageway that have reached a condition where more detailed monitoring or investigation is appropriate and to establish if and when remedial measures are required. The condition of the carriageway is measured using industry standard inspections (see Section A4). Transport Scotland uses this data to generate a score for each section of carriageway,

known as the Transport Scotland Road Condition Indicator (TS RCI)[1]. The three Transport Scotland RCI condition categories, descriptions and example photographs are shown in Table A.3.

Table A.3: Carriageway condition categories

Condition Categories	Description	Photographs
Good (TS RCI <40)	Considered to be in a good state of repair; and does not require investigation or maintenance.	
Fair (TS RCI ≥40-<100)	Should be investigated to provide the optimum time for planned maintenance intervention.	
Poor (TS RCI ≥100)	Should be investigated to determine if structural maintenance is required.	

[1]TS RCI calculation based on several SCANNER survey condition parameters (rutting, profile variance, texture and cracking) and the remaining structural life reported by Deflectograph. It is not equivalent to the Road Condition Index reported by Scottish Local Authorities which is based on SCANNER survey data alone.

Figure A.1 presents the percentage of carriageway in each structural condition band in 2014/15. The graph shows that approximately 87% of trunk road carriageways are in good or fair condition.

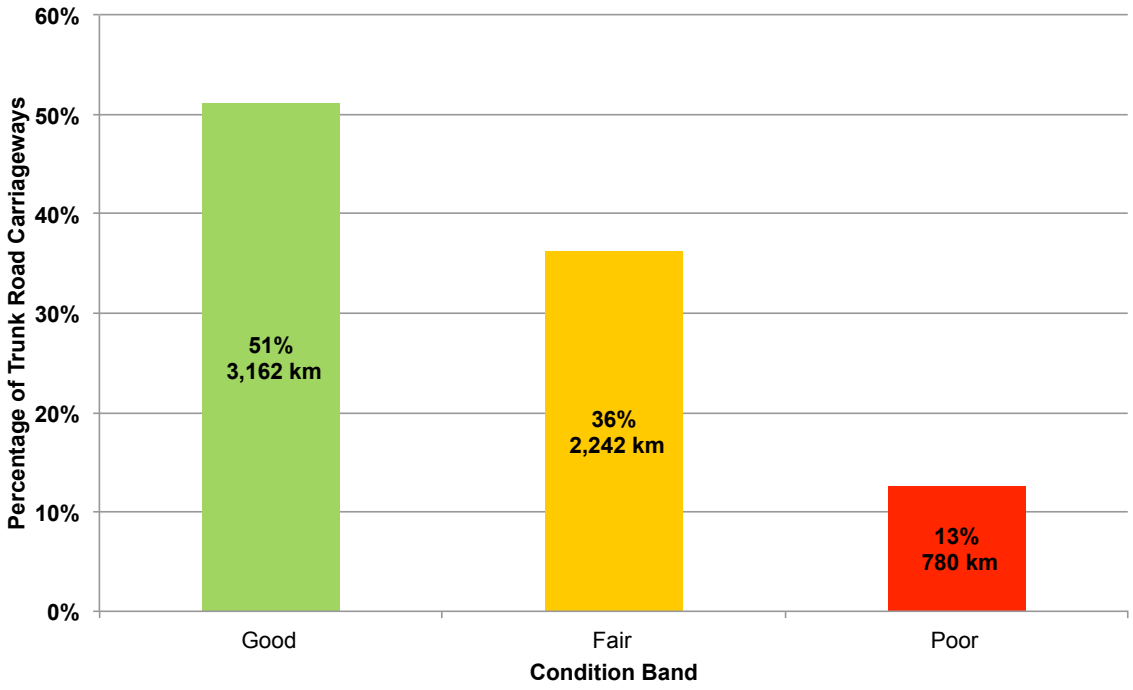


Figure A.1: 2014/15 Structural condition of trunk road carriageway

The percentage of trunk road carriageways in good or fair structural condition, from 2010/11 to 2014/15, is shown in Figure A.2. From 2010/11 to 2012/13, the condition of the carriageway remained relatively stable, before declining by 3% in 2013/14. There was a slight improvement in 2014/15, which may reflect better targeting and selection of works to deliver improved value for money.

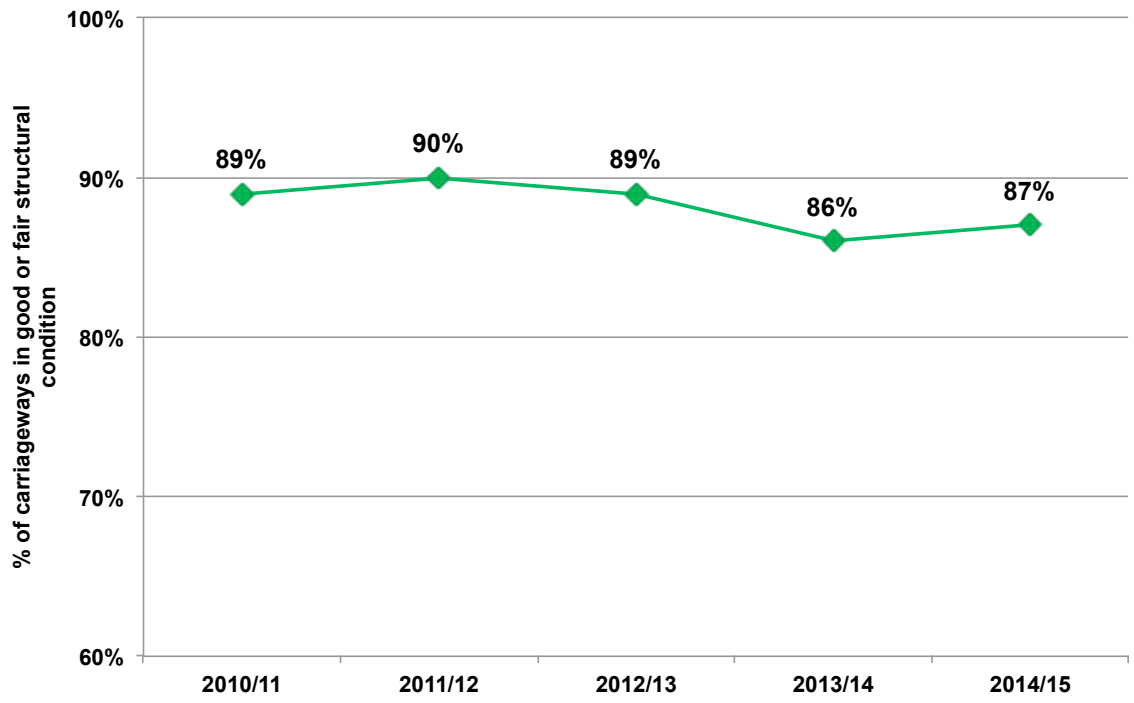
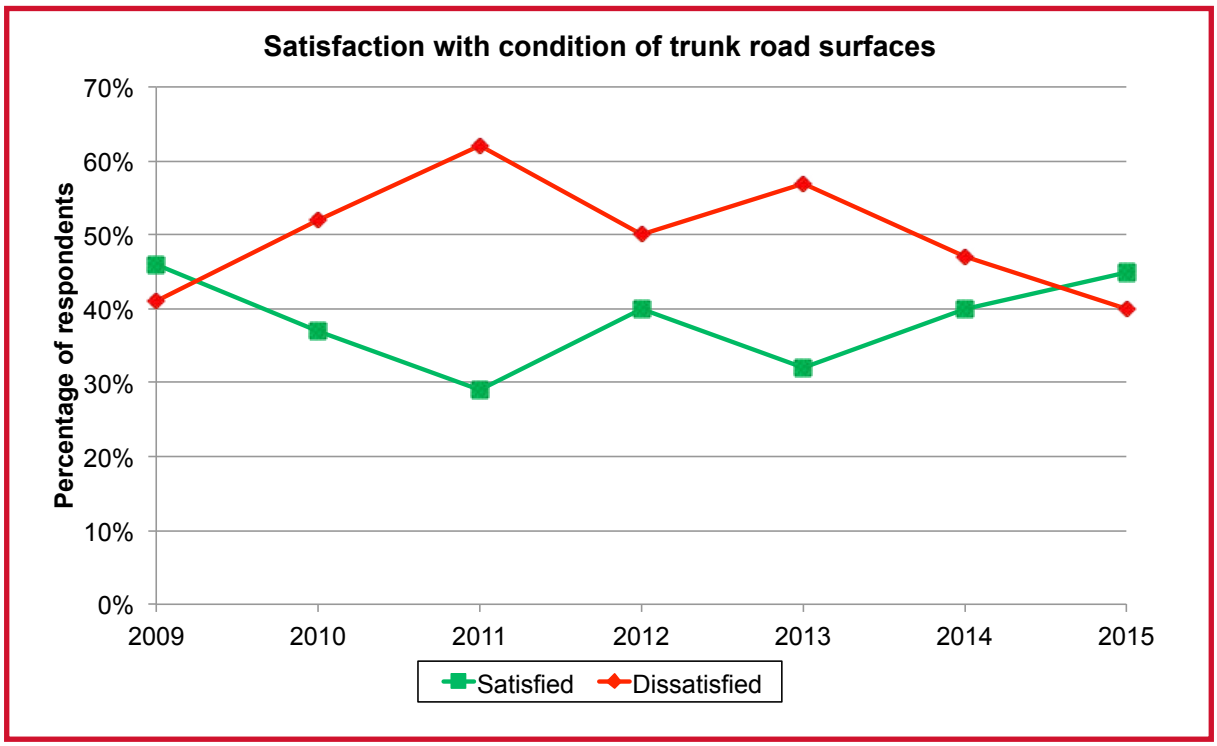


Figure A.2: Carriageway in good or fair structural condition from 2010/11 to 2014/15

Customer Satisfaction

Transport Scotland undertakes an annual customer survey which asks road users about their satisfaction with the condition of trunk road carriageways. This allows us to gauge current levels of satisfaction and compare and trend current and past levels of satisfaction in order to identify areas for improvement.



Satisfaction with the condition of trunk road surfaces has reached its highest level since 2009, at 45% (an increase of 5% since 2014). Reflecting this, the proportion of respondents dissatisfied with road surfaces has decreased, from 47% in 2014 to 40% in 2015. For the first time since 2009, a higher proportion of respondents were satisfied than dissatisfied.

A8 Investment Plan

Investing in Asset Management Activities

Our investment plan for trunk road carriageways outlines how we manage the carriageway in a safe and serviceable condition now and in the future. This involves surveying and inspecting carriageways, undertaking routine repairs, cyclic and winter maintenance and undertaking preventative structural maintenance. Figure A.3 provides a breakdown of the proportion of investment in each of these asset management activities for carriageways.

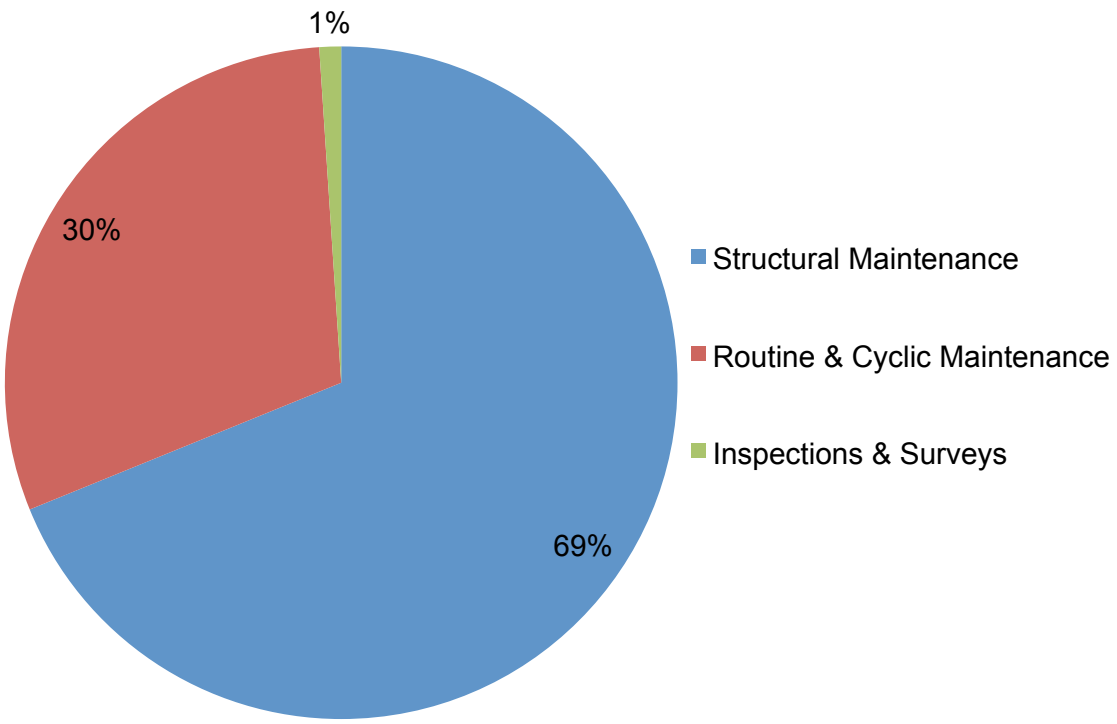


Figure A.3: Breakdown of 2014/15 Investment on Carriageways

Carriageway Historical Investment

The investment in roads structural maintenance over a five-year period is shown in Figure A.4. Spend on roads structural maintenance has ranged from £26m per annum to £52m per annum, with the lowest level of investment in 2011/12 and 2012/13 (£32m and £26m respectively).

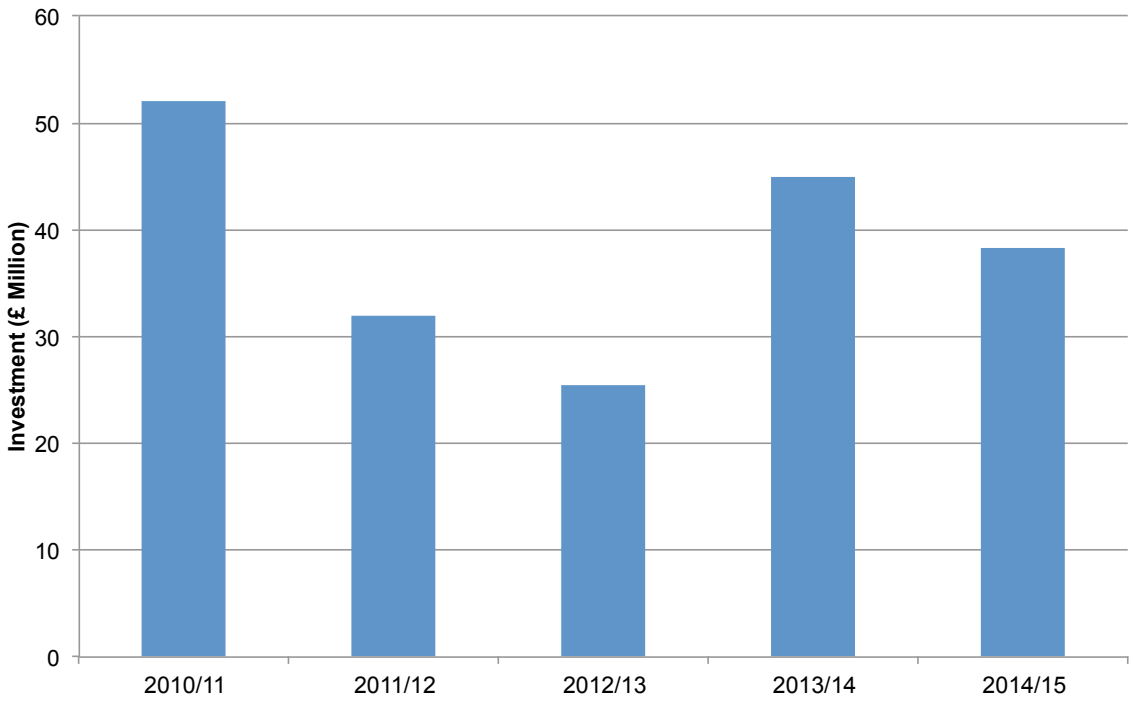


Figure A.4: Investment in roads structural maintenance from 2010/11 to 2014/15 Carriageway Future Investment and Work Plan

Carriageway Future Investment and Indicative Work Plan

We have a good understanding of the carriageway asset that we manage, its current condition, and the impact of different funding scenarios over the next 5 to 10 years on the change in that condition. Transport Scotland's strategic *financial model* provides what-if scenarios for investment in trunk road carriageways. Details of the model and the scenarios considered can be found in Chapter 5.

Our model predicts that a total maintenance budget of £666m (excluding inflation) is required to maintain trunk road carriageways at current structural condition levels (87% in good or fair condition) over the next 10 years. This is equivalent to an annualised average structural maintenance budget of £66.6m per annum[2]. The 2015/16 budget is approximately £34.5m.

[2]This scenario does not include provision of funds to improve skidding resistance, nor does it enable us to reduce the backlog of maintenance work.

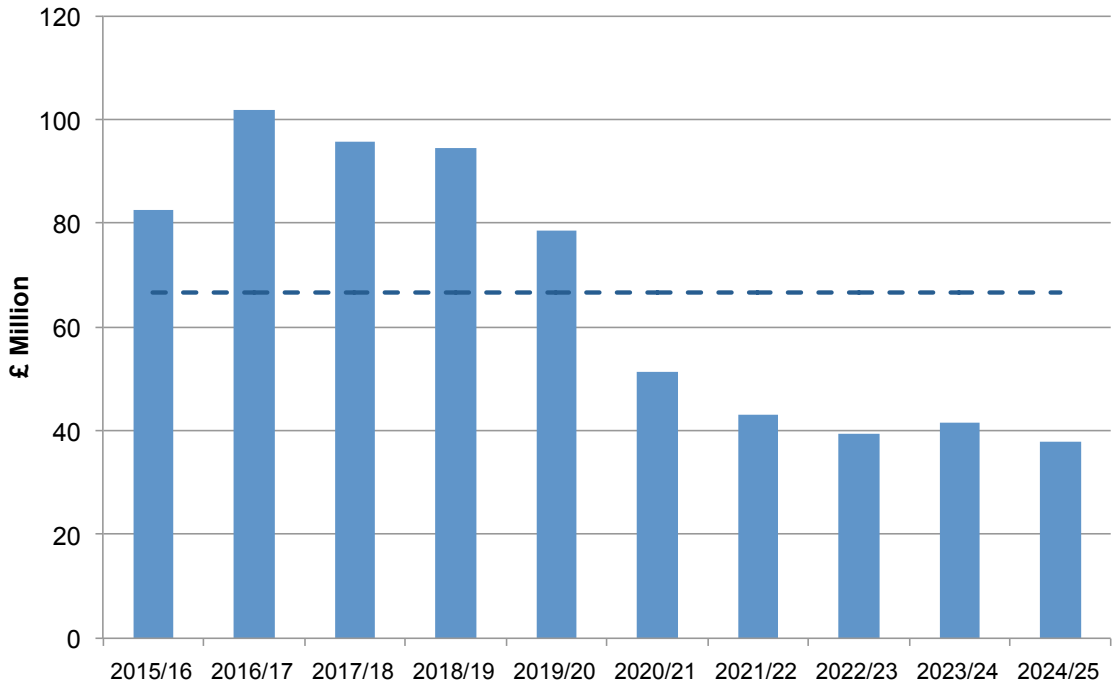


Figure A.5: 10-year expenditure required to maintain current carriageway condition

Assuming that funding will remain at 2015/16 levels (£34.5m per annum), our model estimates that approximately 3,729 lane-km of trunk road carriageways will be reconstructed, strengthened or resurfaced (789, 1,052 and 1,888 lane-km respectively) over the next 10 years.

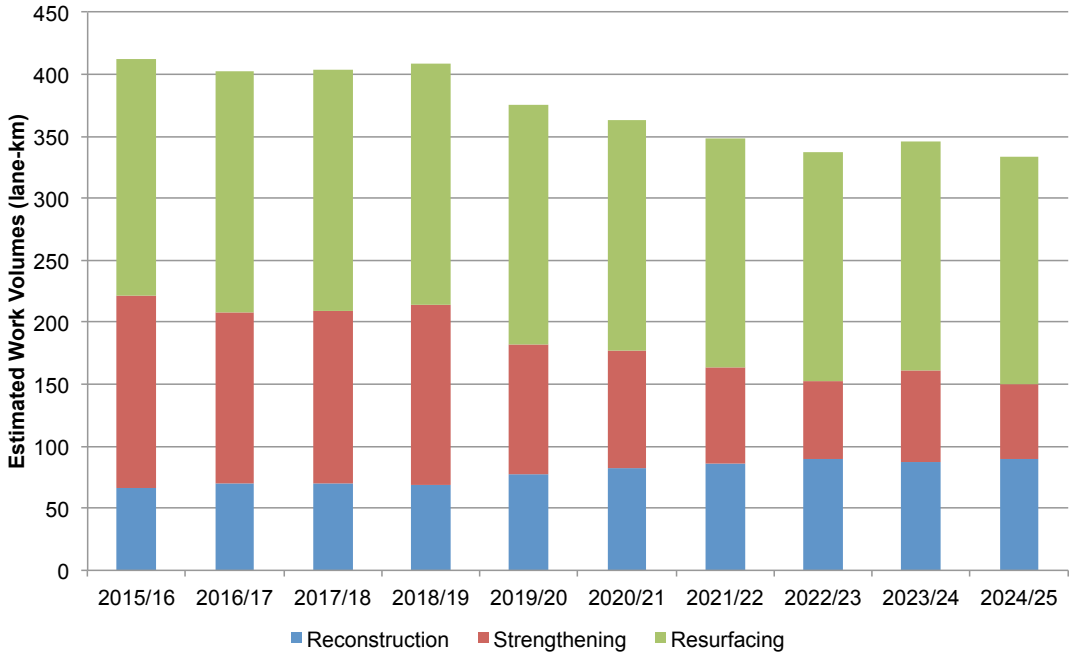


Figure A.6: 10-year indicative work plan with £34.5m annual budget

A9 Future Management Strategy

In order to minimise the impact of reduced budgets we will continue to develop and implement our *Roads Structural Maintenance Strategy*, and work with our supply chain to make best use of available resources. Implementation of this strategy, alongside other efficiency saving initiatives and asset management improvements (see Section 9) will enable us to continue to manage trunk road carriageways in a safe and serviceable condition. Key components of our strategy are provided in Table A.4.

Table A.4: Key Components of Roads Structural Maintenance Strategy

Scheme Identification	• Focus on delivering maintenance schemes which will continue to provide a safe surface for trunk road users. • Implement the *Transport Scotland Skid Policy* to ensure that areas requiring treatment are the given highest priority. • Deliver more proactive maintenance in areas that are approaching the end of structural life, rather than life expired, where a large improvement in pavement life can be achieved with smaller maintenance effort. • Monitor the ongoing costs of life expired pavements through Whole Life Costing techniques to identify the optimum timing for scheme delivery to ensure the maximum benefit is realised before substantial maintenance is delivered. • Encourage and allow greater utilisation of the existing pavement asset and limit further deterioration as far as possible through the use of low cost treatments that intervene to preserve the pavement before more serious and costly defects develop. Examples include surface dressing, crack sealing, patching and thin surface overlays. • Develop and use enhanced scheme identification and ranking tools to consider future changes to maintenance priorities that may be identified, particularly where early low cost interventions demonstrate better whole life value for money. • Review and challenge three year programmes to ensure that the most appropriate schemes and locations are being targeted for maintenance and reflect Transport Scotland objectives and priorities.

Value Management	• Ensure that all structural maintenance schemes are fully assessed and represent value for money. • Ensure that appropriate alternative options are developed and analysed through whole life cost analysis. • Ensure that large or complex schemes are challenged through Technical Workshops and the most deserving schemes are promoted for construction though joint Value Management workshops.
Design	• Consider the implementation of pavement designs that deliver a reduced design life to use less intensive and less costly treatments e.g. locations where the delivery of a standard design is impractical and identifies a high cost with the potential for an unacceptable impact to the public. • Monitor and encourage the use of low cost treatments that intervene to preserve the pavement before more serious and costly defects develop. Examples include surface dressing, crack sealing, patching and thin surface overlays. • Continue to promote the use of crack & seat and insitu recycling where technically appropriate, to utilise the existing pavement materials and deliver similar improvements in pavement life with reduced quantities of new material and cost. • Ensure that designs include a holistic approach that includes drainage and all ancillary assets – ensure that the design includes measures to protect the long-term durability of the pavement – for example by reducing the likelihood of failure at ironwork or road studs. • Ensure that long-term and timely maintenance of pavement is carried out to protect the investment.

Works Programming	• Bringing forward or delaying structural maintenance schemes to align with schemes programmed for other assets at the same location. This will reduce disruption to the road user and reduce costs. • Delaying high value Works Contracts and large reconstruction schemes to allow a greater degree of maintenance over a wider network coverage. In delaying these schemes, their continued added pressure on the planned and reactive maintenance programmes will be kept under review and the case for smaller more limited schemes considered on a whole life cost basis to ensure a safe surface is maintained. • Programme pavement works at a time of year that maximise the long term durability – avoid winter weather conditions and cold/damp weather.
Innovation	• Implement the use of innovative pavement materials and develop new specifications that can provide longer pavement life and reduced costs. • Encourage the use of TS2010, a new surface course specification developed by Transport Scotland, which is proving to be a more durable material. • Support the use of warm and cold asphalts which reduce energy usage, reduce costs and increase treatments depths within restricted working windows. • Maximise the use of echelon and continual paving to avoid longitudinal and transverse construction joints.

Appendix B – Road Structures

B1 Overview

Transport Scotland is responsible for the management, maintenance and operation of trunk road bridges and structures in Scotland and public safety and availability of the network are paramount. Structures that are part of the road asset are, like trunk road carriageways, managed and maintained by our Operating Companies who are contracted by Transport Scotland on behalf of the Scottish Government. They carry out day-to-day inspection, planned and reactive structural inspections, monitoring, management, maintenance and repairs to trunk road structures in accordance with the Operating Company contracts, the Design Manual for Roads and Bridges and best practice. This section of the RAMP describes the lifecycle plan for trunk road structures.

B2 The Structures Asset

Table B.1 provides an overview of the trunk road structures asset, their definitions and quantities. The inventory records held for road structures comply with the requirements set down in BD62: *As Built, Operation and Maintenance Records for Highway Structures*, and are held within the Structures Management Function of Transport Scotland's Integrated Roads Information System.

Table B.1: Road structure asset groups and quantities

Asset Type	Definition	Quantity
Bridge 	A structure supporting the trunk road as it crosses an obstacle (e.g. river, valley or flood plain) or a service (e.g. local road, railway or canal), OR A structure supporting the passage of a local road over the trunk road. Span ≥3 meters.	1,736
Culvert 	A structure supporting the trunk road as it crosses an obstacle (e.g. river, valley, flood plain, agricultural access). Culverts are defined as structures with 2 to 3 meters span, or multi-cell culverts where the cumulative span is greater than or equal to 5 meters or corrugated metal culverts 0.9 metres or more in span.	569

Asset Type	Definition	Quantity
Retaining Wall >1.5m 	A structure associated with the trunk road where the dominant function is to retain earth either above the trunk road or supports the trunk road. The retained fill height must be above 1.5 meters to qualify as a structure.	916
Sign/Signal Gantry 	Portal and cantilever gantries that support signs and/or signals over or adjacent to the trunk road.	327
High Mast Light 	High mast column for lighting 20 meters tall or over.	416
CCTV Mast 	Mast for camera, radio, speed camera and telecommunication transmission equipment adjacent to the trunk road.	119
Footbridge 	A structure supporting a footway or cycleway as it crosses the trunk road.	138

B3 Structures Standards

Transport Scotland adhere to a number of standards that set down best practice, guidance and requirements related to the management and maintenance of trunk road structures, such as those provided below:

- CSS Bridge Condition Indicator Volume 3, 14; Addendum to CSS Bridge Condition Indicator Volume 3.
- DMRB, Volume 3, Section 1: BD63: Inspection of Highway Structures.

- Guidance Note: Trunk Road Structures: Principle Inspections for Maintenance Works Prioritisation, (ii) Location System: Principle Inspections: Trunk Road Structures, (iii) TRBDB User Manual.
- Management of Highway Structures: A Code of Practice, September 2005, TSO, ISBN 0115526420.
- TS Interim Amendment 25, Assessment and Upgrading of Existing Vehicle Parapets, Transport Scotland, Trunk Road Network Management (Bridges), August 2007.
- TS Interim Amendment 29, Identification of 'Particularly at Risk' Supports, Transport Scotland, Trunk Road Network Management (Bridges), June 2009.
- TS Interim Amendment 25, Assessment and Upgrading of Existing Vehicle Parapets, Transport Scotland, Trunk Road Network Management (Bridges), August 2007.

B4 Inspections and Surveys

To ensure structures are maintained to the necessary standards, and to check they are safe for use and fit for purpose, it is essential that their visual and structural condition and integrity are reviewed and monitored on a regular basis. The types of planned inspections, assessments, monitoring and surveys our Operating Companies are required to undertake in accordance with Schedule 7: Part 7 of the Operating Company Contracts are outlined below:

General Inspection – is undertaken at intervals not exceeding two years to provide information on the physical condition of all visible elements of the structure without the need for special access equipment or traffic management arrangements.

Principal Inspection – is the inspection of all elements from within touching distance, and utilising access equipment as appropriate, carried out on a six-year cycle.

The General and Principal Inspections identify and prioritise defects, and the outcomes and are used to calculate the condition scores discussed in Section B7.

Special Inspections – are undertaken to investigate particular concerns identified during a General or Principle Inspection rather than at programmed intervals. A number of Special Inspections are undertaken to provide more detailed information on the condition and structural integrity of specific parts or components of a structure, including those outlined below. There is an ongoing

programme of Special Inspections to review structures identified with 'hidden defects' or 'hidden elements' that cannot readily be inspected during planned Principal and General Inspections.

Scour Inspection – is undertaken alongside Principal Inspections on structures over or carrying watercourses in order to check for removal of sediment such as sand and rocks from around bridge abutments or piers. Also as part of the Level 2 Scour Assessment Programme to BD97: The Assessment of Scour and Other Hydraulic Actions at Highway Structures, currently under way to structures over and adjacent to watercourses.

Inspection for Assessment – is undertaken because of increases in vehicle loadings due to changes in carriageway layout or to assess a structure that has deteriorated or been subject to accidental damage.

Assessment – is determination of the load carrying capacity of a structure in accordance with BD21: Assessment of Highway Bridges and Structures and/or BD86: Assessment of Highway Bridges and Structures for the Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles. A comprehensive programme of assessment has been undertaken to ensure structures can safely carry Authorised Weight (AW) vehicles. It can on occasion relate to the stability of a structure that may be subject to ground movement.

Structural Review – is undertaken in accordance with BD101: Review and Assessment of Highway Structures, to determine whether a structure has to undergo further assessment. This would be required where there is change in condition, operational load carrying requirements or changes to assessment standards. All sub-standard structures (those with load capacities of less than 40/44 tonnes) are subject to an annual review of their monitoring regimes, outputs, condition and interim measures in place.

Assessment of Vehicle Parapets – is undertaken in accordance with TS IA 25 to identify substandard parapets, safety fences around parapets and their connections (a wall/rail/fence that runs along the outside edges of the bridge deck, or retaining wall, parallel to the direction of traffic flow to prevent users from accidentally falling off the bridge).

Identification of 'Particularly at Risk' Supports and Subsequent Assessment – is undertaken in accordance with TS IA 29 and BD48: Assessment and Strengthening of Highway Bridge Supports for supports which are vulnerable under vehicle impact.

B5 Routine and Cyclic Maintenance of Structures

Full details of the routine and cyclic maintenance requirements for structures are provided in Schedule 7: Part 7 of our Operating Company contracts. Routine and cyclic maintenance activities undertaken for structures typically include:

Reactive maintenance – is normally identified through the inspections described in Section 5.2 and Section B1.4, but may also arise from reports received from the police or public. The causes of reactive maintenance vary considerably, but typically include vandalism, vehicle impacts, flooding, fire, fly tipping and ongoing deterioration of the structures. The requirements for defect repairs for all categories of defects are described in Section 5.3.

Cyclic Maintenance – minor work carried out on a regular or cyclic basis that helps to maintain the appearance, condition and functionality of a structure and reduce the need for other, normally more expensive, maintenance works. Examples include cleaning of bridge deck and abutment drains and expansion joints on bridges, removal of vegetation, checking and tightening holding down bolts to parapets, maintenance of services, and lighting.

B6 Programmed Maintenance

Remedial Works

All trunk road structures deteriorate over time due to usage, exposure and other factors, some arising from past design and construction practices. Work aimed at counteracting these mechanisms and maintaining the public safety and the durability and safe use of structures is referred to as structural maintenance. Structural maintenance includes repairs due to deterioration or damage, and bringing sub-standard and non-standard components up to current standards. Also, strengthening or replacement of structures that are life expired or unsuitable for current usage or those with substandard load carrying capacity or road alignment. Current specific programmes of work include strengthening and replacement of structures, upgrading of vehicle parapets, strengthening of supports, and scour protection to structures. Table B.2 presents some indicative maintenance activities and their typical renewal frequency for trunk road structures.

Table B.2: Indicative Maintenance Activities for Key Elements

Element	Description	Typical Renewal Frequency*
Bearings	Replacement of bearings which transfer loads and movements from the deck to the substructure and foundations.	15 to 40 years
Plug joints & Buried Joints	Replacement of an in situ joint in the pavement comprising a band of specially formulated flexible material which may also form the surfacing.	5 to 15 years
Elastomeric in metal rails	Replacement of a prefabricated joint comprising an elastomeric seal fixed between metal rails or runners.	11 to 20 years
Parapets (metal)	Replacement of a safety barrier that is installed on the edge of a structure where there is a vertical drop.	20 to 40 years
Parapets (masonry)		Up to 100 years
Waterproofing	Application of a material to form an impervious membrane on a bridge deck to protect it from the ingress of water and de-icing salts.	20 to 40 years

*Dependent on traffic loadings and whether maintenance is carried out at optimum intervention point.

Strengthening and Replacement

Strengthening work is required to bring a number of trunk road structures up to current load carrying capacity requirements. Under EC Directive all Member States are required to accept articulated vehicles and drawbar-trailer combinations with six or more axles weighing up to 44 tonnes on international journeys. This directive came into effect in the UK on the 1 Jan 1999 and was enshrined in Statutory Instrument No. 3224, see Table B.3.

Table B.3: Summary of Loading Regulations

Year	Regulation	Gross Vehicle Weight and number of axles
1986	Statutory Instrument 1986 No. 1078 *The road vehicles (construction and use) regulations 1986*	38 tonne, 5 axles
1998	Statutory Instrument 1998 No. 3111 *The road vehicles (authorised weight) regulations 1998*	40 tonne, 5 axles
2000	Statutory Instrument 2000 No. 3224 *The road vehicles (authorised weight) (amendment) regulations 2000*	44 tonne, 6 axles

Transport Scotland is progressing a bridge strengthening and replacement programme with a number of structures programmed for strengthening over the RAMP period. At present there are 45 sub-standard trunk road structures with less than 40/44 tonne capacity. This includes 34 bridges (14 sub-standard verges, 17 sub-standard decks, two substandard supports), one culvert and 10 retaining walls. Works have been ongoing delivering the bridge strengthening and replacement programme since 2000, indicating the scale of the impact of increasing vehicle and axle loads on the network.

Future spend will be targeted on bridges with sub-standard decks. The majority of sub-standard bridges are short to medium span structures on the traditional routes. At the present time Transport Scotland's policy is to operate all of its structures without weight restrictions, subject to review and monitoring in accordance with *BD79: Management of Sub-standard Highway Structures* to maximise network availability. However, as public safety is paramount, should ongoing deterioration or traffic volumes and flows alter the load carrying capacity of a structure, this will be reviewed in accordance with *BD101*. If funding for the necessary remedial or upgrading works is not available then in future it may be necessary to impose traffic restrictions or closures to ensure safety and prevent structural collapse.

Identifying and Prioritising Maintenance Schemes

Structural maintenance needs are primarily identified through the regular Principal and General Inspection programmes described in Section B4, where defects are identified, scoped and allocated an indicative cost for remedial works. This schedule of works is known as the Structures Workbank. The Operating Companies review all available information (including all inspection reports, monitoring requirements, test results, known strengthening and replacement requirements) and identify:

- Maintenance operations required for structures and any associated access systems.
- Strengthening and replacement schemes required for structures and any associated access systems.
- Special Inspections and investigations.
- Assessments and any resulting interim and formal measures for sub-standard structures, including monitoring, traffic restrictions, propping, or closure.
- Monitoring requirements for structures with known defects.

Transport Scotland prioritises maintenance for road structures using our *Value Management of the Structures Renewals Programme*. This provides a robust, repeatable and documented process for prioritising needs on the basis of risk[3]. Each scheme in the one-year maintenance programme is scored against the Safety, Functionality, Environment and Sustainability criteria described in Section 6.1.

B7 Monitoring Performance

Structures Condition

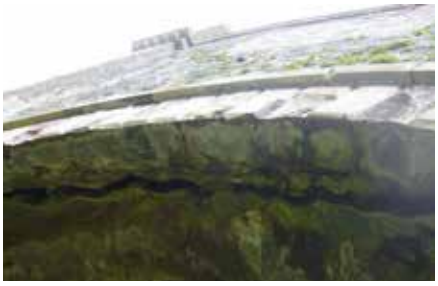
Transport Scotland has adopted the Bridge Condition Index (BCI) inspection standard, which is used by the majority of road bridge owners in the UK. The index is calculated from General and Principal Inspection data (see Section B4), enabling analysis and trending of condition information. Two condition indicators are calculated for each structure, which are defined as:

- BCI_{av}: The average BCI for a structure taking into account the condition of all structural elements on the structure. This score provides an overview of the average structure condition.
- BCI_{crit}: The condition score of the load bearing element which is in worst condition. This score provides an indication of the criticality of the structure with regards to the load bearing capacity.

The five BCI condition categories, descriptions and example photographs are shown in Table B.4.

[3]Some Major Bridge inspections sit outwith the main Principal and General Inspection Programme and works identified often have a unique priority that overrides others.

Table B.4: Bridge and structure condition categories

Condition Categories	Description	Photographs
Excellent (BCI 90-100)	No functional or structural defects.	
Good (BCI 80-89)	Some minor defects that have limited impact on the structure. Examples include localised flaking of paintwork and weather or stained concrete.	
Fair (BCI 65-79)	Minor to moderate defects that may impact on the durability of the structure and may impact function. Examples include small areas of exposed reinforcement and failed paint.	
Poor (BCI 40-64)	Moderate to major defects that are likely to impact on the function of the structure. Examples include large areas of exposed reinforcement and exposed and rusting metal.	
Very Poor (BCI 0-39)	Major structural defects and some components on the bridge may be failed, requires attention.	

A further two condition indicators are evaluated for the stock of structures:

- Structures Stock Condition Indicator ($SSCI_{av}$): the weighted average of the individual BCI_{av} scores, this score provides an overview of the average stock condition.
- Structures Stock Critical Indicator ($SSCI_{crit}$) – the weighted average of the BCI_{crit} scores, this score provides an indication of the criticality of the stock with regards to load carrying capacity.

A full set of condition indicators were collated by the end of the 2014/15 inspection year with all network structures and the smaller Major Bridges included. The Major Bridges A898 Erskine, A9 Kessock, A828 Connel, M8 Kingston and Caledonian Swing Bridges have their own particular inspection requirements contained in their maintenance manuals which do not utilise condition indicators. Therefore the condition of these particular structures sits outwith the condition scoring reporting.

Figure B.1 presents the percentage of trunk road structures in each BCI_{av} condition band in 2014/15. The graph shows that the majority of trunk road structures have an average condition rating of excellent or good (79%). The $SSCI_{av}$ score for the structures stock is 86%.

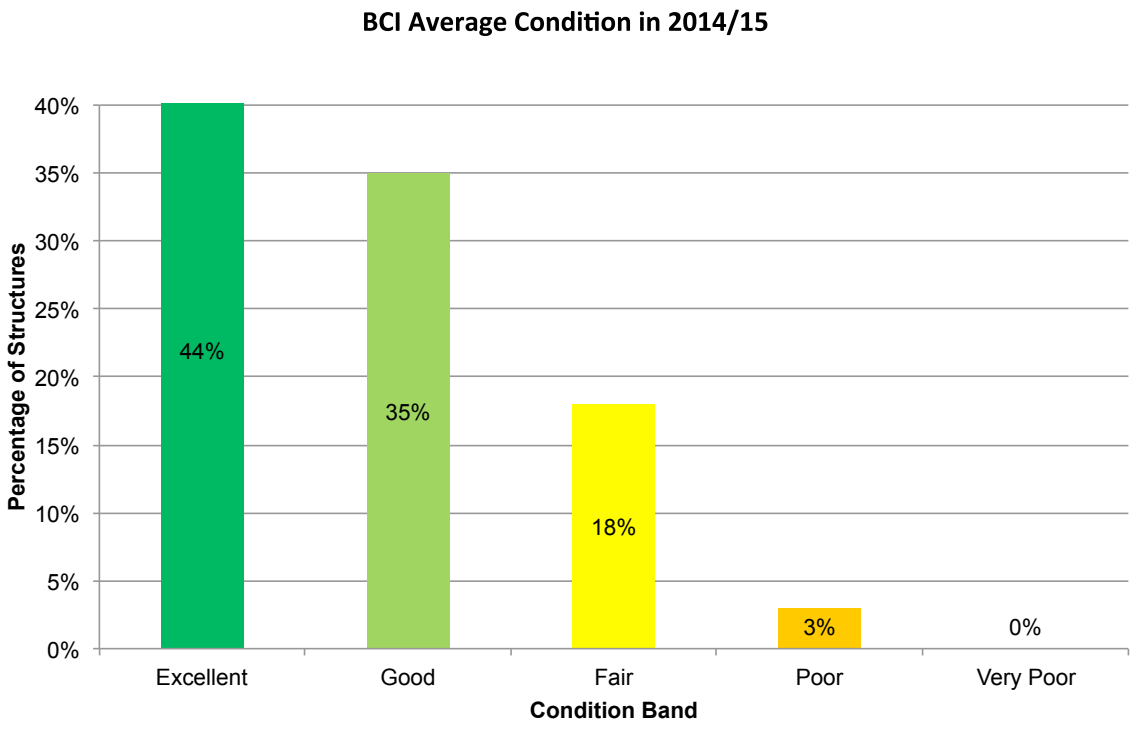


Figure B.1: BCI_{av} condition of trunk road structures in 2014/15

Figure B.2 presents the percentage of trunk road structures inspected in each BCI_{crit} condition band in 2014/15. The graph shows that the majority of trunk road structures have a BCI_{crit} condition rating of excellent or good (61%). The $SSCI_{crit}$ score for the structures stock is 76%.

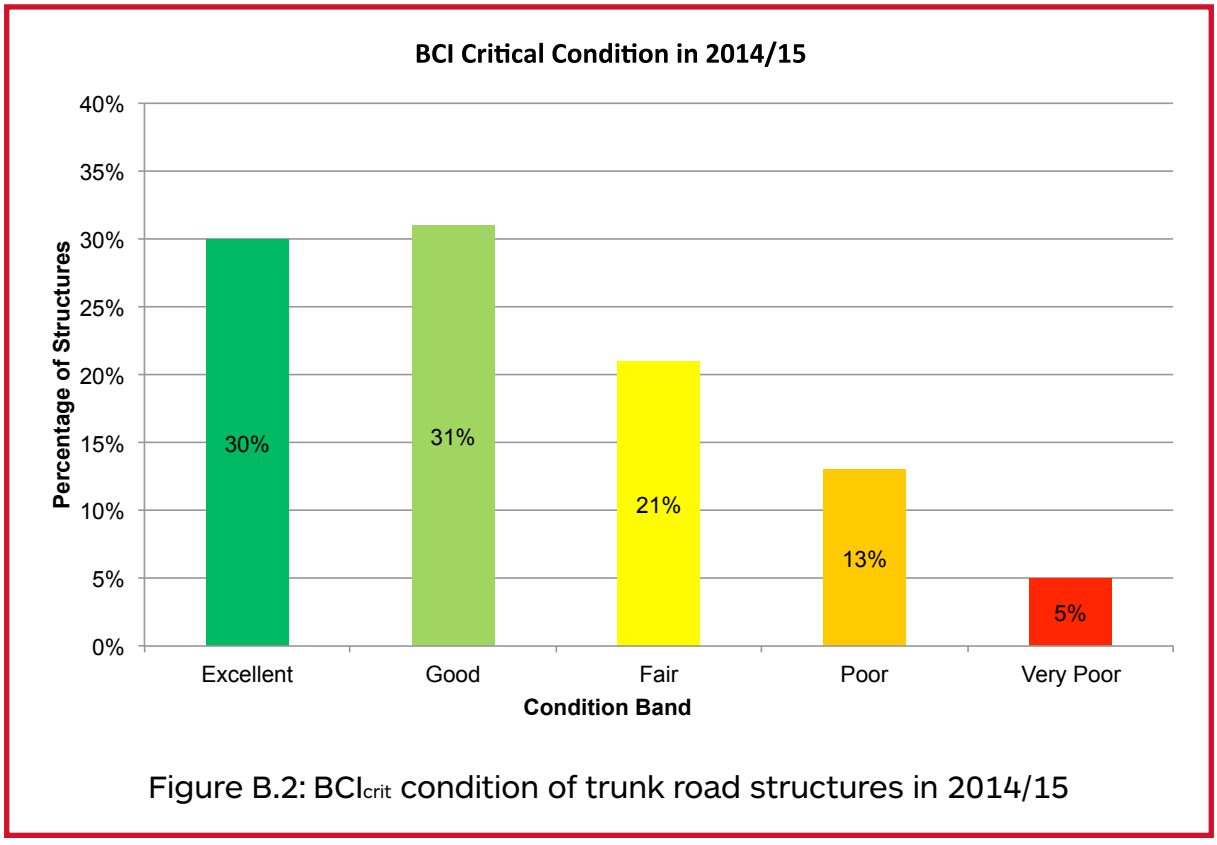


Figure B.2: BCI_{crit} condition of trunk road structures in 2014/15

The percentage of structures in poor or very poor BCI average condition has remained relatively stable, increasing from 2% in 2010/11 to 3% in 2014/15. The percentage of structures with poor or very poor critical element condition has increased from 14% to 18%.

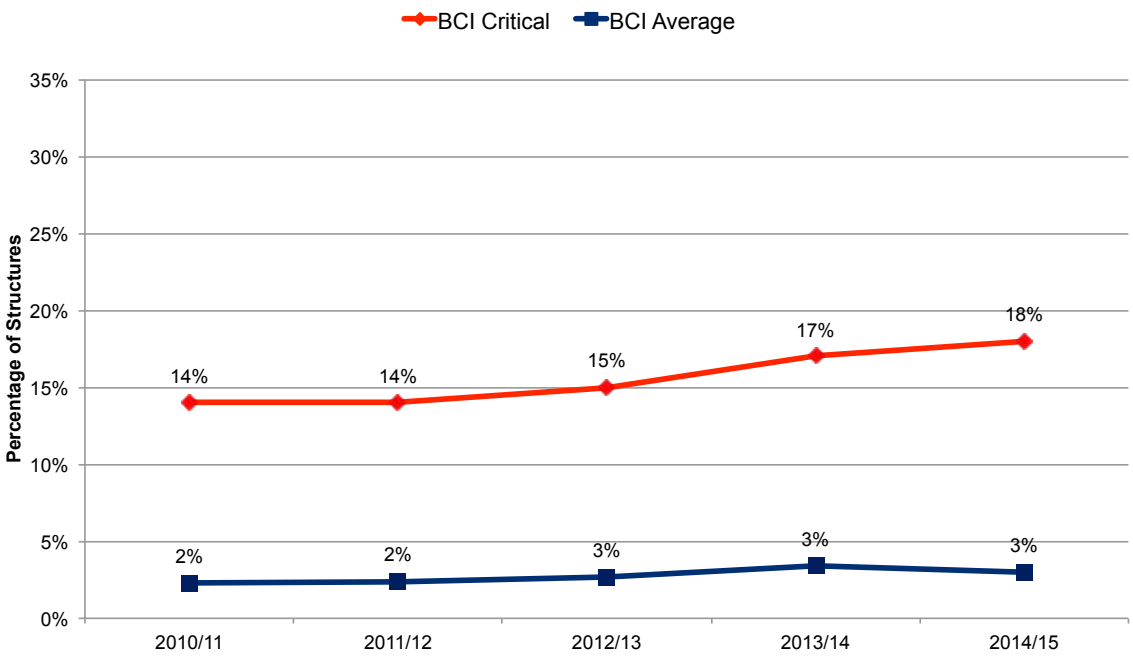


Figure B.3: Percentage of structures inspected in 'poor/very poor' condition 2010/11 to 2014/15

B8 Investment Plan

Investing in Asset Management Activities

Our investment plan for trunk road structures outlines how we plan to manage the structures stock in a safe and serviceable condition now and in the future. This involves surveying and inspecting structures, undertaking routine repairs, cyclic maintenance and undertaking essential preventative and reactive structural maintenance. Figure B.4 provides a breakdown of the proportion of investment in each of these asset management activities for structures.

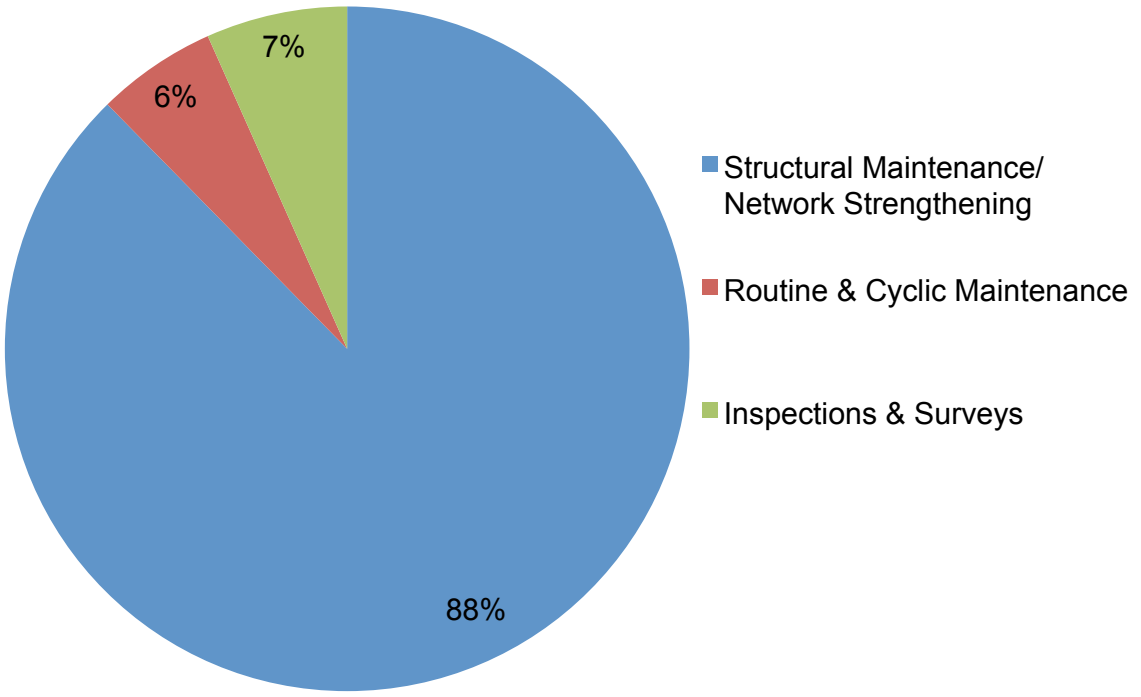


Figure B.4: Breakdown of 2014/15 Investment on Structures

Structures Historical Investment

The investment in structural maintenance and strengthening over the same five year period is shown in Figure B.5. Spend on maintenance of trunk road structures has ranged from £15m per annum to £30m per annum, with the lowest level of investment in 2011/12.

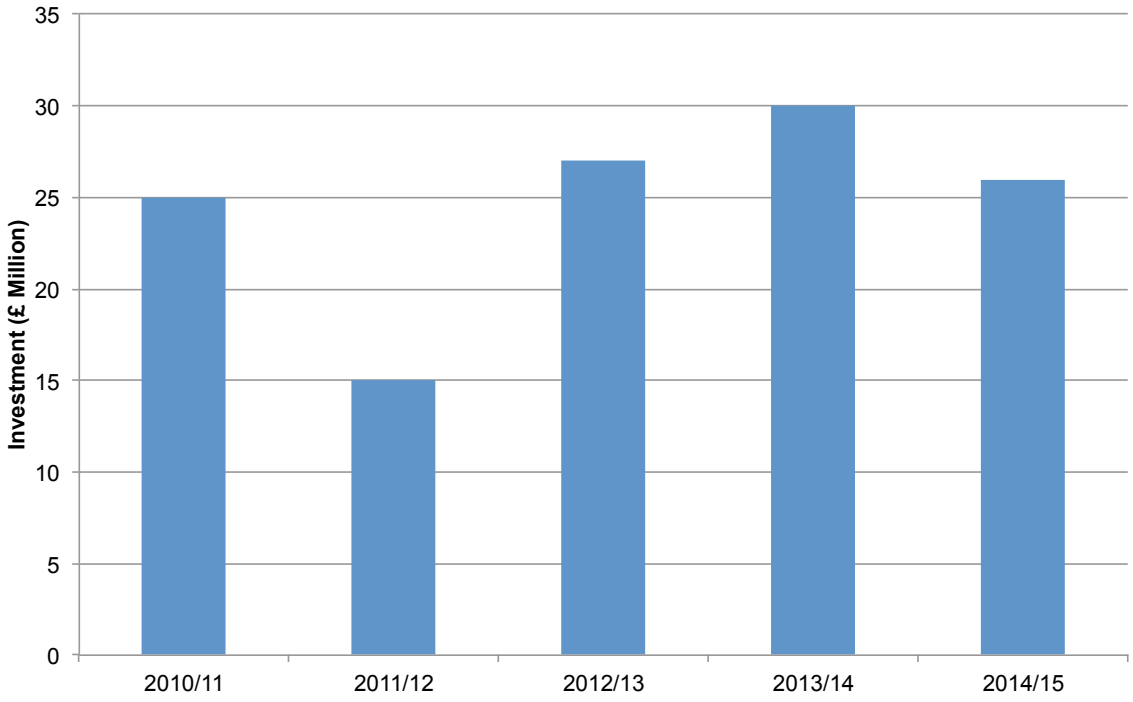


Figure B.5: Investment in structures maintenance from 2010/11 to 2014/15

Structures Future Investment and Indicative Work Plan

The schedule of works and programmes held in the Structures Workbank (Section B6), is used to develop a number of future funding options. Our analysis indicates that a total maintenance budget of £550m is required to maintain trunk road structures at current condition levels over the next 10 years[4]. This is equivalent to an annualised average structures maintenance budget of £55m per year. The 2015/16 budget is approximately £24.5m.

As described in Section 5.4, we are currently developing a new model to inform the long term level of expenditure required on structures maintenance. This will allow us to understand better the impact of a number of different funding scenarios on network condition over the next 5 to 10 years. Initial analysis indicates that the budget required to maintain trunk road structures at current condition levels aligns with the figures shown in Figure B.6.

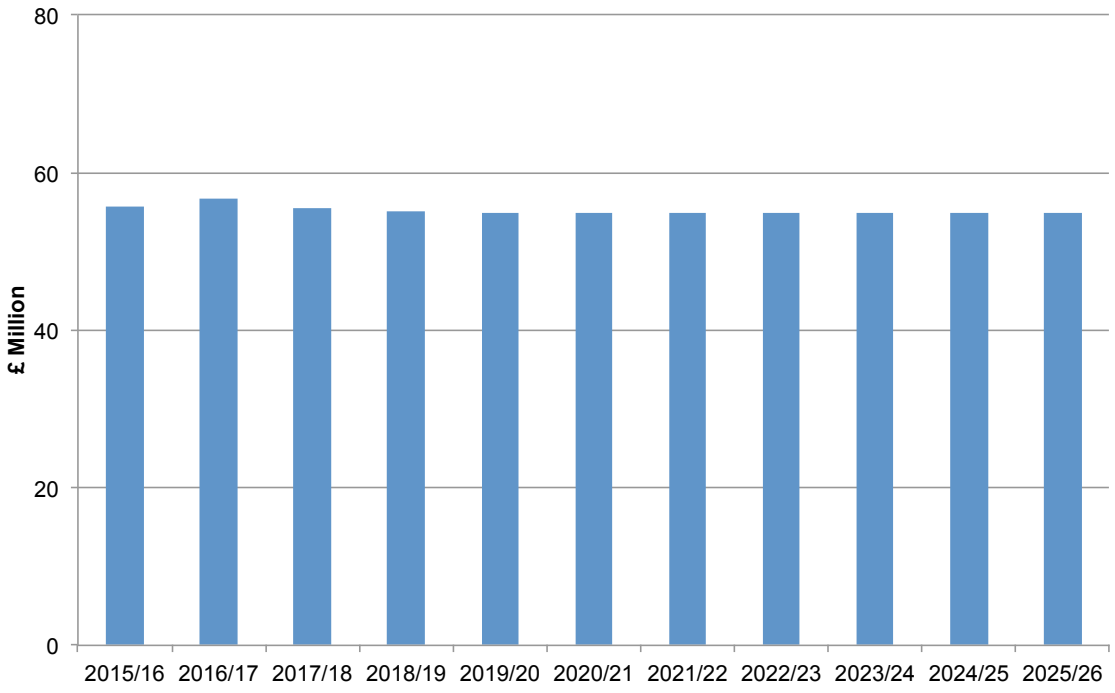
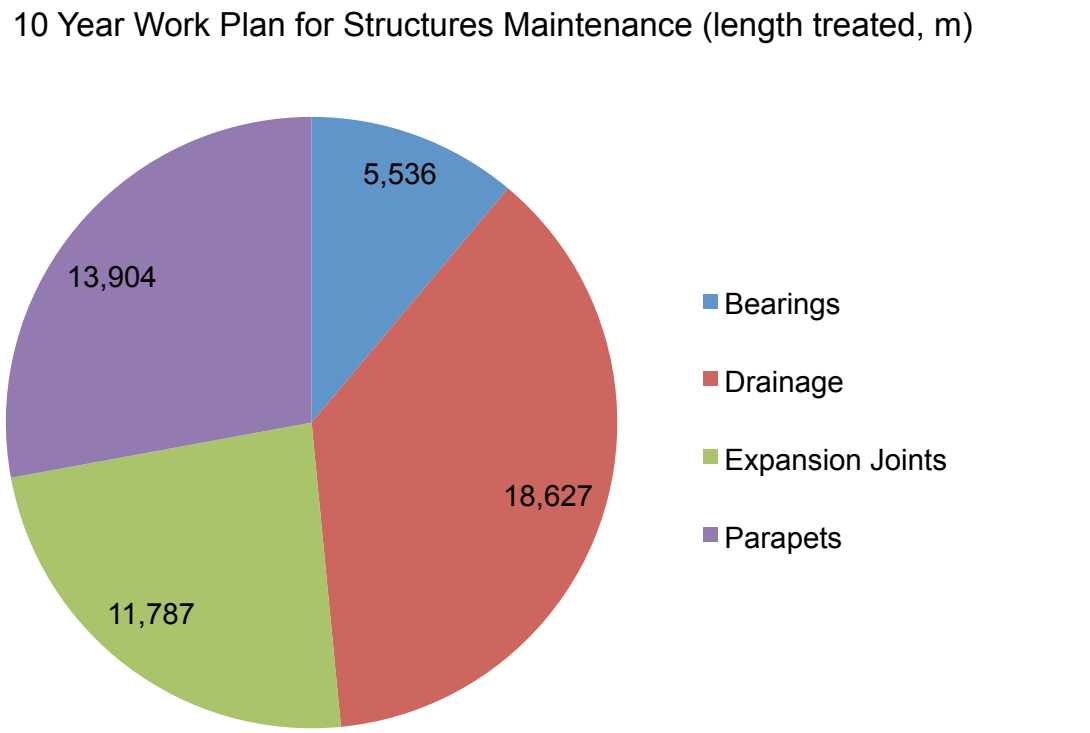


Figure B.6: 10-year expenditure required to maintain current condition of structures

Assuming that funding will remain at 2015/16 levels (£24.5m per annum), our model estimates that approximately 50,000m of bearings, joints, drainage or parapets will be maintained or replaced over the next 10 years. In addition, approximately 240,000m^2 of concrete repairs, waterproofing, and finishes will be undertaken over the next 10 years.

[4]This scenario does not include provision of funds to reduce the backlog of maintenance work.



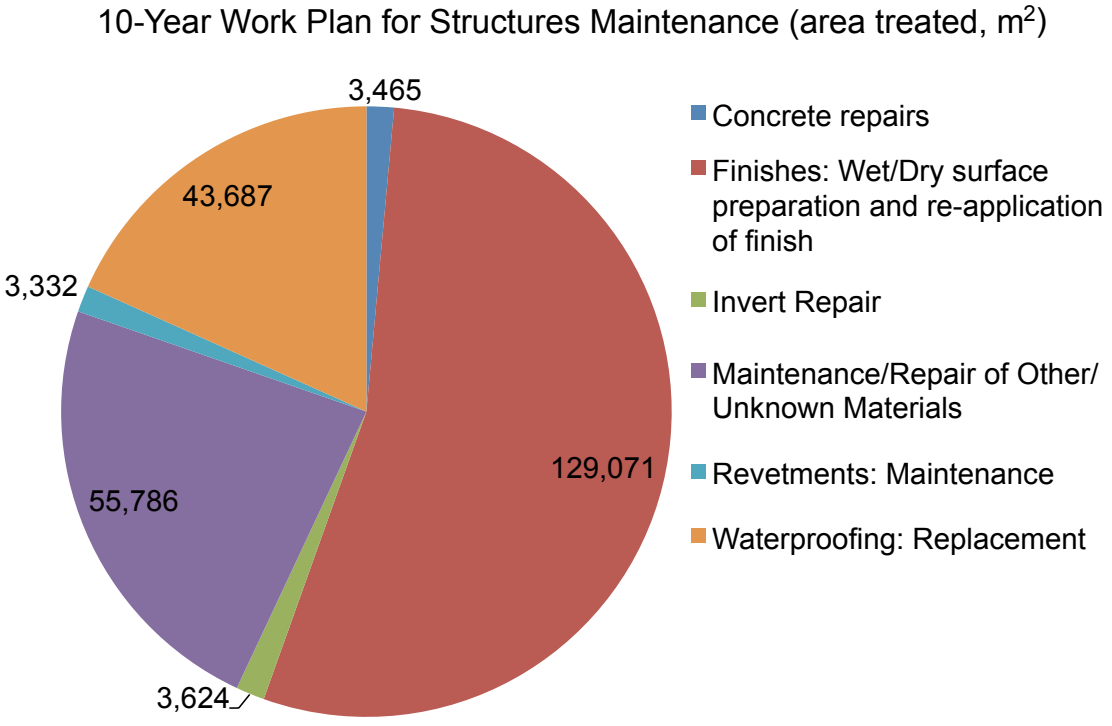


Figure B.7: 10-year indicative work plan with £24.5m annual budget

B9 Future Management Strategy

In order to minimise the impact of reduced budgets we will continue to work with our supply chain to make best use of available resources. Key components of our strategy for managing trunk road structures are provided below.

Scheme Identification	• Use of scheme identification and ranking tools to better reflect the changing maintenance priorities, particularly where early low cost interventions demonstrate better value for money. • Review and challenge three-year programmes to ensure that the most appropriate schemes and locations are being targeted for maintenance and reflect Transport Scotland objectives and priorities.
Value Management	• Ensure that all structures maintenance schemes are fully assessed and represent value for money. • Ensure that appropriate alternative options are developed and analysed through whole life cost analysis. • Ensure that large or complex schemes are challenged through Value Engineering Workshops and the most deserving schemes are promoted. • Collaborate with other Transport Scotland teams to deliver joint maintenance schemes for roads and bridges where possible.
Design	• Continue to improve durability and maintenance access in design of new or altered structures.

Works Programming	• Bringing forward or delaying structures maintenance schemes to coincide with roads maintenance schemes at the same location to reduce disruption to the road user and reduce costs. • Delaying high value Works Contracts and replacement schemes to allow smaller maintenance schemes to be undertaken in more locations, more quickly. Planned and reactive maintenance programmes will be kept under review and the case for smaller more limited schemes considered on a whole life cost basis to ensure a safe network is maintained. • Programme refurbishment works at a time of year that maximises durability, e.g. avoid concrete repairs or bridge deck waterproofing in winter.
Innovation	• Implement innovative materials and techniques with improved durability in maintenance schemes, e.g. Gussasphalt surfacing on long span, steel box bridges such as Kessock Bridge or cathodic protection and prevention on concrete repair schemes. • Using temporary bridges to keep traffic restrictions and delays to a minimum on bridge replacement schemes, e.g. A82 Allt Chonoglais and A830 Dearg bridge replacements. • Undertaking trials of new paints for steel bridges which reduce construction duration and have equal or greater durability than existing materials, e.g. M8 Junction 3 trialled a paint system used on offshore installations.

Appendix C – Ancillary Assets

C1 Overview

The trunk road network includes not just carriageways and structures, but also footways, lighting, traffic signs, drainage networks and much else besides. In this version of the RAMP ancillary assets cover all trunk road asset types with the exception of the carriageway and road structures. This section describes the lifecycle plan for trunk road ancillary assets.

C2 Ancillary Assets

Table C.1 provides an overview of the trunk road ancillary assets, their definitions and quantities. The inventory records held for ancillary assets comply with the requirements set down in Transport Scotland's *Trunk Road Inventory Manual*, and are held within the Routine Management and Maintenance Function of Transport Scotland's Integrated Roads Information System.

Table C.1: Ancillary asset group and quantities

Asset Group	Asset Type	Definition	Quantity
Pedestrian & Cycle Facilities	Footway 	A part of the road exclusively for the use of pedestrians or pedal cycles.	912 km
	Cycle Facility 	A part of the road specifically for the use of pedal cycles.	66 km
Road Markings, Studs & Kerbs	Road Markings 	Longitudinal lines, hatched lines, transverse lines and special lines and markings.	12,580 km
	Road Studs 	Studs placed on the carriageway to guide traffic.	8577 km
	Kerbs 	A border, usually upstanding at the edge of a carriageway or hard shoulder.	4,403 km

Asset Group	Asset Type	Definition	Quantity
Technology Equipment	Variable Message Signs 	A visual warning to inform road users of congestion, road works, speed limits, events or incidents.	586
	Cabinets and Pillars 	A cabinet containing electronic and/or communications, traffic signal equipment or similar.	5,316
	Detector Loop 	A wire loop embedded in the road surface to detect the presence or speed of a vehicle.	3,766
	Emergency Telephone 	A telephone box and booth solely for use in an emergency.	485
	Weather Station 	A remote electronic monitoring device to detect road surface and atmospheric conditions to give early warning of ice and frost.	103

Asset Group	Asset Type	Definition	Quantity
Fences & Barriers	Fences and Barriers 	A boundary fence, wall or barrier which runs alongside the carriageway for screening noise, headlight glare or to prevent access.	2,875 km
	Traffic Control Barriers 	A moveable barrier or gate which can control the flow of traffic or close sections of the road in severe weather conditions.	47
	Safety Fence 	A vehicle restraint system in the form of a continuous barrier erected alongside a carriageway or bridge.	1,975 km
	Pedestrian Guardrail 	A protective fence usually on the edge of a footway intended to prevent pedestrians from stepping on to the carriageway.	44 km
Road Lighting	Lighting Point 	A lighting installation usually consisting of a column, lantern housing and lamp.	20,263
	Road Traffic Signs (lit) 	An illuminated sign, signal or other device for the purpose of regulating, warning, guiding or informing traffic.	7,365
	Bollards (lit) 	An illuminated device placed on a refuge, traffic island or verge to warn drivers of obstructions or to prevent the passage of vehicles.	992

Asset Group	Asset Type	Definition	Quantity
Drainage	Balancing Pond 	A catchment area adjacent to a carriageway to collect surface water run-off following heavy rain.	33
	Counterfort Drain 	A field drain filled with granular material such as gravel, which may be a laid over a porous or perforated pipe.	11 km
	Ditch 	A trench adjacent to a carriageway for drainage, generally running parallel to the carriageway.	657 km
	Channel 	A narrow longitudinal strip, generally near the edge of the carriageway, constructed to carry and lead away surface water.	197 km
	Filter Drain 	A drain surrounded by granular material which remains visible (such as gravel), within which may be laid a porous or perforated pipe.	1498 km
	Grip 	A shallow trench across the verge of a road to lead surface water away from the carriageway.	25,818
	Gully 	A chamber at the side of the road connected to a drainage system to receive surface water and to trap debris.	86,387

Asset Group	Asset Type	Definition	Quantity
Drainage	Culvert ≤3.0m 	An enclosed channel or large pipe for conveying water under or alongside the trunk road.	6,471
	Drainage 	A chamber provided in a drainage system with a sump or pit to collect silt or solid material and prevent it from blocking inaccessible parts of the drains.	1,451
	Manhole 	A chamber constructed to give access to a drain, sewer or other underground service.	53,085
	Piped Grip 	A piped conduit across the verge of a road to lead surface water away.	1,024
Geotechnical	Embankments & Cuttings 	A cutting is an area where the carriageway is below existing ground level within an excavation. An embankment is an area where the carriageway has been raised above existing ground level.	2,054 km
Traffic Signs & Signals	Road Traffic Signs 	A sign, signal or other device for the purpose of regulating, warning, guiding or informing traffic.	100,125
	Bollards 	A device placed on a refuge, traffic island or verge to warn drivers of obstructions or to prevent the passage of vehicles.	3,141
	Reference Marker Point 	Used to show the position of the start and end of sections on high speed roads.	6,187

Asset Group	Asset Type	Definition	Quantity
Traffic Signs & Signals	Road Traffic Signals 	A system of different coloured lights, including arrow-shaped lights, for stopping streams of traffic and permitting them to move.	1,833
	Pedestrian Crossing 	A transverse strip of carriageway marked to indicate where pedestrians have priority to cross the road.	420
Landscaping	Tree 	A perennial plant with a woody self-supported trunk and branches.	12,376
	Hedge 	Distinct linear planting strips of single or mixed species, which are intended to be formally shaped and maintained.	300 km
	Verge 	Part of the road outside the carriageway that may run through the middle.	7,625 km
	Grass, Bulbs & Wildflower Areas 	A grassed area, an area of naturalised or planted bulbs, or an area of sown or naturalised herbaceous and/or flowering species of ecological or environmental value.	35,984 km^2

C3 Ancillary Asset Standards

Transport Scotland adheres to a number of standards related to the management and maintenance of trunk road ancillary assets, such as those provided below:

- TD 25/01 Inspection and Maintenance of Traffic Signs on Motorway and All-Purpose Trunk Roads, Volume 8 Section 2 Part 2.
- TD 26/07 Inspection and Maintenance of Road Markings and Road Studs on Motorways and All-Purpose Trunk Roads, Volume 8 Section 2 Part 2.
- TD 23/99 Trunk Roads and Trunk Road Motorways Inspection and Maintenance of Road Lighting, Volume 8 Section 3 Part 2.
- TD 24/97 All-Purpose Trunk Roads Inspection and Maintenance of Traffic Signals and Associated Equipment, Volume 8 Section 1 Part 2.
- Design Manual for Roads and Bridges, Geotechnics and Drainage, Volume 4 Section 1 and 2.
- HA108/04 The Landscape Management Handbook, Volume 10 Section 3.
- HD40/01 Footway Maintenance, Volume 7 Section 4 Part 3 Chapter 2.
- Electrical Maintenance Guidelines for Roadside Electrical Apparatus lighting and Power Supplies: Document No. LDS8023_09.

C4 Inspections and Surveys

In addition to the surveys described in Section 5.2, our Operating Companies are required to undertake the following inspections:

Specialist Road Markings Surveys includes retro-reflectivity testing to ensure that markings of the line can reflect light from the vehicle back to the driver during the hours of darkness and skid resistance testing to ensure that markings are providing a specified level of surface grip.

Specialist Road Stud Testing is undertaken to ensure that road studs (often referred to as cats' eyes), are reflecting light from vehicle headlights during the hours of darkness.

Specialist Drainage Inspections are generally undertaken using specialist surveying techniques to investigate a potential problem identified through safety or detailed inspections, such as flooding or blockages.

Landscape Opportunities Inspections are undertaken by the Landscape Architect at intervals not exceeding 12 months in order to identify potential opportunities to improve the landscape associated with the trunk road network. **Specialist Woodland inspections** of hedges and trees are also required at set intervals.

C5 Routine and Cyclic Maintenance of Ancillary Assets

Full details of the routine and cyclic maintenance requirements for ancillary assets are provided in Schedule 7: Part 1 and Part 2 of our Operating Company contracts. Routine and cyclic maintenance activities undertaken for ancillary assets typically include:

Reactive maintenance – unplanned work normally identified through the inspections described in Section 5.2 or reports from members of the public. The requirements for defect repairs for all categories of defects are described in Section 5.3.

Cyclic Maintenance – day-to-day servicing, rather than repair, of assets to keep them operating. Examples include weed control (on footways, cycle lanes, kerbs etc.), pressure jetting of slot drains and kerb block drains, checking tensioning devises on relevant road restraint systems and bulk lamp changes.

Renewals – programmed maintenance on ancillary assets is typically of a lesser nature than those undertaken on carriageways and structures, typically comprising the replacement of faulty or worn out equipment, for example:

- Patching and maintenance of footways and cycle lanes.
- Replacing road side kerbs.
- Road lighting and electrical work.
- Repair and/or replacement of safety fences.
- Repainting of road markings and replacement of road studs.
- Repair and remedial works to earthworks, embankments and cuttings.

Our Operating Companies are required to log all Category 2 Defects found during Detailed Inspections in our Integrated Roads

Information System. They are then required to produce short to medium-term work programmes by prioritising, preparing and submitting programmes and bids for the repair of these defects while at the same time taking account of service life and lifecycle requirements. Where appropriate, renewals of ancillary assets are undertaken as part of programmed carriageway or structure maintenance schemes as this will reduce disruption to the road user and provide good value for money.

C6 Monitoring Performance

Transport Scotland measures and monitors the performance of trunk road carriageways by undertaking annual inspections and condition surveys and road user satisfaction surveys. This helps us to understand and prioritise the needs of our network.

Ancillary Asset Condition

The collection of condition data for ancillary assets will enable us to compare the performance of assets across the trunk road network and assess how they are performing over time. The assets are categorised by the severity of their defects according to five levels of service or condition categories. These condition categories are *excellent*, *good*, *fair*, *poor and very poor*. The condition categories developed for footway and cycle facilities and road markings are shown as examples in Table C.2 and Table C.3.

Table C.2: Footway and cycle facilities condition categories

Condition Categories	Description	Photographs
Excellent	New or nearly new condition with no obvious visual defects. May have obvious signs of disturbance in the surrounding grassed areas indicating recent works.	
Good	An even and comfortable surface, free from defects and with few visible signs of surface deterioration. Showing no signs of the original construction works and all surrounding grassed areas returned to vegetation.	
Fair	Free from safety defects but poor visual aesthetics. Evidence of initial deterioration, minor cracking, crazing and fretting. Minor isolated spot defects. Poor quality reinstatements including minor differences in level with original surface. Minor settlement/ unevenness or filler loss on block paved areas.	
Poor	Extensive cracking, failed patching, potholes, standing water (>10mm deep), small areas of depression (>25mm) or slab trips (>20mm). Extensive missing filler and/or loose blocks. Extensive wearing of screed for cycle facilities.	
Very Poor	Requires replacement/ rehabilitation, life expired. Effects include extensive and severe surface failure, cracking, distortion or slab trips. Complete loss of screed for cycle facilities.	

Table C.3: Road markings condition categories

Condition Categories	Description	Photographs
Excellent	New or nearly new condition. Score of 5/5 on the visual assessment of 'Wear' (TD26/07).	
Good	No visual defects and with few visible signs of deterioration. Good night time conspicuity and very little wear, score of 4/5 on the visual assessment of 'Wear' (TD26/07). >100mcd/m²/lux retroreflectivity.	
Fair	Some initial visible wear and/or fair night time conspicuity characteristics score of 3/5 on the visual assessment of 'Wear' (TD26/07). 80-100 mcd/m²/lux retroreflectivity.	
Poor	Visible but has bare spots and poor night time conspicuity, score of 2/5 on the visual assessment of 'Wear' (TD26/07). <80 mcd/m²/lux retroreflectivity. Skidding resistance results close to threshold.	
Very Poor	Barely visible, score 0 or 1/5 on the visual assessment of 'Wear' (TD26/07). Below any threshold levels on critical road areas (e.g. Give Way or Stop lines). Below threshold skidding resistance levels detailed in BS EN 1436. <80 mcd/m²/lux retroreflectivity on unlit single carriageway. Life expired asset.	

Our Operating Companies have been contracted to collect ancillary asset condition data annually from 2013/14. In the absence of full network coverage, condition data collected to date can be considered indicative of network condition. The condition of trunk road ancillary assets, aggregated under eight asset groups is presented in Figure C.1. Approximately 41% of ancillary assets are categorised as excellent or good condition. Approximately 18% of ancillary assets are categorised as poor or very poor condition (15% and 3% respectively).

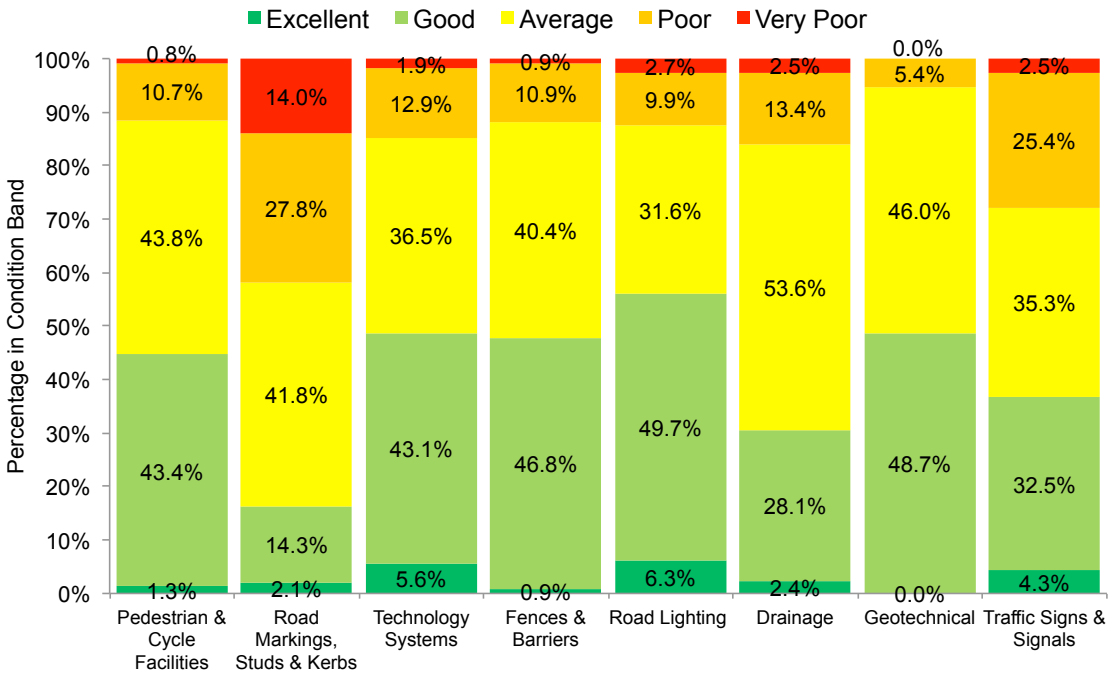


Figure C.1: 2014/15 condition of trunk road network ancillary assets

Customer Satisfaction

Transport Scotland undertakes an annual customer survey which asks road users about their satisfaction with the condition of trunk road footways, cycleways, lighting, signs and road markings. This allows us to gauge current levels of satisfaction and compare and trend current and past levels of satisfaction in order to identify areas for improvement.

Views of trunk road lighting, road markings and signage were mainly positive in 2015. Respondents were most satisfied with the visibility of road signage (76%), the provision of signs giving directions (71%), lighting along roads (68%), followed by the provision of electronic

message boards (67%), and the visibility of road markings (63%). With the exception of lighting (2% decrease), levels of satisfaction were higher than in 2014.

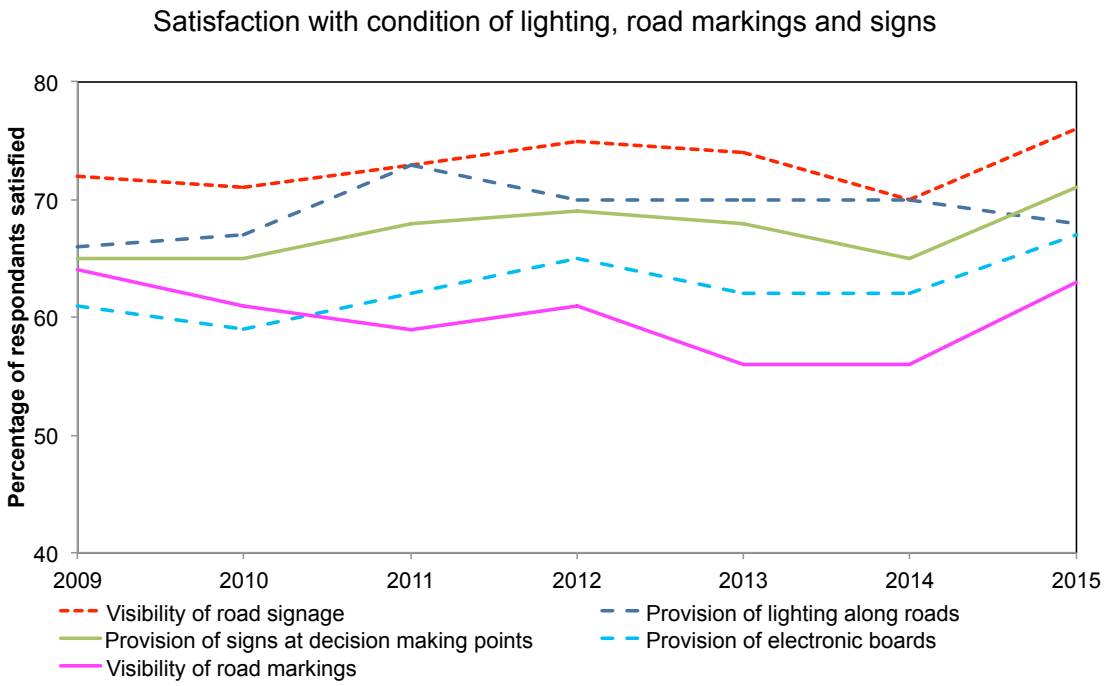


Figure C.2: Trends with lighting, markings and signage

C7 Investment Plan

Investing in Asset Management Activities

Our investment plan for trunk road ancillary assets outlines how we manage the assets in a safe and serviceable condition both now and into the future. This involves surveying and inspecting ancillary assets, undertaking routine repairs, cyclic maintenance and undertaking asset renewals. Figure C.3 provides a breakdown of the proportion of investment in these asset management activities for each ancillary asset group.

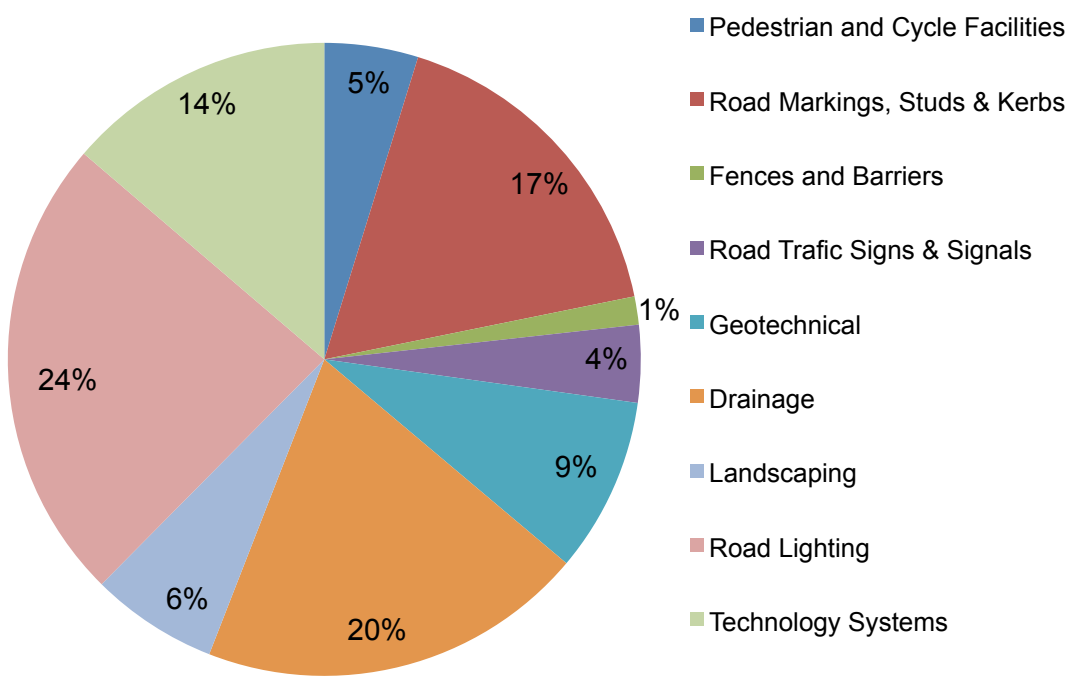


Figure C.3: Breakdown of 2014/15 Investment on Ancillary Assets

Ancillary Assets Historical Investment

The investment in ancillary asset renewals over a five-year period is shown in Figure C.4. Spend on renewing ancillary assets has ranged from £8m per annum to £13m per annum, with the lowest level of investment in 2013/14.

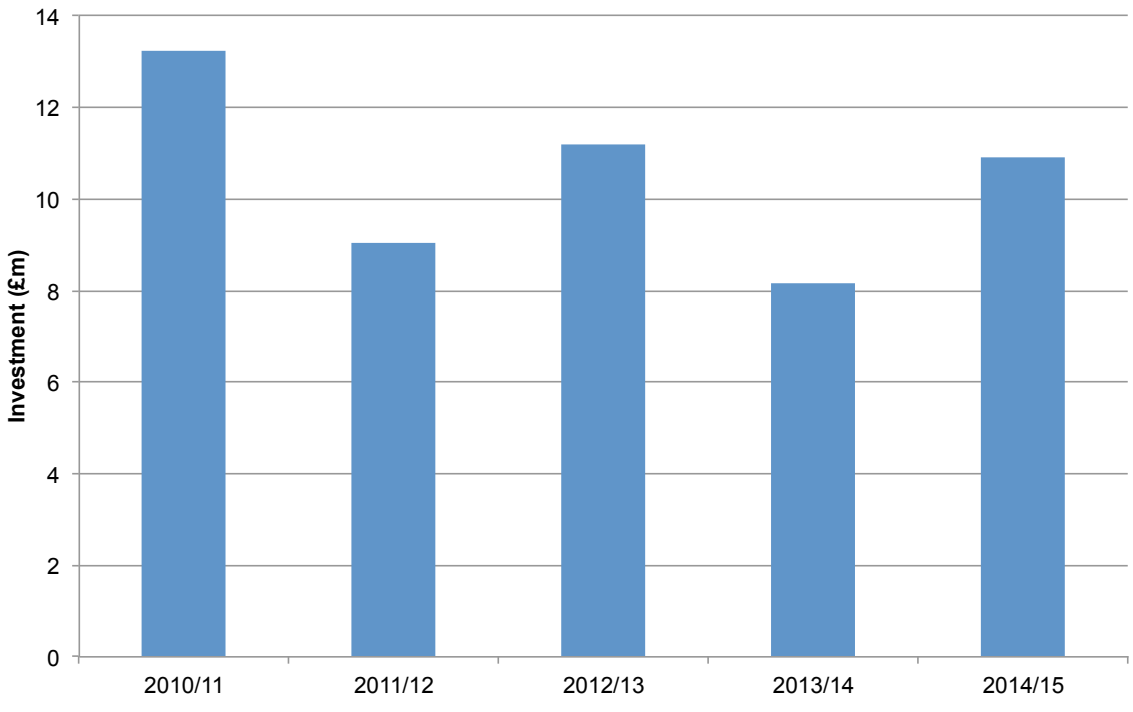


Figure C.4: Investment in ancillary assets renewals from 2010/11 to 2014/15

Ancillary Assets Future Investment and Indicative Work Plan

We are currently working with our Operating Companies to better understand the current condition of the ancillary assets that we manage. This will allow us to understand the impact of different funding scenarios over the next 5 to 10 years on the change in that condition. Transport Scotland's *ancillary assets model* provides what-if scenarios for investment in trunk road ancillary assets. Details of the model and the scenarios considered can be found in Chapter 5.

Our model predicts that a total maintenance budget of £540m (excluding inflation) is required to replace all ancillary assets that fall into the very poor condition band over the next 10 years. This is equivalent to an annualised average maintenance budget of £54m per year. The 2015/16 budget is approximately £11m.

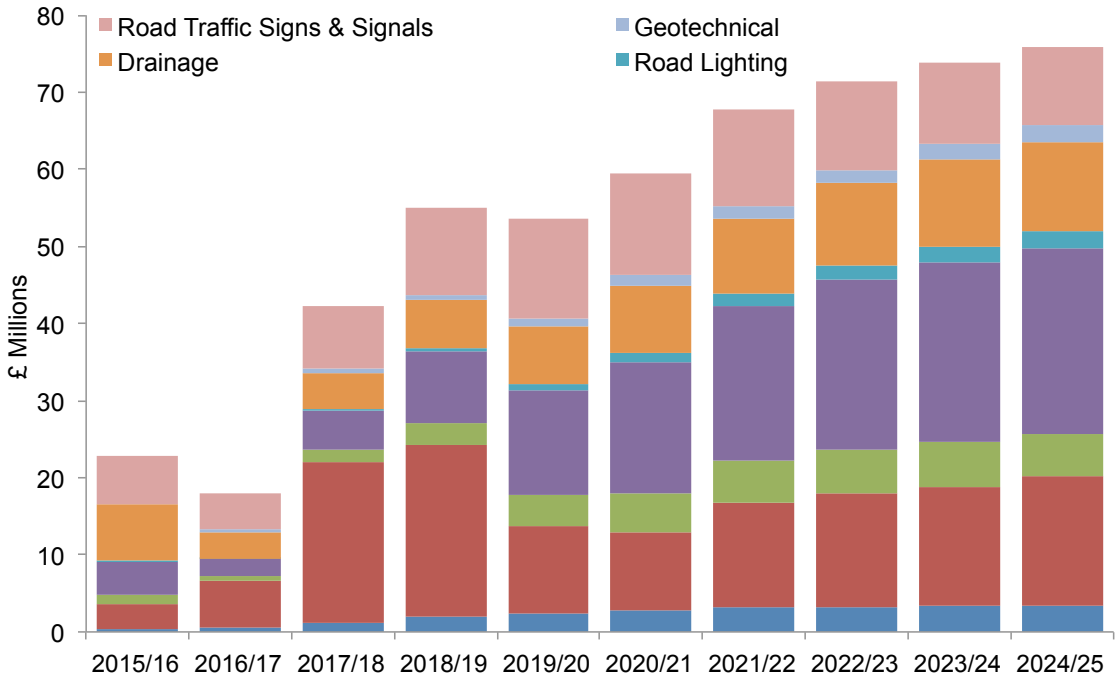
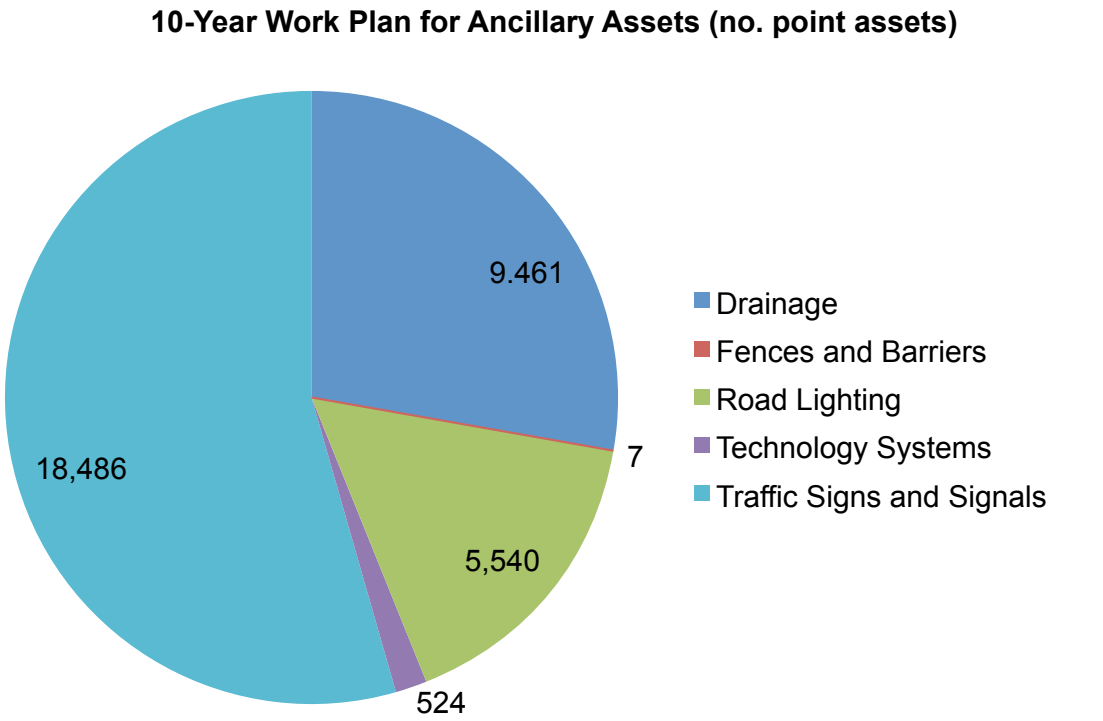


Figure C.5: Ancillary assets 10-year maintenance expenditure

Assuming that funding will remain at 2015/16 levels (£11m per annum), our model estimates that approximately 33,400 individual point assets and 9,700 km of continuous assets will be replaced over the next 10 years.



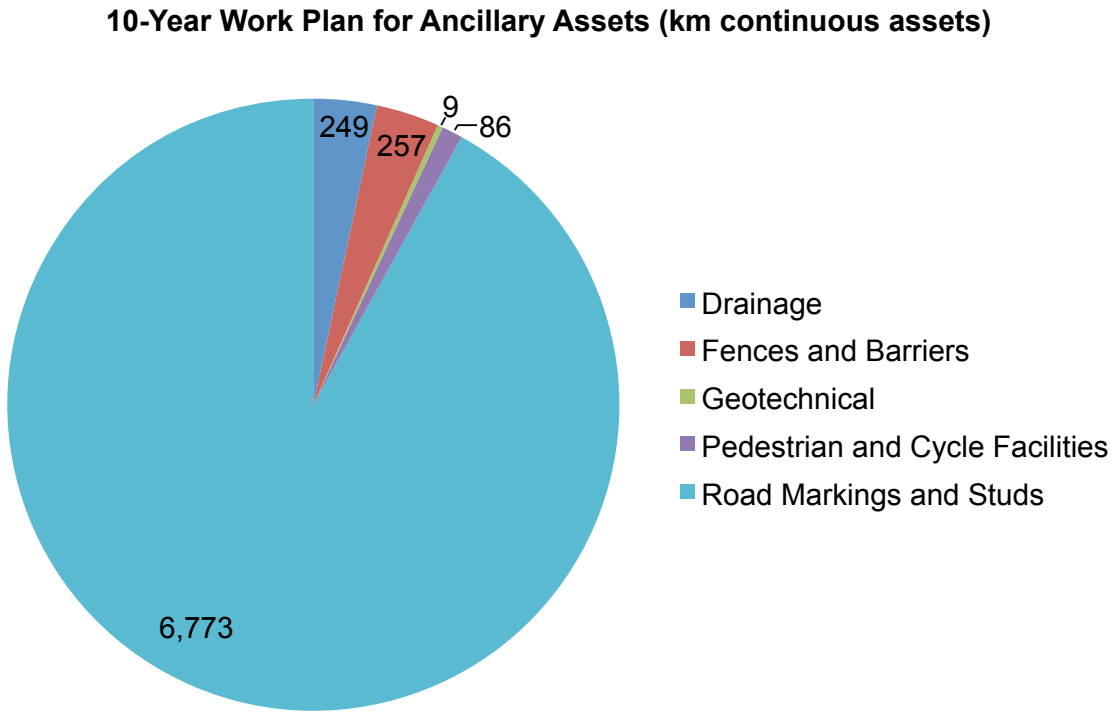


Figure C.6: 10-year indicative work plan with £11m annual budget

C8 Future Management Strategy

In order to minimise the impact of reduced budgets we will continue to work with our supply chain to make best use of available resources. Key components of our strategy for managing ancillary assets are provided below.

Scheme Identification	• Continue to collect condition data for ancillary assets and use it to identify renewals schemes and 3-year programmes. • Continue our strategy of focusing on essential maintenance of ancillary assets in preference to improving their condition. Replacement of ancillary assets will be delayed where possible to achieve the maximum possible life. • Renewal activities will be focused on low value activities that can achieve a wide network coverage, such as white lining.
Value Management	• Ensure that all ancillary asset renewals schemes are fully assessed and represent value for money. • Ensure that appropriate alternative options are developed and analysed through whole life cost analysis, where appropriate. • Develop bidding guidance, prioritisation processes and whole life cost tools for key assets to ensure that the most appropriate and deserving schemes are being targeted for maintenance, and reflect Transport Scotland's objectives and priorities.
Works Programming	• Consider bringing forward or delaying renewal of ancillary assets to align with schemes programmed on carriageway and structures assets at the same location. This will reduce disruption to the road user and reduce costs.
Innovation	• Continue to investigate innovative treatment and assessment methods such as filter drain recycling, drainage condition assessments and GPS recording of maintenance activities. • Continue to invest in schemes which improve efficiency and/or asset life, such as LED Street Lighting, which provides a longer life, lower energy consumption and cheaper maintenance costs.

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Transport Scotland
Buchanan House, 58 Port Dundas Road, Glasgow, G4 0HF
0141 272 7100
info@transport.gov.scot

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