Asset management capability

We will build on our progress developing excellence in asset management to further our capability in CP5
Our Asset Management Challenge

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Introduction

Asset management is about aligning the way we manage our assets with our corporate objectives. In the case of Network Rail our principle objective is the delivery of our outputs in a sustainable way for the lowest whole life, whole system cost.

We are working to achieve a highly developed approach to asset management. This includes alignment of planning processes, functional and technical specifications, approvals processes, installation and commissioning processes and the design of complementary and efficient inspection and maintenance regimes.

We have made significant progress in CP4, but recognize that continued improvement in our asset management capability is required during CP5 to deliver our planned efficiencies and effective long term planning of the railway. To achieve this, we have set ourselves the target of ‘setting a worldwide benchmark for excellence in asset management’ by the end of CP5. This document explains how we measure our asset management capability, provides an overview of our progress during CP4, confirms the scope of further priority improvements through CP5 and identifies the resultant improvement in capability we expect to achieve.

Context

Network Rail is one of the biggest asset management companies in the UK. When we last undertook a detailed comparison with other sectors our renewals expenditure of £12.5bn during CP4 is approximately the same as the total equivalent investment of the 23 water and sewerage companies combined. It exceeds the levels of investment made by the 11 electricity distribution companies and National Grid’s UK electricity and gas transmission businesses.

In railway terms, we have the oldest system in the world and one of the busiest networks in Europe, with 20% more train services than France, 60% more than Italy and more than Spain, Switzerland, The Netherlands, Portugal and Norway combined. We maintain around 30,000 bridges, 2,500 stations and over 20,000 miles of track. The effective management of these assets requires a robust understanding of their behaviour and the most appropriate actions to mitigate asset degradation or failure.

While we share many of the challenges faced by the utility companies, such as a geographically dispersed asset base, an ageing infrastructure and a constant drive for service improvement at reduced cost, there are also some additional challenges. For example, the categorisation of rail as a high hazard sector (along with the nuclear, chemical, oil and gas industries) imposes additional safety requirements, requiring more precise planning, and for safeguards to be designed in to each discrete activity. In addition, we manage complex interfaces between trains and our assets. These add to already marked challenges harmonising the interfaces between our own assets, for example how our signalling, electrification, telecoms, track and structures assets work as a system to allow level crossings to function safely.

Challenge

Our benchmarked comparisons have demonstrated that we are already established as best practice amongst European railways and UK utilities in our strategic planning, the delivery of projects and maintenance, and the way we work with our suppliers. We are striving to develop these areas further whilst working to improve our asset information, whole life cycle planning, approach to sustainable development, adaptation to climate change, and organisational culture. These are all areas where our benchmarking has shown more significant improvement is possible.

The principles of asset management require that the decisions we take consider railway system wide implications, crossing departmental and discipline boundaries and focus on whole life cycle value. This is not easy as complexities surround cost, risk and performance trade offs, short-term and long term impacts and understanding of how activity on one asset group (e.g. track) may impact on another part of the overall railway system (e.g. signalling). Thus we must make ‘wise’ decisions supported by reliable information, effective processes and delivered by competent people.

To help us address these challenges we have devolved asset management decision making and accountability within the business to route teams, supported by improvements to the provision of policy, assurance and essential services (telecoms, energy and asset information) from a centralised Asset Management Services organisation. This change is encouraging more local decision making (within a national policy framework), and driving an improved system view of assets, improved trade-offs between maintenance and renewal activities, and more innovation and challenge to asset management processes. Additionally, we have produced a comprehensive asset information strategy and implementation programme (ORBIS) that is progressively addressing the challenge of strengthening our asset information.

We have spent considerable time in CP4 seeking out asset management best practice from other organizations – our objective for asset management capability by 2019 is that we will provide a benchmark against which organisations throughout the world choose to assess their own asset management capabilities.
Measuring our Asset Management Capability

How we measure our capability
We need a good understanding of our current capability, to allow us to prioritise areas for improvement. Additionally we have been keen to establish what best practice looks like in other companies. Over the past seven years, AMCL, the Independent Reporter for Asset Management, has assessed our asset management capability using their Asset Management Excellence Model (AMEM). AMEM involves a review of 23 areas of capability and is a questionnaire based model with a 6 point maturity scale that ranks the responses in a range from 'Innocent' to 'Excellent'. The assessment has been undertaken three times, firstly in 2006 again in 2009 and most recently in 2011, and will be repeated early in 2013 to provide an assessment of our capability underpinning this SBP. Network Rail’s Benchmarked Capability in Asset Management as at the Initial Industry Plan is summarized below. (The next update to this benchmark will be undertaken during Q4 2012/13).

Our relative position
The 2011 AMEM assessment has confirmed improvements in all priority areas relative to the 2006 study. These results, together with other benchmarking work have been used to establish areas where we are at ‘best practice’.

In CP4 we were asked to lead the development of UIC guidelines for asset management, a railway interpretation of PAS 55, reflecting the confidence that others have in our asset management capability.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Network Rail’s ‘Best Practice’ Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Strategy &amp; Planning</td>
<td>Benchmark confirms we are towards the frontier of UK organisations, we are the first Railway company to have produced an Asset Management Policy and Asset Management Strategy.</td>
</tr>
<tr>
<td>Whole Life Decision Making</td>
<td>We have made significant investment in whole life cycle costing and strategic forecasting models which underpin the asset policies, in these areas we are at least as advanced as the best UK utilities.</td>
</tr>
<tr>
<td>Asset Creation (management &amp; delivery of major projects)</td>
<td>Comparisons with utility sector confirms that our capability is judged to be similar. Additionally the AMEM model confirms we are close to the frontier.</td>
</tr>
<tr>
<td>Maintenance Delivery</td>
<td>In these activities we lie at the frontier compared to both UK comparators and other rail organisations.</td>
</tr>
<tr>
<td>Weather &amp; Climate Change</td>
<td>Our current research work into climate change is at the lead of known practices in both rail and utilities.</td>
</tr>
</tbody>
</table>

Key areas for improvement
The progress made across many areas of capability, together with the areas of real strength outlined above have allowed us to focus on other areas that represent a priority to improve:

- Asset information – The specification, currency and availability of appropriate levels of asset information has been an area of concern. We have produced a comprehensive asset information strategy and implementation programme (ORBIS) that is progressively addressing this opportunity for improvement.
- Opex assessment – Despite excellence in maintenance delivery, we have lacked leading edge design of our maintenance regimes. We are addressing these weaknesses through our risk based maintenance programme.
Developing our Asset Management Capability – Strong Progress in CP4

Progress so far
During CP4 we have made substantial progress in key areas, particularly those that help to inform the strategic business planning process. This work has been completed as part of an over-arching Asset Management Improvement Programme that is planned to continue in CP5. The key aspects of this programme are headlined below. Further details follow later in this section or are available in other related parts of the SBP.

Our Asset Management Framework
All of our improvements are being developed in a complementary way such that they can be deployed as an integrated Asset Management System. The conceptual framework of this system is shown in the figure below. We have made strong progress by clarifying roles across asset management through the process of devolution, placing decision making closer to the customer whilst protecting and nurturing expertise in national support roles within our Asset Management Services organisation.

Asset Management Framework

Our long term aim is to develop our approach in a manner that is demonstrably world class, with our capabilities appropriately matched with those of our industry partners. These are ambitious targets, our progress during the past couple of years, measured by the 2011 AMEM benchmark confirms we are on track to have developed overall capabilities that are demonstrably comparable with best practice elsewhere in Britain by 2014.

Asset Policy Development
We have moved from asset policies that were largely time-based in CP3, to policies that are condition-based in CP4. For CP5 we have now developed policies that are risk-based, and have a balance between renewal, refurbishment (component replacement) and maintenance. Getting this balance right, to deliver the required level of infrastructure performance in a sustainable way, is what achieves the lowest whole life cost.

Suite of Whole Life Cost Modelling Tools
The CP5 policy development has focussed on improving our understanding of asset degradation through better condition information; quantifying the impact of refurbishment as an alternative to full renewal; and applying risk-based whole life cycle cost models to compare the costs, performance impact, and sustainability, for a range of possible maintenance and renewal regimes.

Route Plans
Our plans have been developed through an iterative process of “top down” forecasting of our long term activities and costs and the development of “bottom up” route-based asset management plans. The top down modelling is used to validate our route plans and demonstrate our policies and plans are sustainable and minimum whole life cost.

Asset Information
Through our Asset Data Improvement Programme (ADIP) we have progressively improved the accuracy and currency of our asset information with improvements prioritised to support the development of the SBP and ensuring the railway can be maintained effectively and safely.

In October 2011 an 8 year programme was launched – Offering Rail Better Information Systems (ORBIS), with the purpose of making a step change in the collection and use of asset information. The programme aims to improve the way asset information is collected, increase the quality of data gathered, turn a greater volume of that information into intelligence and insight and improve the way information is disseminated and communicated. It will ensure that the data we hold on all assets will be collected, managed and communicated in a consistent, systematic and coherent way to an agreed quality standard.
Reliability-Centred Maintenance setting foundation for Risk Based Maintenance
This initiative is allowing us to further refine our maintenance tasks and intervals. It is applying improved asset knowledge to quantify the most cost-effective levels of reliability and risk, from which we will optimise our maintenance regimes. The first phase of this programme has been to design our approach and to develop reliability centred maintenance regimes. This work was developed first for our signalling assets and has now been applied to other asset groups. Piloting of the resulting maintenance regimes has now commenced, with progressive implementation then planned across the network. This programme will continue to run throughout CP5 allowing progressive learning and subsequent improvements to our maintenance regimes. Further information is provided later in this document.

Building and Civils Asset Management Transformation programme
This programme was developed to address concerns surrounding both the strategic planning and subsequent management processes for civils assets. The scope of the programme was informed by the recommendations of an independent review by Arup of all aspects of civil structures management. The report was commissioned by Network Rail and ORR as a result of our asset policy not being proved to be sustainable, a series of infrastructure incidents and concerns regarding the timeliness and quality of some inspection activities.

The fully defined programme commenced in June 2011 with both ‘Discover’ and ‘Design’ tranches now complete. These have delivered future state policy and management processes. The programme will conclude with ‘Deliver’ and ‘Demonstrate’ tranches phased over the remainder of CP4 and early years of CP5. During these tranches solutions will be piloted and implemented. Within the overall programme, safety-critical and ‘no regrets’ activity has been accelerated and implemented as quickly as practical. Having now addressed critical areas of concern, the development of civils asset management will continue in CP5 as a core part of the Asset Management Improvement Programme.

Weather Resilience and Climate Change adaptation
Our system wide research into climate change has shown that the number of occasions when the weather will threaten performance affecting asset failures is likely to increase. The research has also allowed us to conclude that work in hand to improve asset policies, gather more granular knowledge on the resilience of our assets, improve remote condition monitoring and carry out targeted campaigns to improve resilience to weather events is complementary to meeting the challenges posed.

Specific activity that flows from our climate change research is confirmed within each asset policy. This includes a review of the adequacy of current specifications for renewals to ensure that appropriate environmental specification and product testing is rigorously defined, specified and validated.

We continue to sponsor and provide leadership for the Tomorrow’s Railway and Climate Change Adaptation programme (TRaCCA) of research and development in partnership with the RSSB. This aims to deliver step changes in the knowledge of climate change vulnerabilities and the development of support tools.

Competence and Culture
We have focused our work to date on improving clarity of roles, responsibilities and channels of communication. We have developed a competency framework for asset management that helps provide a clear understanding of expected standards and through which our people can access support to aid their development of appropriate competency.
Developing our Asset Management Capability – Achieving Excellence in CP5

Overview of planned improvements
There are a number of areas which have been prioritised because they are the next sequence of fundamental improvement steps towards an excellent asset management regime. These are summarised below, with more detail provided on each within the next sections:

Optimisation of Asset Policies – This will build upon our existing work on our asset policies, developing further our analysis of past information and available knowledge to improve guidance on where and how to intervene on our assets to deliver the required infrastructure outputs at the lowest whole-life, whole-system cost. We will enhance network and system wide reliability understanding, seek to optimise intra-asset activities, cross asset configuration and provide enhanced links to customer asset management.

Risk-based maintenance – Further refinement of our maintenance tasks and intervals. This will apply improved asset knowledge to quantify the most cost-effective levels of reliability and risk, from which we will optimise our maintenance regimes. These will continue to deliver benefits from reliability centred maintenance first will continued improvement towards fully developed risk based maintenance regimes.

Weather Resilience & Climate Change adaptation – Building on our programme of research and development into the implications of climate change to help us identify adaptation activities.

Asset Information – The provision through transparent, readily accessible means of enhanced asset information, improving the quality, integration, and where appropriate, extending the scope of the asset information needed to support strategic planning and delivery processes, and improved set of decision support tools providing asset stewards with the basis to enhance their short and longer term decision making, including the use of Intelligent infrastructure involving the deployment of Remote Condition Monitoring (RCM) technology.

Asset Management Services organisation – Building upon our current technical strengths to create a service based organisation that is respected as the pre-eminent source of railway systems innovation and best practice, both within and outside of the rail industry. This long term plan reflects the breadth and depth of the cultural change that the programme aims to deliver.

People Competence and Culture – Developing our approach to asset management requires some new thinking. The competence and behaviour of our staff need to reflect the requirements of the asset management activities. We have developed a competency framework, together with a complementary training programme.

In addition to the priority areas highlighted above there are also key themes where we continue to pursue improvement, these areas are highlighted below:

Route based delivery plans – Our delivery and work execution capabilities are already highly developed and were therefore not a priority part of our asset management improvements. Our whole lifecycle decision making has now created a need to integrate processes, systems, tooling and competencies across the delivery phase. Integrating information flows across the delivery phases will improve resource strategies and feedback and learning.

Benchmarking – we will continue to pursue a clearer understanding of leading thinking and best practice through a programme of benchmarking. We will continue to establish the most relevant comparator organisations through involvement in industry forums, and established work with professional institutions.

Research and Development – leveraging further benefit from our strategic relationships with universities to research and develop new tools and techniques that support asset management. Continued efforts to develop new technology and other innovation through improved dialogue with our supply chain and wider markets, as will be outlined in our Technical Strategy.

Management Review, Audit & Assurance- We have established mechanisms for reviewing performance, processes, risks, and future objectives. We will continue to develop the effectiveness of these aspects so we can fine tune the direction of asset management improvement activity.

All our initiatives are interdependent and complementary, the relative sequence of the dependency is shown on ‘the building blocks of improvement’ below:
<table>
<thead>
<tr>
<th>Building Blocks of Our Improvement</th>
<th>Achievement in CP4</th>
<th>Priority in CP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient/ Optimal Asset Plans</td>
<td>Feedback, Learning</td>
<td>Route Delivery Plans</td>
</tr>
<tr>
<td>System Configuration</td>
<td>Feedback, Learning</td>
<td>In place on highest risk projects</td>
</tr>
<tr>
<td>Decision Support Tools (eg LADS)</td>
<td>Feedback, Learning</td>
<td>Used more widely</td>
</tr>
<tr>
<td>Risk Based Maintenance</td>
<td>Feedback, Learning</td>
<td>Track tool in place</td>
</tr>
<tr>
<td>Integrated information &amp; processes</td>
<td>Feedback, Learning</td>
<td>Mobilised for other assets</td>
</tr>
<tr>
<td>Lifecycle Asset Policies</td>
<td>Feedback, Learning</td>
<td>Reliability Centred Maintenance</td>
</tr>
<tr>
<td>&amp; Cost Optimisation tools</td>
<td>Feedback, Learning</td>
<td>Risk Based Maintenance</td>
</tr>
<tr>
<td>Reliability, Failure Mode,</td>
<td>Feedback, Learning</td>
<td>CP5 Asset Policies &amp; WLCC model</td>
</tr>
<tr>
<td>Criticality &amp; Asset Risk Analysis</td>
<td>Feedback, Learning</td>
<td>Optimisation WLCC modelling</td>
</tr>
<tr>
<td>Asset Data</td>
<td>Feedback, Learning</td>
<td>FMEA &amp; Improved FMS</td>
</tr>
<tr>
<td>Remote Condition Monitoring</td>
<td>Feedback, Learning</td>
<td>Integration of datasets &amp; tooling</td>
</tr>
<tr>
<td>Competence &amp; Culture</td>
<td>Feedback, Learning</td>
<td>Intelligent Infrastructure Deployed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Widespread use of Remote Monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Competency framework</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complete suite of training</td>
</tr>
</tbody>
</table>
Progress & Planned Improvements – Optimising Asset Policies

We are developing our asset management capability to permit us to achieve our strategic objectives in a sustainable way for the lowest whole life, whole system cost. This requires that we reflect priorities, optimise cost, risk and performance trade offs and can demonstrate both short and longer term implications from our activity. This requires highly developed and integrated approaches to decision making whether this be our approach to gathering information, undertaking maintenance activities, specifying renewals or enhancements, or subsequent delivery strategies.

The whole life cycle and portfolio planning tools we have developed to build our Policies for our strategic business plan are currently being developed further, so that they may be deployed for use as decision support tools with our route asset managers. These will be accompanied by mechanisms to provide feedback and learning – helping us to ensure that our planning mechanisms are soundly rooted in fact-based reality of risks, opportunities and constraints encountered on the front line. Through this we will continue to pursue a cross-organisation shared approach to making effective decisions.

The pursuit of these capabilities has several purposes which can be summarised as:

- Providing greater knowledge and support to the industry long term planning process whilst enhancing our own strategic planning processes. This will include improved ability to generate different scenarios to allow demand variation, changed funding availability and varying outputs to be considered.
- Greater appreciation of cross-asset and cross-railway system trade offs – balancing future programmes of investment across the differing asset groups. This capability will also be of significant value in developing whole system and whole railway alternative strategies to adapt to climate change.
- Further improvement to renewal and maintenance planning, providing longer term forecasts of activity form and subsequent use in optimising access, and resource planning.

We know that there remains scope to improve our policies to achieve the optimal whole life, whole system approach in support of the above. In particular, we are keen to reduce uncertainty in rates of asset degradation and provide greater resolution of future maintenance costs, observed risks and asset reliability. Achieving these improvements will allow us to finesse the relationship between our capital and maintenance investment decision making.

We plan to draw on the results of our established improvement programmes. These are essential to allow us to deliver improved asset knowledge, upon which subsequent improvements will rely.

The most significant areas of knowledge we are developing are:

- The classification of failure modes.
- Acquisition of new data on degradation, reliability & failure modes.
- Effect of failures on performance and costs taking account of actual traffic volume & form.
- Determination of cost effective reliability levels.
- Analysis of energy consumption and disposal costs.
- Records of planned and unplanned activity.
- Improved financial data comprising unit costs of capital and maintenance activities, impact of failure, modern equivalent replacement values.

These initiatives will continue to run through CP5 and will progressively enhance our understanding and evidence upon which further development of our most critical Asset Policies will be based. The Policies themselves will continue to be developed through our established 10 step framework. With underpinning decision support tools being further refined to accommodate the new knowledge and where appropriate additional analysis we will need to undertake. A diagrammatic representation of our long term development of policies is provided below.
Progress & Planned Improvements – Risk-based Maintenance

Risk-based maintenance overview
Historic infrastructure maintenance regimes have developed over many years. Change has mainly occurred as a result of accidents, incidents and the introduction of new technology. There is also little consistency of approach between the different assets. It is therefore likely that opportunities exist to improve the efficiency and effectiveness of our maintenance regimes to meet business needs.

Best practice has been researched, and this confirms that the total cost of providing reliable infrastructure has been reduced by others through the adoption of risk-based maintenance techniques. However, to achieve the optimal maintenance regimes requires a range of business initiatives to be pursued and aligned (illustrated by the figure opposite).

We have produced a Maintenance Strategy that confirms the breadth of improvement we have underway. We are applying techniques using Failure Modes and Effects Analysis (FMEA) and evaluating the acceptability of the consequences of failure. These requirements are entirely consistent with the design of our life cycle costs models and we are using these as a core part of the process of developing improved future maintenance regimes testing the possible trade-offs that exist between renewal and maintenance (cost) with differential levels of risk.

The regimes that govern how our maintenance is carried out are the subject of a current programme of improvement and re-design. This has focused first on adoption of reliability centred maintenance – effectively changing the maintenance intervals to draw from acquired learning. This work has also included improved specification of future information on reliability and defects, together with wider work to improve the integration of processes surrounding failure management. We are therefore now monitoring the effectiveness of these changes and capturing new information to allow us to evaluate opportunities to vary the cost/risk trade-off achieved through our maintenance. For example, we may establish it is right to do more maintenance to provide a significant extension to asset lives, or conversely we will reduce the level of maintenance we carry out where the actual implication of not carrying out a maintenance task does not import undue risk and is less costly than carrying out the task.

Our work towards fully developed risk based thinking will continue throughout CP5. We will prioritise our activity on those regimes that are most critical first and to those areas where newly acquired information points to major benefits being possible. Regimes will continue to be refined and improved as the results from the other programmes become available. It is essential that the new regimes are sufficiently based upon strong evidence that they are robust, sustainable, demonstrably manage safety and performance risk, whilst being as efficient as practicable.

Further details are available in our Maintenance Strategy and Requirements Analysis Process document.
Progress & Planned Improvements – Weather Resilience and Climate Change

Weather Resilience
As with rail networks throughout the world, the operation of Britain’s rail network can be affected by adverse weather conditions. Ice, snow, heavy rainfall, lightning, heatwaves and high winds can all lead to asset system failure or degraded operation. For example, periods of drought can lead to embankment deterioration, and high temperatures increase the risk of track buckling: both impacts may result in the requirement to impose temporary speed restrictions. Analysis indicates that under most weather conditions (i.e. where temperatures are between around 0°C and 26°C, and where wind speeds or rainfall is not excessive) the network has become increasingly reliable. However, on the relatively small number of days per year when the weather conditions are outside of these parameters infrastructure reliability deteriorates, with a corresponding impact on train service reliability.

Network Rail is committed to seeking improvements in infrastructure design and asset components to meet this standard and to increase reliability during periods of extreme weather. A series of initiatives has been undertaken to minimise the impact of infrastructure failure on service performance, for example points heating, and trace heating of conductor rails.

Reliability and Improved Resilience
We have completed a strategic review of system reliability and weather impacts by:
- reviewing weather patterns to gain an improved understanding of the likelihood of weather conditions being experienced under which service disruption might be expected;
- reviewing past performance during adverse weather and the key causes of service disruption; and
- examining asset component and system specifications to understand better their potential weather resilience.

We are exploring a number of options to improve both the resilience of the infrastructure (by changes to design or installation specifications) and its ability to mitigate the impact on service disruption during periods of degraded infrastructure operation. A primary aim of this work is to identify opportunities to make a step change in the resilience of the network and to discuss the affordability of these options with funders. These provisions are represented in the appropriate Policy for each asset. In addition, we are considering whether large-scale environmental testing of switches & crossings, points, signalling systems, overhead lines and train carriages should be adopted to demonstrate correct operation in the required environmental conditions. This will enable identification and modification of those components that fail environmental testing and support innovative design in pursuit of a more resilient railway system.

Climate Change Adaptation
Weather resilience issues will be exacerbated by climate change. Although it is difficult to predict the precise changes in future weather events with any certainty, there is sufficient evidence to suggest that there will be an increase in the range of weather related factors that the system will need to be resilient to. Climate change research indicates the potential impacts of climate change in the UK include increases in average and maximum daily temperatures and changes in rainfall patterns. Additionally it is understood that the UK will still experience occasionally very cold winter conditions, indeed, it is entirely possible that the UK may experience cold winters more regularly than it has done in recent years.

The challenge for the industry, as for all organisations with assets that are vulnerable to weather events is to develop cost effective strategies to accommodate climate change and implement these strategies in a timely manner to avoid an unacceptable drop in overall system reliability or undeliverable downstream risk mitigation strategies.

Our Climate Change Adaptation Report has recently been reviewed by DEFRA’s Adapting to Climate Change team who concluded that the organisation “clearly considers climate change to be a key issue for long term planning and it is excellent to see that consideration of these issues is being embedded into the organisation’s business practices. The good quality report produced by Network Rail clearly demonstrates actions being taken to prepare both rail infrastructure and operations”.

Network Rail
Our Current Priorities

Our current focus has been on initiatives that need to be implemented in CP5. For the majority of assets their relatively short life (in climate change terms) means that no additional investment in CP5 is required to address the issue of climate change specifically. Work to address current weather resilience can include an incremental provision to provide resilience to projected impacts from changes to the UK climate.

However, for some long life assets, in particular bridges, work carried out on the infrastructure during CP5 will be expected to accommodate projected climate change impacts. As a consequence of this work, we have identified changed activity and specific increases in the design capability of bridge scour protection and drainage system capacity. A table demonstrating wider initiatives currently in hand that complement weather and climate resilience is shown opposite.

While the rail industry will plan against a core set of climate scenarios, based on the UK Climate Change Projections (UKCP09), we are aware that scientific understanding of climate change is evolving rapidly. In addition, increasing global carbon emission levels, a key input to climate modelling, and failure to decarbonise will require assessment of vulnerability against higher emission climate scenarios. As a result, we will need to take future developments in climate change knowledge, and the uncertainties inherent in climate change projections, into account when planning to increase infrastructure reliability.

Further Climate Change Research

We support the Tomorrow’s Railway and Climate Change Adaptation programme (TRaCCA) in partnership with the RSSB. The initial work highlighted the significance of research and knowledge constraints to understanding the impacts of climate change, and the consequential effect on decisions for investment and management of the railway. A two year £2 million programme is now under way to deliver step changes in the knowledge of climate change vulnerabilities and the development of support tools to increase the weather and climate resilience of the GB railway. This work is in line with UK Government aims for improved resilience of the National infrastructure and reducing the costs of running the railway.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Initiative</th>
<th>Current Scope</th>
<th>Future Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSET POLICY IMPROVEMENTS</td>
<td>NR Drainage policy</td>
<td>A coherent policy across the drainage system. Linked to integrated drainage programme improving asset information held on drainage system. Includes links to track policy (track drainage) structures Policy (Tunnels) and Earthworks Policy (earthworks drainage). Specific interventions identified in earthworks, structures and Track Policy documents</td>
<td>Continue to pursue improved records of assets. Seek a clearer understanding of how changes in rainfall intensity will impact on new asset specification &amp; maintenance regimes</td>
</tr>
<tr>
<td></td>
<td>Earthworks remediation of vulnerable cuttings</td>
<td>Changes in earthworks policy to better target sources of risk such as drainage in cuttings and water flowing from outside railway</td>
<td>Monitor and learn from implementation. Improve sources of information and pursue future improvements to interventions/maintenance regimes</td>
</tr>
<tr>
<td></td>
<td>Scour reduction programme</td>
<td>Specific actions to improve resilience of Bridge/culvert foundations to extreme flood flows. Programme enhanced to include normally dry areas subject to flood flow under extreme weather</td>
<td>Highlight as an area of Policy to review in light of improved R and D/evidence on longer term impacts of Climate Change</td>
</tr>
<tr>
<td></td>
<td>Weather resilience campaigns</td>
<td>Targeted interventions on most critical assets identified as vulnerable to weather from analysis of fault &amp; reliability data</td>
<td>Continue to share learning across routes. Identify additional actions where new evidence emerges</td>
</tr>
<tr>
<td></td>
<td>Improvement to asset failure data capture</td>
<td>Failure codes drawn from new Failure Mode Effect Analysis. Improvements to data flow and data quality. Data used to help design risk based maintenance regimes</td>
<td>No additional action proposed</td>
</tr>
<tr>
<td></td>
<td>Improvement to remote condition monitoring</td>
<td>Programme to deliver real time information on asset condition/state</td>
<td>Enhance where practicable the capture of weather data associated with reliability by developing decision support tools to aid the analysis of impacts on infrastructure and thereby improve management of local weather conditions</td>
</tr>
<tr>
<td></td>
<td>Route activity on known historical problems (e.g. heated con rail)</td>
<td>Local actions and programme to remedy performance issues, observed vulnerable assets. Learning shared to help improve network wide thinking</td>
<td>Continue to share local learning</td>
</tr>
</tbody>
</table>
Progress & Planned Improvements – Asset Information

**Asset Information**
Asset Information comprises all our data sets that are accessed through information systems which store, process and transmit asset management information. Asset information supports all the primary decision and activity components covered in our asset management framework, including the development of optimised asset policies and the production and implementation of asset plans. The scope of asset information is broad, covering all meaningful data relating to assets and asset management, this includes asset type / location, age, capability, and condition. It also includes failure histories and consequences, work histories, unit costs and as-built drawings. Asset information is critical to maintenance and renewal decision making at both the strategic and tactical levels.

Currently, our asset information is held in a number of differing systems supported by a range of data maintenance and assurance procedures. Our strategy for asset information was published in 2011 covers the scope and sequence of improvements we intend to make up to the end of CP5. This includes improving data quality, availability, the integration of currently disparate systems, deploying new techniques to gather and make information real time.

The effective management of asset information has historically proved a difficult area for Network Rail, but we are beginning to realise benefit from our improvement activity. Our work in CP4 has primarily concentrated upon improving the quality of information we already hold, the scope of this work also included the definition of required datasets and their acquisition for new Policy requirements for the beginning of CP5.

During CP5 we will build upon the foundations put in place in CP4 to develop network wide integrated access to information, We will do this by connecting up the key relationships between our asset across the network. This will provide us and our stakeholders with a consistent view of network capability, capacity and asset performance. The level of information and integration achieved is such as to place us as ‘representative of best practice’ by mid 2016. Subsequent work to the exit of CP5 will improve the real time railway system wide integration of information, aligning our asset information with traffic management and integrated access planning tools. This programme of activity is forecast to break even during CP5, although we acknowledge that further evaluation and knowledge gained during the deployment of these improvements will improve our ability to derive maximum benefits from these investments.

**ORBIS**
The majority of our improvement needs in asset information will be delivered through the established ORBIS programme. This will continue to run throughout CP5. The scope complements wider improvements to document management, financial information and project management systems. This also complements the decision support tooling delivered through our Policy development programme. The core scope of ORBIS focuses on creating an integrated platform for sharing of information, continuously improved asset data specifications and data quality, easier data capture, better control of safety schematics, comprehensive records of work history.

**Intelligent Infrastructure –**
Remote Condition Monitoring (RCM) technology is being pursued within our Intelligent Infrastructure programme. This makes it possible to detect asset degradation and to intervene before individual assets fail. Therefore it enables us to maintain our infrastructure in a more reliable way and at a lower cost. In part, these benefits are delivered by enabling a migration from a frequency based maintenance regime to maintaining assets based on their condition as measured by RCM devices. RCM technology can be applied to equipment that is located on fixed infrastructure to monitor the condition of this as well as equipment that is located on rolling stock to measure the condition of fixed infrastructure and vice versa. We have started to implement this form of technology during CP4 and we will expand the use of it in CP5 across the areas of signalling, electrification & plant, and telecoms.
Progress & Planned Improvements – Asset Management Services

Overview
Asset Management Services (AMS) is our central asset management and engineering function. It exists to set asset policies and provide assurance, provide essential services to the routes (information, energy, telecoms), and to support internal and external customers in achieving optimum performance from the rail infrastructure. By providing these services centrally, we have been able to allocate scarce, expert resource in the most optimal way, and for services that are ‘networks’ by definition, such as energy and telecoms, we benefit by running them centrally. AMS was created as part of a journey from a large delivery organisation, to a smaller, efficient, expert service provision organisation. That journey began with the devolution of maintenance and renewal activity to the routes.

Vision
The vision for AMS is to be respected as the pre-eminent source of railway systems innovation and best practice, both within and outside of the rail industry.

Purpose
AMS exists to:
- set asset policies and provide assurance;
- to provide essential services to the routes (information, energy, telecoms); and
- to support internal and external customers in achieving optimum performance from the rail infrastructure.

Role
The role of AMS is to:
- Continuously improve asset policies, asset standards and the processes which govern them
- Conduct assurance activities on behalf of the board and stakeholders
- Take a long term view of assets and their environment to assure sustainability of the network
- Provide telecoms and energy services to the routes and their customers
- Offer trusted asset-related information management, insight and tools to enable better informed business decisions
- Guide customers on how to operate, maintain and renew to obtain lowest whole-life cost of assets
- Identify and share best practice and knowledge across the whole business to drive out costs and improve performance
- Innovate and research and develop new processes and technologies

Programme
The transformation of Asset Management Services in to an efficient, customer-focused, service-orientated organisation is being delivered through Programme Olympus. It will be complete by 1st April 2013, though ongoing cultural and service improvements will continue beyond that date.

The longer term objective for AMS is to become the supplier of choice to route and strategic customers. We expect this to eventually lead to profit and loss accounts, where AMS’s customers have the option to choose other suppliers but return to AMS due to quality and cost. This will enable AMS to continue to make productivity improvements whilst growing the business to meet demand.

Industry Impact
We expect the industry impact of AMS to be positive. The development of a Technical Strategy for Network Rail, aligned with the Industry Technical Strategy, will be beneficial for customers and suppliers alike. There are already tactical activities that AMS is involved in that will contribute to an improved railway industry, for example delivering for Rail Delivery Group (RDG) workstreams; international benchmarking activities; and provision of information services to industry. In the longer-term AMS has an ambition to be able to sell their expertise to other parts of the railway industry and beyond.
Progress & Planned Improvements – People, Competence & Culture

Further development of culture and competence
We will continue to develop a culture and competencies to deliver effective asset management – this embraces the wider Network Rail work on behaviours, safety culture, devolution, collaboration, system wide thinking; and a training and development programme to maintain high levels of technical excellence, whilst supporting the development of a strengthened asset management competence.

A strong starting point
The engineering competencies that have served the railway well over many decades are as relevant today as they have ever been. We will continue to nurture these and support staff development through the adoption of specific technical competency frameworks. Our Technical Strategy will provide further definition of future technology and some foresight of future technical capability across network rail, its supply chain and the required pipeline of new talent entering the Railway Industry.

The development of the asset management discipline is still relatively formative compared to the technical professions. This presents additional challenges that require new knowledge, abilities and behaviours. The work of the Institute of Asset Management has been influential in defining the scope of competencies and culture necessary to realise benefits, Network Rail contributes to this through its Patron status within the IAM and by participating in working groups regarding the specification of training programmes.

Competency Framework
We have already developed a competency framework that is aligned to our Asset Management System, although its application has thus far been limited to a pilot. We will extend this during the remainder of CP4 and continue its use throughout CP5. The asset management competencies have been designed to provide the required skills and experience to operate our Asset management System in its entirety, and can be used by staff to determine their development requirements, which in turn will enable the preparation of development plans.

We know we require a relatively small number of very proficient asset management professionals to design, develop, deploy, assure, and improve the Asset Management Policy, Strategy and System. These correspond to the asset management ‘experts’ who play a key role, but for most staff, the proficiency is geared to operating the relevant parts of the Asset Management System, and can be a more specific scope of asset management competence.

We will deploy the competency framework and use it to establish an actual baseline of competency and reveal gaps that have been tested through development, training and buying in expert supporting resources.

We plan to build upon wider progress made in CP4, including the programme of asset management awareness that has started to be rolled out. We will develop a professional development framework to complement known areas where we are already investing effort to raise competencies. This will include subject specific areas for example:

- Risk Based Maintenance programme (RBM) within which a pilot project has delivered Reliability Centred Maintenance (RCM) training to a selected audience of Signalling personnel
- Systems engineering
- Lifecycle cost modeling

Line of sight
The wider corporate work on line of sight and key behaviours supports the development of asset management capability.

Clear guidance on who is responsible, accountable, consulted and informed in each activity within the Asset Management System has been shared. This confirms the fit of activities within a wider context and helps improve an understanding of the links between corporate objectives, team activities and individual actions – improving line of sight. This guidance fits back-to-back with the team and individual competency frameworks, supported by corporate work on the desired and balanced set of complementary behaviours expected, involving personal accountability, customer focus, collaboration, & challenge. We will continue to apply and embed this approach. Raising awareness of asset management benefits through our competency development programme supports the development of a more questioning culture, seeking to enhance understanding and derive feedback/learning.
Developing Our Asset Management Capability – Future rate of improvement

Forecast Trajectory in CP5
The collective impact of our intended improvements will increase our asset management capability and will therefore also result in improved scores as measured by the Asset Management Excellence Model (AMEM).

Generating anticipated trajectories of improvement against the AMEM model is not a deterministic process. This is because the model is the subject of revised scoring parameters as new best practice emerges. Some improvement is therefore necessary simply to be seen to stand still. This makes the rate of change hard to predict. It is understood that these issues become more significant the higher up the scoring scale Network Rail is placed. In CP5 the uncertainty of the rate of improved scores is more significance than in CP4.

We expect that our plans will drive substantial improvement and that where we focus our effort, we will continue to improve at an equivalent rate to that achieved so far. There may be areas though where having achieved a score equivalent to excellence within the AMEM model we will see only modest further improvement in scores. This will have an overall impact of reducing the rate of average improvement in score. An indication of the trajectory that we believe we will achieve through the AMEM model is provided opposite. We are developing further confidence in our future trajectories and will include an updated view in our delivery plan for CP5 when this is published in 2014. Our forecast rates reflect the diminishing return within the model as we approach frontier performance, rather than any reduction in our efforts towards further developing our asset management capability.

We will continue to update our forecast of the AMEM score as we progress with our plans during CP5. Where necessary we will update our plans with reference to the underlying objectives rather than in order to achieve a particular AMEM score.