A Report for
Network Rail and the ORR
from
Asset Management Consulting
Limited (AMCL)

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Initial Industry Plan 2011 Review
Final Report

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AMENDMENT HISTORY		
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Draft A	All	Initial draft for client review
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Executive Summary

AMCL (Asset Management Consulting Limited) is the Independent Reporter for Asset Management to both Network Rail and the Office of Rail Regulation (ORR) for Control Period 4 (CP4). As part the periodic review for Control Period 4 (CP4), AMCL undertook a review of the Asset Policies published by Network Rail in June 2006, October 2007 and January 2010.

Network Rail issued a revised set of Asset Policy documents to the ORR in support of the CP5 Initial Industry Plan (IIP) in September 2011. The ORR commissioned AMCL to undertake a review of the revised Asset Policies for Track, Signalling, Electrical Power and Telecoms as part of its progressive assurance for the IIP. The key objectives of this review are:

- Assessing the robustness of Network Rail's contribution to the IIP for the purpose of providing Advice to Ministers in February 2012;
- Gaining assurance that sufficient progress is being made in the development of Network Rail's Strategic Business Plan (SBP); and
- Assuring that Network Rail will comply with the Network Licence, particularly Section 1 which relates to Network Management.

This report documents AMCL's findings from the review of Network Rail's final IIP Asset Policies (as published in September 2011).

The Asset Policies were assessed by AMCL against the following three key criteria, set by the ORR (see Section 1.2 for further details of the assessment criteria):

- Robustness;
- Sustainability; and
- Whole-life whole system efficiencies

Network Rail has implemented a 10-stage Asset Policy development process for all Asset Policies which is considered by AMCL to be commensurate with current good practice. The process assures a consistent, logical and structured framework for the development work and enables common formatting of the suite of documents. This represents a significant improvement over the process used to develop the CP4 Asset Policies.

At this stage of the periodic review process for CP5, the 2011 Asset Policies represent good work-in-progress towards the development of robust, sustainable and efficient Asset Policies in time for the SBP. As well as the 10-stage development process, Network Rail has developed a

three-tier modelling approach and notably a new suite of Tier 2 whole-life cycle cost models for each asset group. However, the strategic framework that defines how the different tiers of models and the Asset Policies are integrated as part of a holistic Asset Management process is still not fully developed and the interfaces between the models and the Asset Policies are not yet fully effective.

A summary of our findings are shown in Diagram 1 below, with a key as follows:

- **GREEN** indicates that, in our opinion, the policy fully meets the criteria for Robustness, Sustainability and Efficiency.
- **AMBER** means partially meets the criteria for Robustness, Sustainability and Efficiency but does not yet fully demonstrate compliance; and
- **RED** means there is little evidence that the criteria have been met.

It should be noted that the asset groups are listed in order of proposed spend for CP5, with Track having the highest proposed spend and Telecoms the lowest.

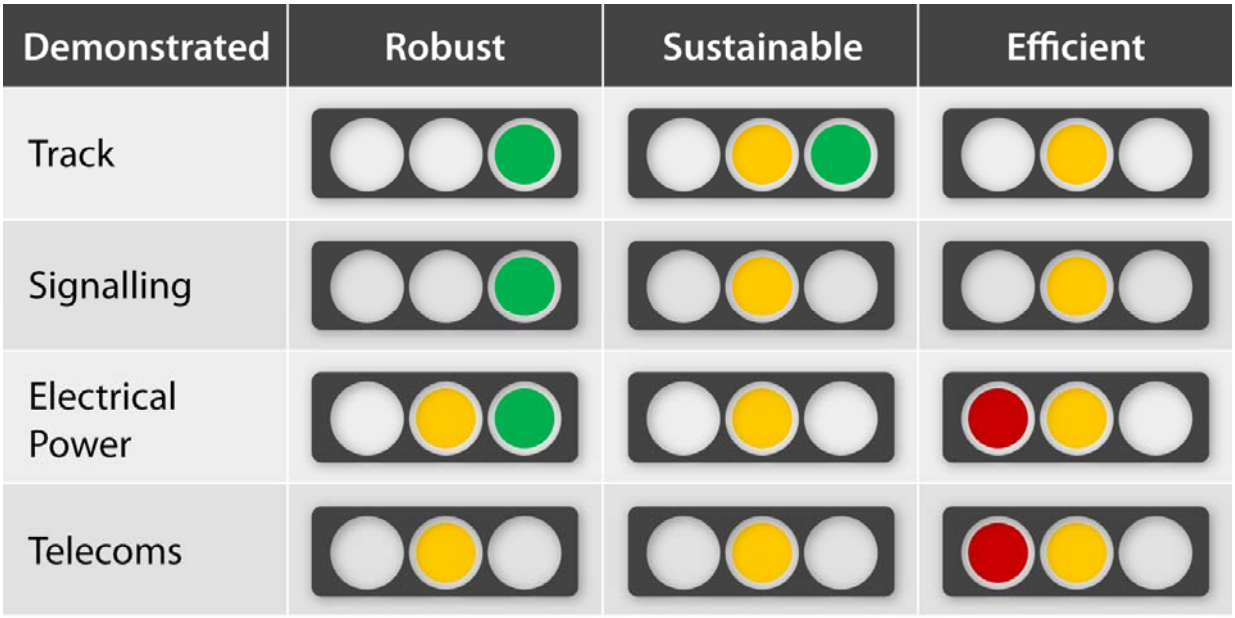

Diagram 1 Summary of Findings

This shows, for the asset groups within the scope of this mandate, that Network Rail has developed the Asset Policies furthest for those asset types with the highest expenditure, demonstrating a criticality based approach to the development process.

In terms of how this relates to expenditure in CP5, Diagram 2 below shows the proportion of CP5 expenditure that can be considered to be Robust, Sustainable and Efficient across the asset groups assessed by AMCL using the same key as above.

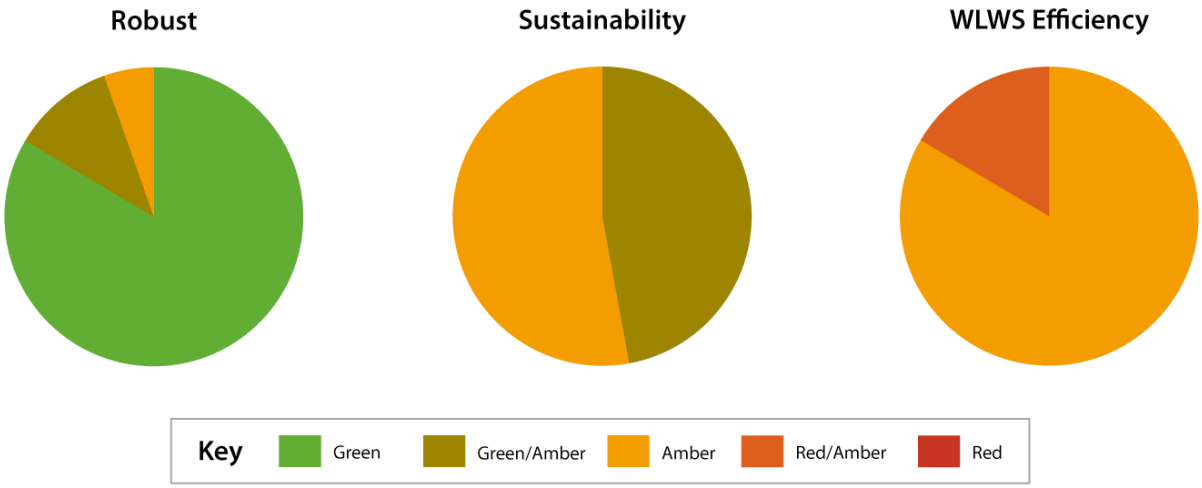

Diagram 2 Proportion of CP5 Expenditure by RAG category

This represents a reasonable position for Network Rail to have developed the Asset Policies by at this point in time but it also shows there is considerable work to do by the SBP if the majority of expenditure is going to be demonstrably Robust, Sustainable and Efficient.

Proposals have been made in the main body of this report for the further development of the Asset Policies for each of the asset groups prior to their next issue in January 2013 as part of the SBP submission. The following summarises AMCL's generic proposals for implementation prior to SBP which apply to all the Asset Policies reviewed:

- Development of the Asset Policies and models to consider a whole system approach, including interfaces with other asset groups and analysing the whole life costs of the overall system.
- Further development of Route Asset Management Plans to demonstrate a clear 'line of sight' between the Asset Policies and the bottom up costs and work volumes.
- Further development of the Tier 2 whole-life cycle cost models to validate the assumptions within the models, including degradation rates, and the intervention volumes proposed.
- Further integration of the Tier 1 and Tier 2 models and provision of greater assurance that the workbanks have been developed in accordance with the rules defined by the Tier 2 models and captured within the Asset Policies.

- Definition of the levels of outputs and remaining life that represent a sustainable level of investment.
- Modelling of relevant outputs that are expected to be delivered by the application of each of the Asset Policies over the next five control periods and comparison of these to the sustainable levels defined above.
- Further development of the Quantified Risk Assessment, which outlines uncertainty ranges for volumes and efficiencies, as an integral and clearly linked element of the models and Asset Policies.
- Greater clarity on the required improvements in asset information used to inform the Asset Policies and models for SBP and how these will be delivered through the ORBIS project.
- Greater clarity on the derivation of the efficiencies that will be delivered as a result of the improved asset information delivered through the ORBIS project.
- Clearer quantification of the embedded efficiencies within the CP5 Asset Policies when compared to the CP4 Asset Policies.
- Further development of maintenance strategies and the optimisation of maintenance and inspection activities on a cost-risk basis to achieve further scope efficiencies during CP5.
- Improved clarity on the nomenclature relating to the different options identified in Asset Policies to achieve specific output scenarios.

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1 Introduction

1.1 Context

AMCL (Asset Management Consulting Limited) is the Independent Reporter for Asset Management to both Network Rail and the Office of Rail Regulation (ORR) for Control Period 4 (CP4), having also fulfilled the role in CP3.

As part of that role, and in support of the ORR's overall assessment, AMCL undertook a review of the Asset Policies published by Network Rail in June 2006, October of 2007 and January of 2010. As a result of these reviews, AMCL issued the following independent audit reports:

- *Review of Asset Policies* (August 2006);
- *Interim Review of Network Rail's 2007 Asset Policies* (January 2008); and
- *Asset Policies 2010 Review - Summary of AMCL Findings* (April 2010).

The ORR wrote to Network Rail on the 1st June 2010 following the review of the 2010 Asset Policies outlining its conclusion were that there was still much to do in the lead up to the 2013 periodic review. The lack of whole life cost justification, for example, was an area where the ORR felt more work was required together with being able to demonstrate the linkage between activity levels and output measures.

Network Rail issued a revised set of Asset Policy documents to the ORR in support of the CP5 Initial Industry Plan (IIP) in September 2011. The ORR commissioned AMCL to undertake a review of the revised Asset Policies and supporting information to support the ORR in:

- Assessing the robustness of Network Rail's contribution to the IIP for the purpose of providing Advice to Ministers in February 2012;
- Gaining assurance that sufficient progress is being made in the development of Network Rail's Strategic Business Plan (SBP); and
- Assuring that Network Rail will comply with the Network Licence, particularly Section 1 which relates to Network Management.

This report documents AMCL's findings from its review of Network Rail's 2011 Asset Policies in accordance with the objectives, scope and methodology set out below.

1.2 Objective(s)

As part of the ORR's overall review of Network Rail's proposed Asset Policies for CP5 AMCL was requested to provide input to this process in the form of attendance at meetings and workshops, gaining a thorough understanding of the basis and assumptions underpinning the Asset Policies and proposing recommendations for improving them further from the IIP stage to the SBP, due in 2013.

1.3 Scope

AMCL was required to provide an input to the review of the Asset Policies, all supporting information and the Initial Industry Plan (IIP). This scope included providing assessments of the degree to which Network Rail has demonstrated that the Asset Policies are robust, sustainable, and assure lowest whole life and whole system cost and efficiencies (see Section 2 for further details).

AMCL was also to provide recommendations for what further improvements could be made leading up to the SBP due in 2013 in order to increase the robustness of the Asset Policies, robustness and accuracy of their justification and therefore the related output, volume and expenditure plans.

AMCL was responsible for the review of the Asset Policies relating to the following asset groups:

- Track;
- Signalling;
- Electrical Power; and
- Telecommunications.

With respect to the Track Asset Policy AMCL's scope related to the Asset Management principles and processes aspects of the Track Asset Policy and the IIP. Arup have been commissioned to advise the ORR on the technical aspects of the Track Asset Policy. As required by the ORR, AMCL liaised extensively with Arup during the review process to reduce possible overlap in the scope of work relating to the Track asset group.

1.4 Methodology

As defined by the ORR's mandate, AMCL's methodology for this review was based on the following key activities:

1) Attend the respective Asset Policy presentation meetings;
2) Attend challenge meetings with the ORR and Network Rail;
3) Undertake a review of the draft and final Asset Policy and policy justification documents;
4) Undertake a review of any other relevant supporting and information including bases and assumptions, documentation, models, presentations etc; and
5) Prepare and submit a draft and final report to both ORR and Network Rail, setting out the main observations and conclusions arising from the review process.

During the review process and as instructed, AMCL co-ordinated its activities with the analysis being carried out by both Arup and the ORR in order to avoid duplication of work.

1.5 Structure of Document

The remainder of this document is set out as follows:

- Section 2 - Provides an overview of the assessment criteria on which the review of the Asset Policies was based;
- Section 3 - Summarises AMCL's generic findings relating to the suite of Asset Policy documents, associated models and other supporting information;
- Section 4 - Details AMCL's specific findings related to the Track Asset Policy, associated models and other supporting information;
- Section 5 - Details AMCL's specific findings related to the Signalling Asset Policy, associated models and other supporting information;
- Section 6 - Details AMCL's specific findings related to the Electrical Power Asset Policy, associated models and other supporting information;
- Section 7 - Details AMCL's specific findings related to the Telecoms Asset Policy, associated models and other supporting information; and
- Section 8 - Documents AMCL's overall conclusions and proposals for further development of the suite of Asset Policies for SBP.

2 Assessment Criteria

For the purpose of this review, the Asset Policies have been assessed against three key assessment criteria, namely Robustness, Sustainability and Efficiency.

The Robustness and Sustainability criteria were first introduced by the ORR in a letter dated 1st June 2010 and were identified as the two key criteria that ORR used to evaluate the efficacy of Network Rail's policies and plans at the time.

Following review and consideration of the definition of these two criteria, how they relate to Network Rail's wider Asset Management obligations under the Network Licence and how they could be demonstrated, a further note was issued on 31st October 2011. That note set out for discussion the ORR's interpretation of the two assessment criteria and the wider Asset Management obligations that the ORR intends to consider as part of the Periodic Review 2013 process. This note included further definition of the Robustness and Sustainability assessment criteria and included a third key criteria considering delivery of the Network Licence outputs in the most effective way at lowest whole life cost and whole system cost, taking into account scope and unit cost efficiencies over time.

These three key assessment criteria, as defined in the ORR's discussion note, are detailed below and form the framework for consideration of the Asset Policies, associated models and other supporting information throughout this document. However, it should be noted that following the delivery of this report these definitions are to be subject to a stakeholder review process to refine them ahead of the future SBP submission deadlines and subsequent review process. The following definitions apply:

Robustness:

> *Is it reasonable to believe that the policy can deliver the required outputs, for England, Wales and Scotland? In testing the robustness of the policy ORR will consider whether the policy and plans have been demonstrated to be capable of delivering the outputs required for CP5 (2014-2019).*

Sustainability:

> *If demand on the network were to remain steady, would application of the Asset Policy continue to deliver the outputs specified indefinitely? A sustainable Asset Policy is one which delivers (at least) the agreed outputs for the final year of the control period in the*

long term (to at least end of CP11) if demand on the system remains within the capacity limits of the current network and any enhancement schemes already committed to by industry. The demonstration of compliance with this test is likely to involve forecasting and modelling as part of the submission. This test is to ensure that, in managing within CP4 funding, Network Rail is making genuine efficiencies and is not deferring essential work at the cost of inefficiently higher expenditure in later control periods.

Efficiency:

Lowest whole life, whole system cost: Has the Asset Policy been demonstrated to deliver the required outputs both in the short and long-term at lowest possible whole system cost over the lifetime of the assets? In assessing minimum whole life cost we will assess whether both scope and unit cost efficiencies have been fully considered.

3 General Findings

Network Rail has made good progress in developing its Asset Policies since the last CP4 policies were made available. The different asset groups are at different stages of development, but to a large degree, this reflects the different level of expenditure on the different assets and the prioritisation that Network Rail has therefore placed on the policy development work. It is recognised that the 2011 Asset Policies are still being developed and that Network Rail will be publishing a final suite of CP5 Asset Policies as part of the SBP submission in January 2013. Nonetheless, these policies have been reviewed against the assessment criteria described in Section 2 to establish the progress that Network Rail has made towards the end goal of robust, sustainable and efficient policies at the time the SBP is submitted.

The asset group specific findings from the Asset Policy review are discussed in Sections 4 to 7 but a number of the findings are common across the asset groups and are discussed below.

3.1 Development Process

All the Asset Policies reviewed by AMCL have been developed in accordance with a standard 10-stage process which is summarised in Table 1 below.

Section	Title	Content
1.	Asset Description	Summarises the scope, composition and utilisation of the asset base and its interfaces with other asset groups.
2.	Historical Analysis	Describes the historical trends within an asset group including age profile, utilisation, condition and performance.
3.	Asset Criticality	Identifies the most critical asset sub-groups in terms of expenditure and impact on outputs, and prioritising later analysis.
4.	Route Criticality	Defines the approach to segmenting the network and the framework for prioritising decisions based on the impact of infrastructure failures on service outputs.
5.	Asset Degradation	Catalogues the degradation mechanism(s), modes of failure or degraded operation and the consequences in terms safety, costs and performance.
6.	Intervention Options	Specifies possible intervention options, their effectiveness, costs and associated dependencies.
7.	Planning & Funding Scenarios	Defines the scenarios required to evaluate alternative output / funding options and identifying the trade-offs between activity, expenditure and outputs needed in model development and policy definition.
8.	Model Development	Describes the modelling tools and their capability to analyse Whole Life Cycle Cost and forecast activities, expenditures and outputs.
9.	Investment Options	Presents the results from the application of the models to the specified scenarios.

Section	Title	Content
10.	Policy Selection	Justifies the selection of the preferred policy option and provides further detail on the selected policy.

Table 1 Network Rail's 10-stage Asset Policy Development Process

This represents a significant step forward from the approach used in the CP4 Asset Policies and provides a logical development process for the development of all the Asset Policies, which AMCL considers is aligned with current good practice.

3.2 Overall Planning Process – Line of Sight

As was reported in AMCL's recent AMEM assessment [1], Network Rail has developed a high level Asset Management framework that describes some of the relationships between the Asset Management key documents and processes. However, this framework does not explain all the relationships between the different processes and Network Rail's AMIP (Asset Management Improvement Programme) initiatives that are brought together to develop the IIP or how these will be developed further when the SBP is published.

It is acknowledged that Network Rail is developing a strategic framework and strategic processes but these were not available at the time of this review.

At the time of this assessment, Diagram 3 represents AMCL's understanding of the extent to which these capabilities and interfaces are working in practice to produce the IIP.

[1] 2011 AMEM Assessment, Version 1.1, 6th December 2011

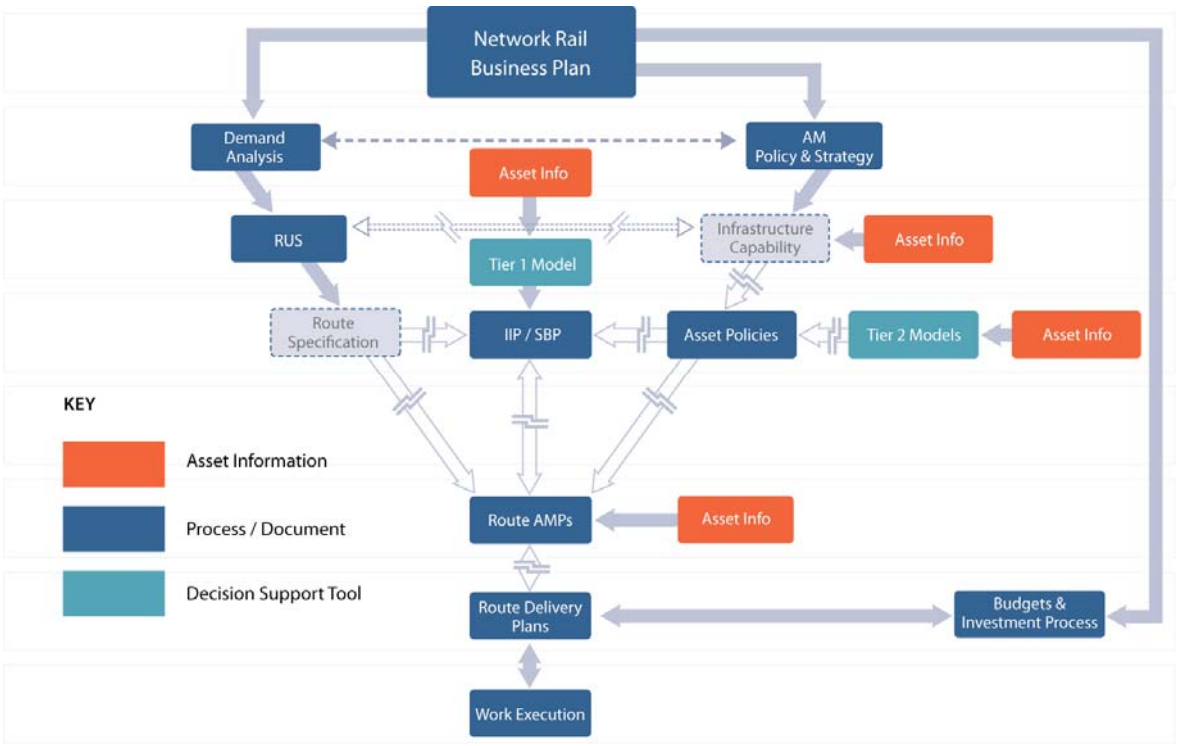

Diagram 3 AMCL's Understanding of Network Rail's Strategic Process

The 'dotted lines' in Diagram 3 represent AMCL's opinion of areas of capability that are not fully developed and the broken arrows indicate interfaces that are considered not currently effective, although this does vary by asset group. The key focus for the assessment of the Asset Policies is the extent to which the Tier 2 models have influenced the Asset Policies and the extent to which the Asset Policies have influenced the work volumes and costs within the IIP. At this stage, although again it varies by asset group, this is considered to be limited but actively developing.

The further development of Route Asset Management Plans (RAMPs) to demonstrate a clear 'line of sight' from its Asset Management Policy and Strategy, via the Asset Policy derived costs and volumes and Route AMPs through to work delivery on the ground is also considered to be required.

3.3 Modelling Approach

Diagram 4 represents Network Rail's modelling approach to developing the IIP work volumes and costs.

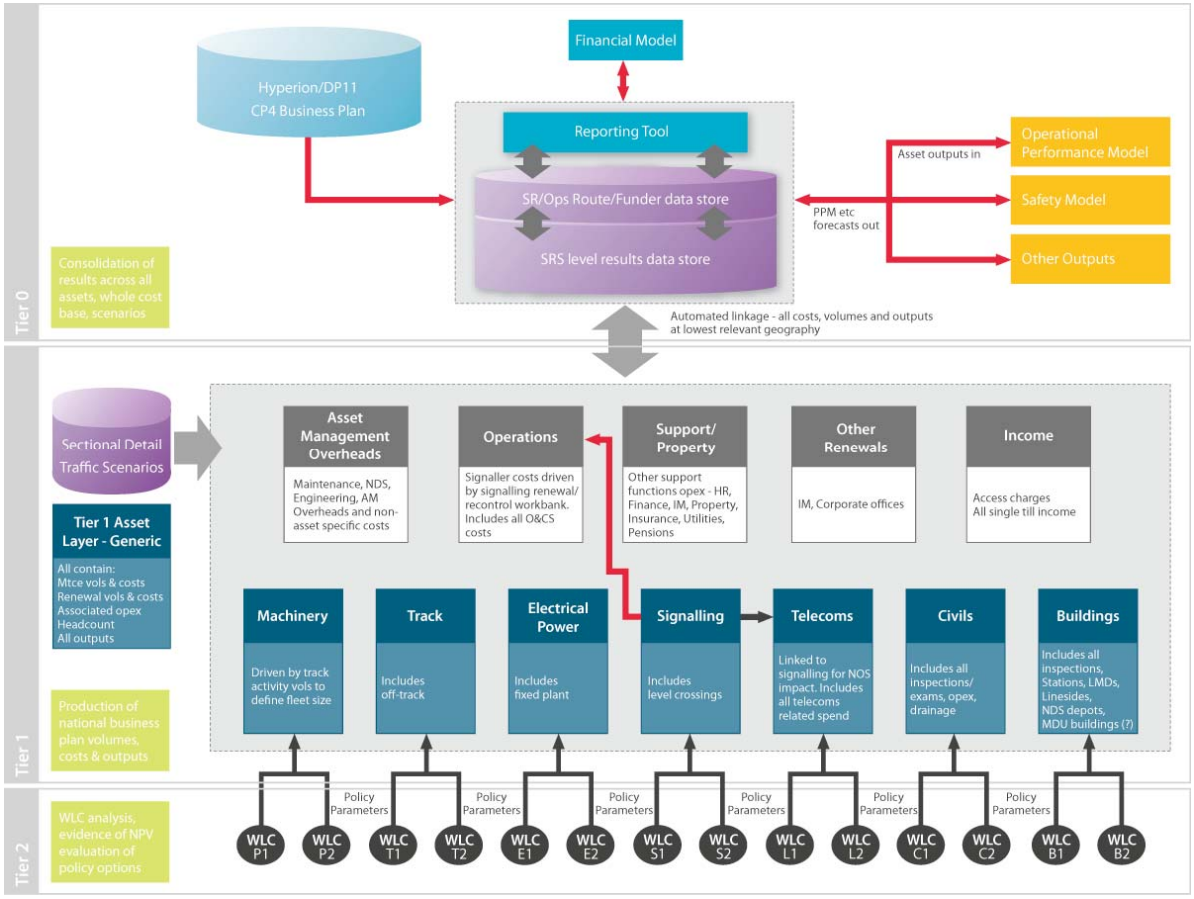

Diagram 4 Network Rail IIP Modelling Approach

The modelling approach is considered to be generally logical but relatively complex and, at this stage, is limited in terms of direct interfaces between the models, particularly with respect to the interface between the recently developed Tier 2 models and the Tier 1 models. For the IIP, many of the Tier 1 work volumes and costs are derived from work-banks or other off-line sources rather than the Tier 2 models. This is described in more detail in sections 4 to 7 for each asset group. However, it is recognised that Network Rail has undertaken a significant amount of work to specify the approach and develop the Tier 2 models. Although subject to ongoing validation and development, the Tier 2 models appear to provide useful decision support tools to enable whole-life cost decisions on an asset type, and potentially portfolio, basis.

The overall approach outlined in Diagram 4 above should support the development of a more integrated approach as the models continue to develop. However, although planned model enhancements have been captured in the relevant Asset Policies and the Infrastructure Cost Model Specification, further assurance, in the form of clear plans, resource allocation and progressive assurance may be required in order to demonstrate that the necessary development can be achieved by the SBP. The further refinement of asset data and knowledge to provide appropriate inputs to the model suite may also require similar assurance. Although the modelling approach for the IIP appears to consider the key interfaces that are identified in the current version of the Asset Policies, as Network Rail moves towards a more systems-based approach to Asset Policy development, additional interfaces between the models may also be necessary in order to model the costs for the SBP.

The final consideration for modelling for the SBP is the demonstration of modelled performance outputs (condition, remaining life, risk, etc.) in terms of the scenarios applied, whole-life cost decisions made, and funding constraints applied. This would facilitate both the demonstration of sustainability of the Asset Policies and the modelling of the impacts on the asset base of different funding options and management approaches.

3.4 Scenarios

The use of scenarios is sometimes confusing in the Asset Policies. The core output or funding scenarios being considered in the Asset Policies and/or IIP are understood to be:

- Current Railway;
- Current Railway plus Investments; and
- Preferred Plan.

However, in a number of the Asset Policies there are also technical solution options which describe different ways of delivering the particular outputs for the relevant asset group but are also termed 'scenarios' in the documentation.

In some cases the technical solution options clearly map to the output/funding scenarios but sometimes this mapping is less clear or not directly aligned. In other cases the options identified as 'scenarios' in the Asset Policies are simply workbank options.

Network Rail should consider the following to improve the clarity of the Asset Policies for the SBP in this area:

- Align output scenarios with common SBP output/funding scenarios;
- Re-name technical scenarios as technical solution options or another appropriately differentiated and relevant nomenclature; and
- Clearly separate output/funding scenarios from the different technical option solutions for delivering each output scenario.

3.5 Embedded Efficiencies

The key high-level types of potential efficiency to be gained by Network Rail during CP5 are summarised in Diagram 5 below.

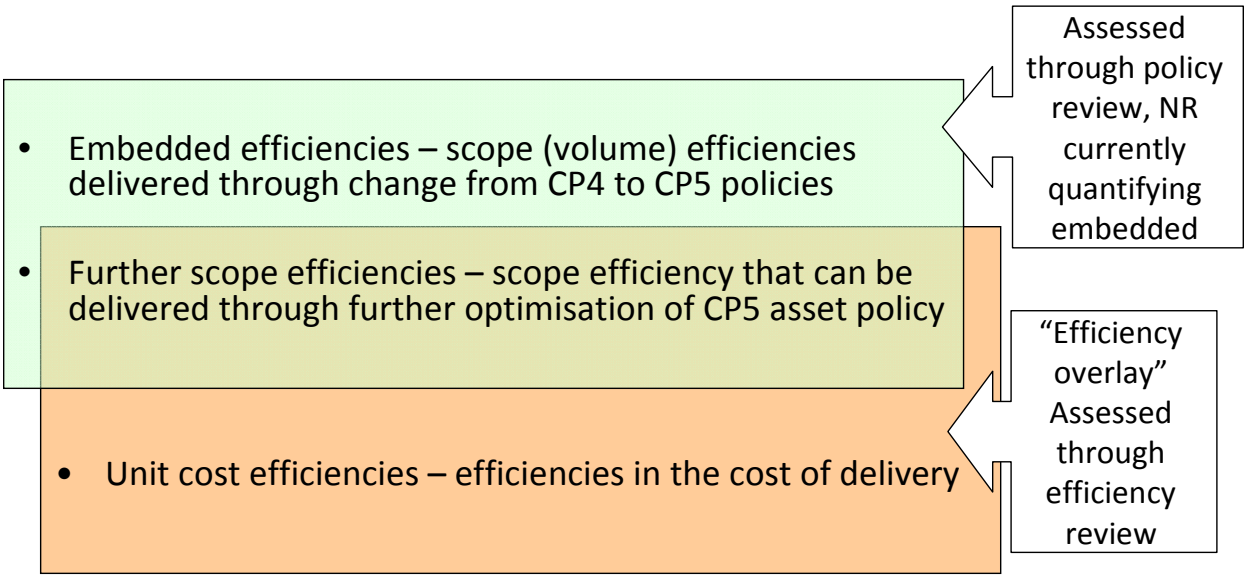

Diagram 5 Sources of CP5 Efficiencies

The key type of efficiency relating to the Asset Policies are the embedded efficiencies, i.e. those efficiencies gained by changes in the Asset Policy from CP4 to CP5 which result in a more optimised approach to the management of the relevant assets. A good example of this is the 2011 Signalling Asset Policy which proposes a move from full conventional reSignalling in CP4 to a targeted approach in CP5 which renews only specific sub-systems, assets or components as they degrade instead of the whole system. This approach maximises asset life and reduces the unnecessary renewal of other sub-systems, assets or components. The gains have to be balanced with the demonstration that necessary outputs continue to be achieved and, in this particular Signalling example, with the potential programme costs of greater numbers of interventions. In this case, the whole-life cost benefits of the approach have been modelled to justify the proposed change.

However, as a general rule, the embedded efficiencies within the latest suite of Asset Policies are hard to determine and limited in their quantification. It is understood that Network Rail is actively seeking to quantify the likely efficiencies and that this will be inherently linked with the further development of the suite of whole-life cost and forecasting models discussed in section 3.3. Quantifying and demonstrating the embedded efficiencies within the final CP5 Asset Policies will be critical to justifying the SBP and associated funding submissions.

In AMCL's opinion, further scope efficiencies are achievable during CP5 including the development of optimised maintenance strategies and processes. Currently, although the Asset Policies do provide a high-level overview of the proposed maintenance strategy for each asset group the level of detail and development plans provided are limited at this stage. Furthermore, the adoption of risk-based maintenance and inspection varies and has been slow to develop in those asset groups that have started to adopt it. Based on emerging evidence in comparable sectors, it is estimated that Network Rail could identify 15% to 20% Opex savings, largely through adoption of appropriate cost-risk optimised maintenance processes across the asset base and different Route criticalities.

Although unit cost efficiencies have not been reviewed in detail as part of this review, AMCL did note in its recent Asset Management capability maturity assessment of Network Rail that the processes used to develop unit costs have developed since the 2009 assessment and represent a significant area of achievement for Network Rail.

3.6 Asset Information Strategy

Network Rail is currently implementing a revised Asset Information Strategy (AIS). The revised AIS consists of two key phases:

- Phase 1 - the Asset Data Improvement Programme (ADIP) to support Network Rail's immediate asset information requirements for development of the Initial Industry Plan (IIP) and subsequent Strategic Business Plan (SBP) for CP5; and
- Phase 2 - an Asset Information Strategy for Network Rail detailing the longer term provision of better quality asset information for the Great Britain (GB) rail industry, referred to by Network Rail as ORBIS (Offering Rail Better Information Services).

The overall ORBIS strategy is a significant development programme and is scheduled to run throughout CP5 and CP6.

The ADIP programme to support the development of IIP has been reviewed by AMCL under a separate mandate[2]. The outcomes of this identified that while it was considered more could have been achieved had Network Rail started the process earlier, a range of data enhancements based on the requirements of the overall modelling approach (see section 3.3) and the development of the Asset Policies and IIP were successfully achieved. Network Rail is understood to be currently developing a second ADIP phase of work to further support the development of modelling and Asset Policies for SBP.

As previously stated, Network Rail's modelling of whole-life costs and output costs and volumes is a developing process between IIP and SBP and the individual Asset Policies each identified areas where enhancements of asset data is planned, for example, in relation to validating degradation curves. However, there were very limited references within the Asset Policies to the underlying ADIP work or the overall ORBIS strategy, in terms of demonstrating a coordinated and integrated approach to the optimisation of asset data and knowledge across the organisation. Without such an approach there is a risk of duplicated effort and potentially conflicting sources of data/knowledge to the enhancement of data to support the periodic review process.

The Asset Policies also have done little to quantify the benefits of enhanced asset data/knowledge to the organisation and subsequently support to the business case for the significant ADIP and overall ORBIS strategy costs. Whilst this type of business case information may not necessarily be expected to be included in Asset Policies, this could be disputed in the case of Track. The Track costs and volumes for IIP were identified as including the efficiencies associated with the ORBIS within the pre-efficient CP5 costs for the ‘Current Railway plus Investment’ funding/output scenario. This is understood to not be the case for other asset groups. Notably, Track also has the highest individual asset group benefits associated with ORBIS, at approximately £191m in CP5.

In general, although the Asset Information Strategy business case information may not necessarily be expected to be included in the Asset Policies, clear or referenced data enhancement specifications, justifications and plans to support their further development would. This would also be expected to be clearly integrated with the organisation's Asset Information Strategy.

[2] Review of Phase 1 AIS, AMCL

3.7 Quantified Risk Assessment

To support the IIP submissions Network Rail has produced a high-level Quantified Risk Assessment (QRA) and accompanying overview document. The QRA identifies the most likely and highest and lowest credible ranges of uncertainty associated with CP5 volumes, CP4 exit rate efficiencies and CP5 efficiencies. It is also noted that the uncertainties are intended to be reduced by the time of SBP.

Although the QRA development processes and data have not been subject to audit as part of this review, AMCL considers that the uncertainties identified by Network Rail appear generally credible and reflect sensible ranges of uncertainty at this stage in the periodic review process.

The one area of the QRA that AMCL would question is the uncertainties associated with the Electrical Power asset group are of a very similar range to those of the Track asset group (based on a qualitative review only at this stage). This would appear questionable based on AMCL's understanding of the quality and quantity of asset data in the Track asset group, which is considered to be good by Network Rail, when compared to the quality and quantity of data in the Electrical Power asset group. Network Rail's own Confidence Grading Summary for IIP[3] identified the following data confidence grades across the two asset groups in Table 2 below.

Asset Group	Asset	Inventory	Condition
Track	Plain Line	B3	B2
Track	Switches & Crossings	B3	B2
Electrical Power	OLE	C3	B4
Electrical Power	Conductor Rail	C3	B3
Electrical Power	HV Switchgear	C3	B4
Electrical Power	Signalling Power Supplies	C3	B4

Table 2 Network Rail's Assessment of Track and Electrical Power Asset Data Confidence Grades

Specific concerns cannot be clarified without a detailed audit of the QRA process and data but further clarity and understanding of its development and the uncertainty ranges targeted is needed during the move towards SBP. The process should also be integrated with the policy development process, and demonstrate clear linkages, with the associated Asset Policy, Asset Information and model development.

[3] Overview of Confidence Grading Summary for September 2011 IIP Submission; v0.7, Network Rail, October 2011

4 Track

4.1 Summary and Changes since CP4

The 2011 Track Asset Policy builds on the policy produced in 2010 but includes a further refinement of the approach developed for CP4. The policy has been restructured to follow the standard 10-step approach which makes the document more logical to read and provides a clearer argument for the final policy decisions.

Sections 1 and 2 provide an overview of the Track assets and the historical performance of these assets. This provides a useful context to the content in the following sections.

Section 3 contains an analysis on asset criticality. The asset criticality is primarily based on safety impact, performance impact and expenditure on maintenance and renewal. The policy argues that that these three parameters best represent the criticality of Track assets but this method does not result in formation or drainage being identified as high criticality asset types. However, the policy does go on to identify formation and drainage as being critical assets based on their impact on the whole life costs of the whole Track system. It should be noted that drainage is covered by a separate Asset Policy and is therefore not considered further in this report.

Section 4 contains an analysis of the route criticality. The 2010 Track Asset Policy used 4 quadrants to differentiate the criticality of strategic route sections (SRSs) and used both the frequency and consequence of failure to define the four quadrants. This approach did have some drawbacks, as highlighted in AMCL's review of the 2010 Asset Policies, in that it was possible for an SRS to move from one quadrant to another as the asset degrades, which is not consistent with the concept of route criticality. The 2011 policy has moved to 5 criticality bands which are based solely on the consequence of failure which it is argued is a good proxy for the overall criticality of each SRS. This is a positive step in our opinion and addresses the concerns raised in the 2010 policy review. The distribution of the number of km of track across the criticality bands is as follows:

- Band 1 (most critical) – 10%
- Band 2 – 16%
- Band 3 – 25%
- Band 4 – 27%
- Band 5 – 22%

This is a significant improvement on the original CP4 Track Asset Policy where around 60% of track was in primary and secondary routes with high tonnage, and therefore had the same policy applied, which was likely to result in the over specification of renewals and maintenance on certain SRSs.

Sections 5 and 6 contain an analysis of asset degradation and intervention options which is discussed in Section 4.2 on robustness.

Section 7 discusses output and funding scenarios and Section 9 contains the investment options considered both of which are discussed under sustainability in Section 4.3 below.

Section 8 contains the modelling approach which is discussed in Section 4.4 below on whole-life whole-system efficiencies.

Section 10 includes the Asset Policy statements by criticality band. The key change from CP4 is the move towards increased refurbishment focused on middle and lower criticality bands to maximise component asset life. It describes the preferred policy options for the five criticality bands for all key activities, although it is noted that some of the policy options are common across the criticality bands.

When looking at the expenditure within the IIP for Track, there is good alignment between the policy statements and the work volumes and costs within the IIP. Diagram 6 below shows that the proportion of expenditure on renewals reduces from band 1 to band 5 and conversely the proportion of expenditure on refurbishment increases.

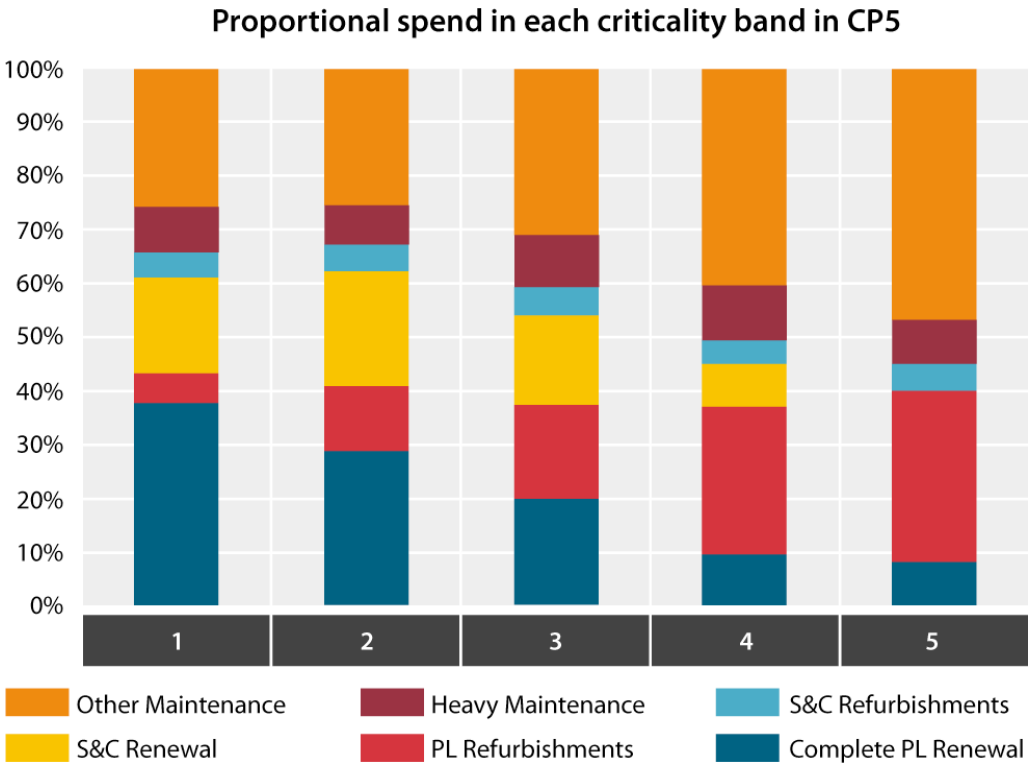

Diagram 6 Split of Expenditure by Criticality Band

4.2 Robustness

In terms of the technical robustness of the policy, this has been examined under a separate mandate and is not discussed further in this report. This section instead focuses on the extent to which the Track Asset Policy can be considered robust from an Asset Management perspective.

The policy can be considered to be robust from an Asset Management perspective for the following reasons:

- It includes a detailed analysis of strategic failure modes, renewal drivers and deterioration mechanisms for all key asset types;
- Intervention options for all key assets types are documented, including the potential use of new technology and new approaches;
- The prediction of remaining life and outputs in CP5 appear to demonstrate that policy is robust in terms of delivering the required outputs; and
- It includes the assumptions, success criteria and improvement initiatives relating to the application of the policy.

There are a number of risks associated with the deliverability of the policy, the most notable of which are:

- Availability of the appropriate competences both within Network Rail and its supply chain to deliver the changed work volumes in CP5;
- Availability of improved Asset Information through the ORBIS project that is necessary to successfully deliver the policy;
- Availability of appropriate plant and machinery to undertake the work volumes identified; and
- Proving the plain line pattern recognition technology to reduce the manual track patrolling as proposed.

These risks have been recognised by Network Rail and appropriate mitigations appear to be in place but these will need to be monitored and reviewed again when the SBP is produced.

4.3 Sustainability

The Track Asset Policy has aimed at demonstrating sustainability in two ways;

1. By predicting the average age of the key components over the next 20 years; and
2. By predicted key outputs over the next 20 years that will be delivered through the proposed asset interventions.

The remaining life is modelling by predicting the used life fraction of the key track components in each of the next 20 years in each of the 5 criticality bands as shown in Diagrams 7, 8 and 9.

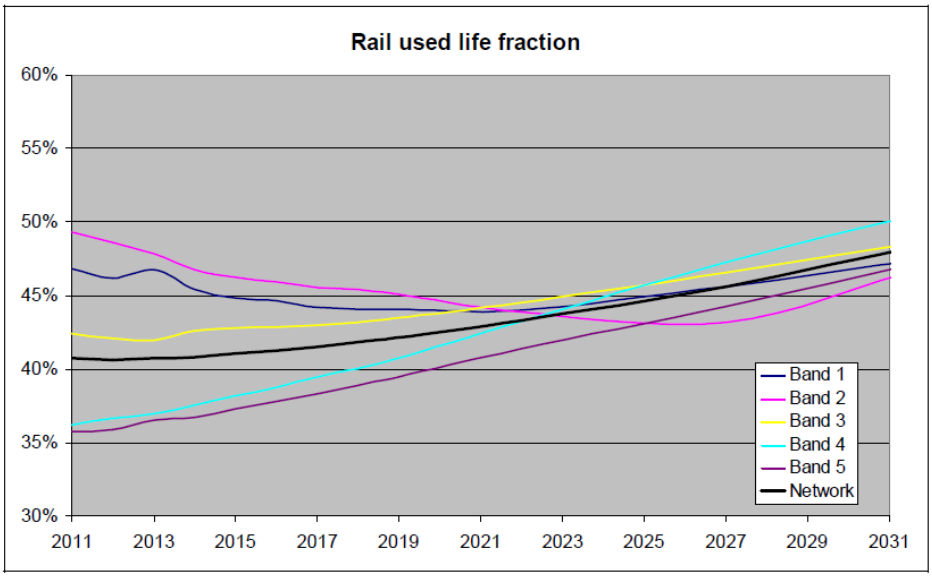

Diagram 7 Rail Used Life Fraction

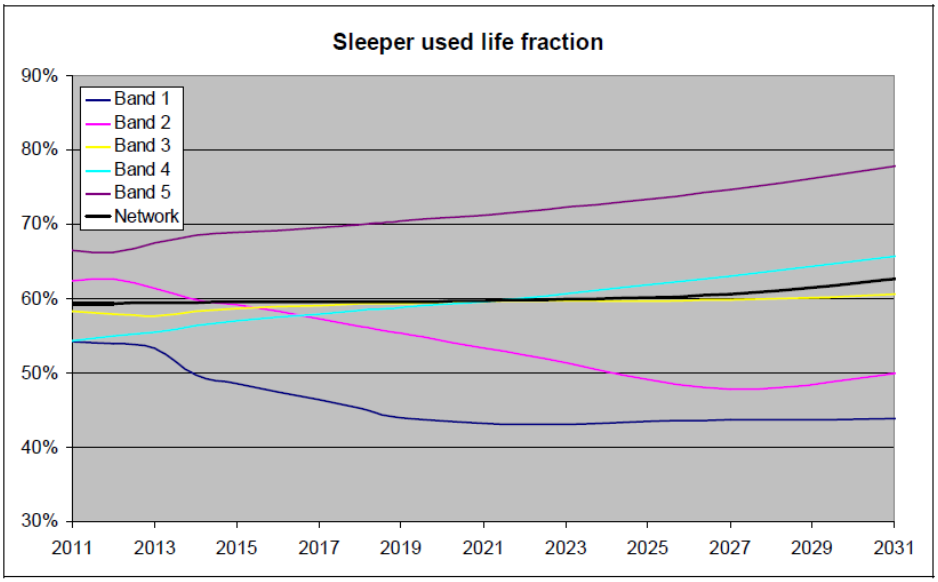

Diagram 8 Sleeper Used Life Fraction

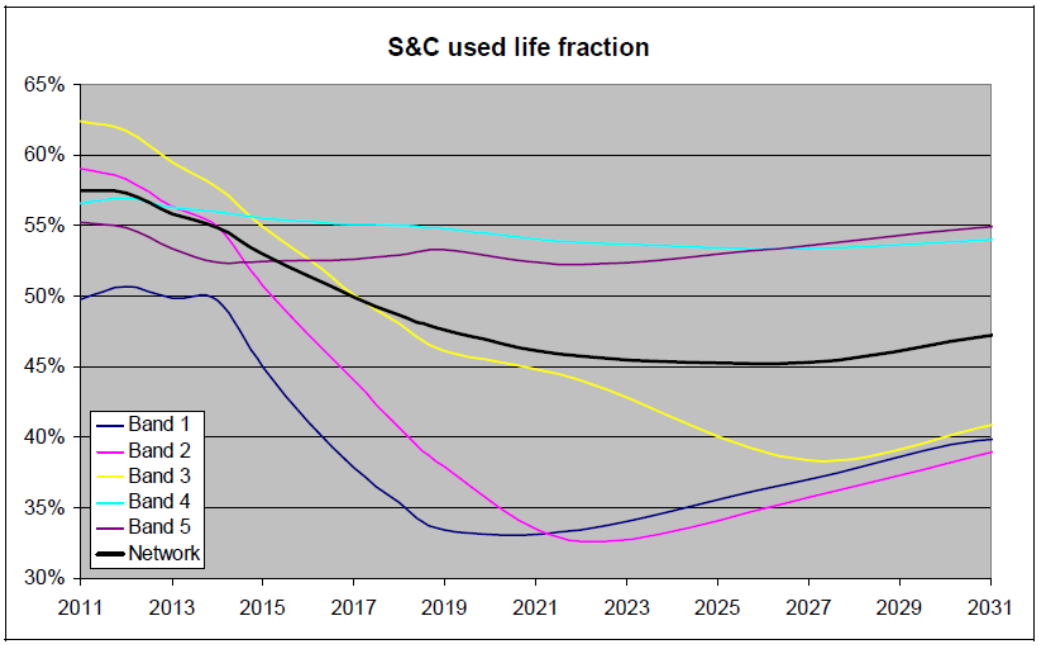

Diagram 9 S&C Used Life Fraction

These all show that during the course of CP5, the used life fraction reduces for most of the components, in particular for criticality bands 1 and 2. They also show that this used life fraction then slowly increases beyond CP5 towards 2031. The ability to predict this, acknowledging there are various assumptions behind these predictions, is a significant step forward in being able to demonstrate that the Track Asset Policy is sustainable, but the following would also be needed to be undertaken before the policy could be fully proven to be sustainable:

- Statements on what the sustainable steady state used life fraction should be for each of the criticality bands, noting that this could be greater than 50% for criticality bands where component renewal is the preferred policy;
- Predictions that the trend of the used life fraction is tending towards this steady state value within each of the criticality bands; and
- Demonstration of the assumptions that medium refurbishment delivers a 20% increase in service life and that heavy refurbishment delivers a 50% increase in service life.

The Track Asset Policy also contains predictions on the expected outputs for given scenarios over the next 20 years for good and poor track geometry, serious defects, failure rates and ballast fouling as shown in the Diagrams 10, 11, 12 and 13.

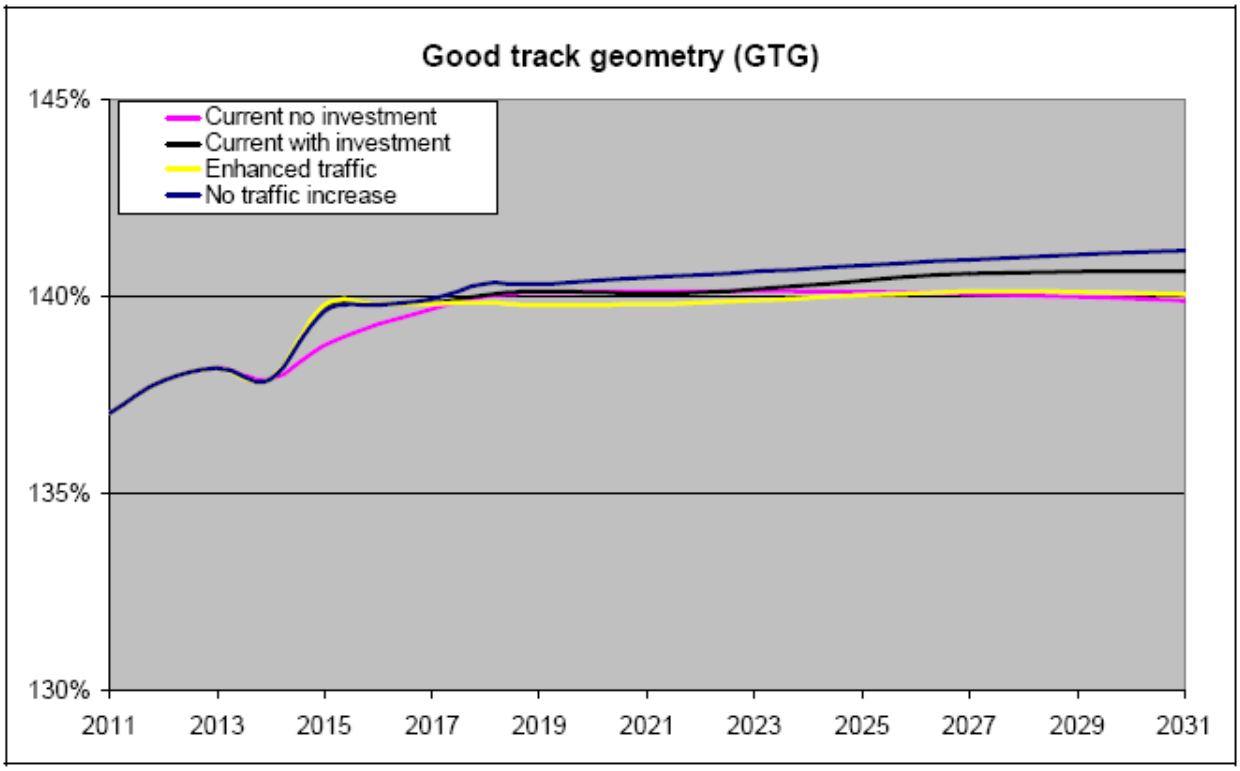

Diagram 10 Good Track Geometry

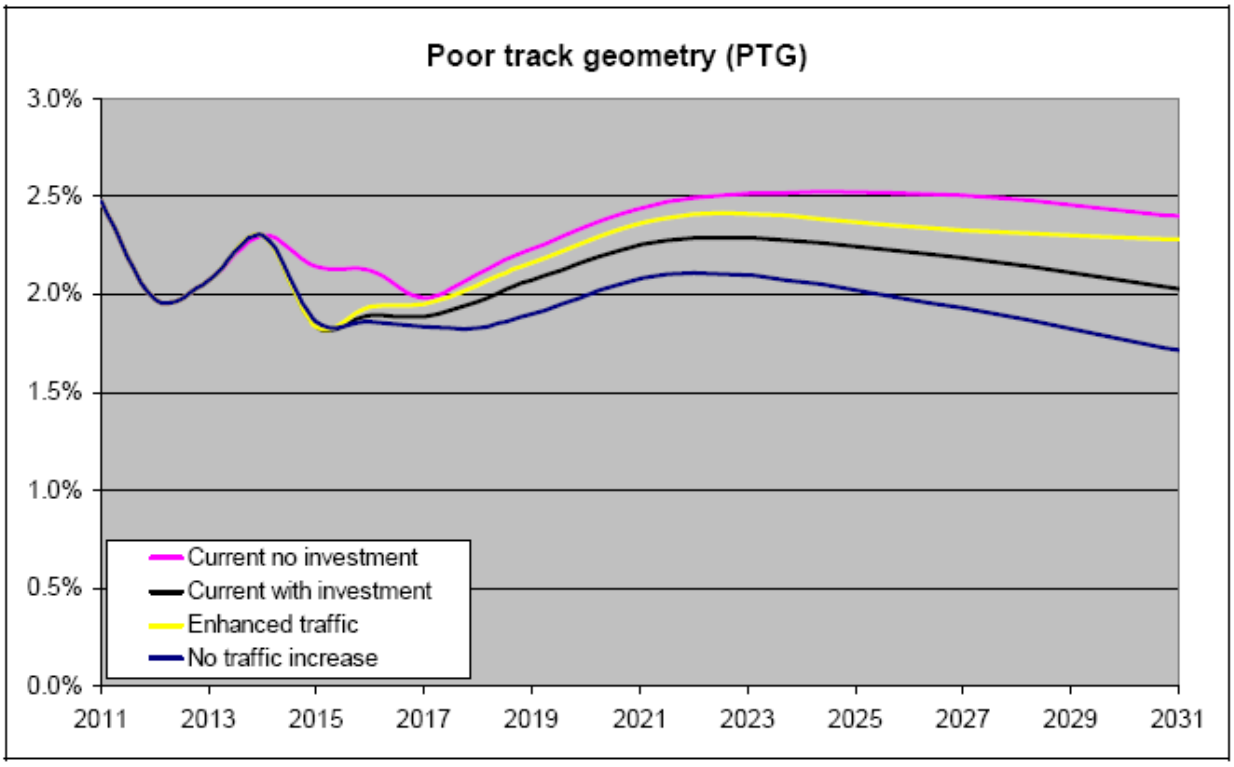

Diagram 11 Poor Track Geometry

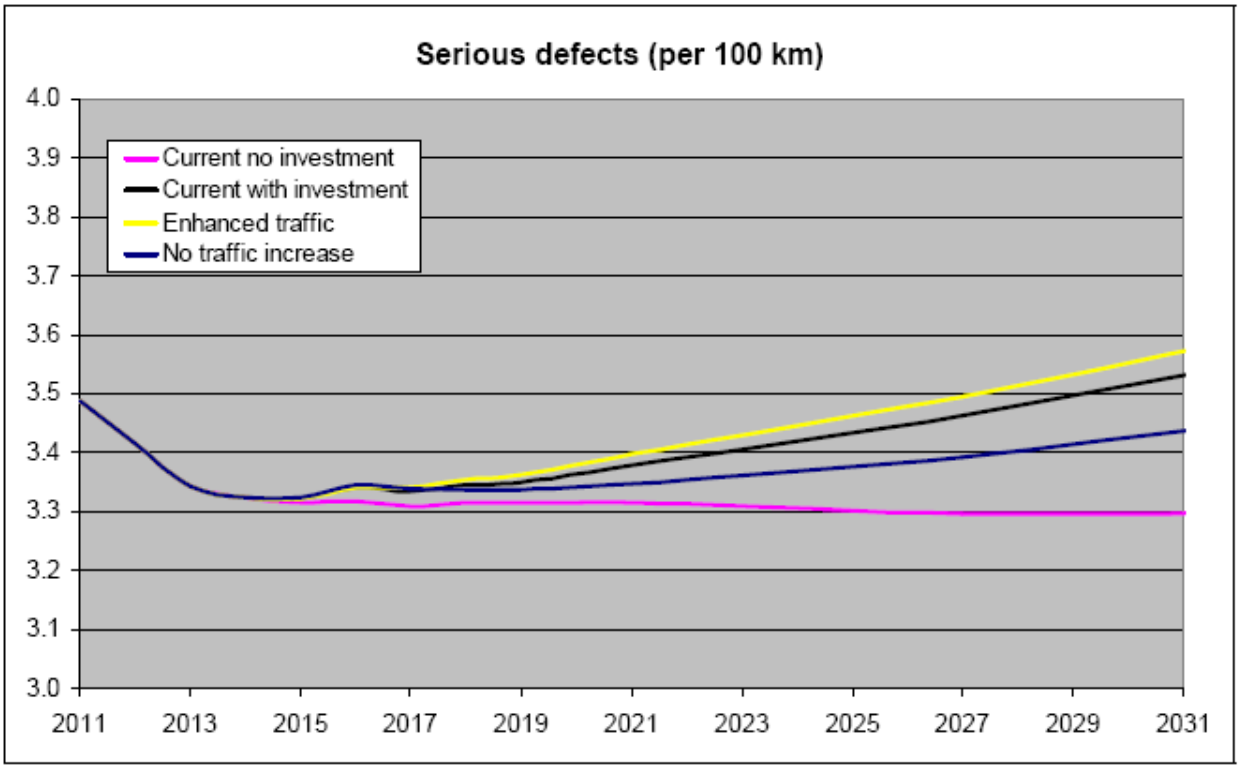

Diagram 12 Serious Defects

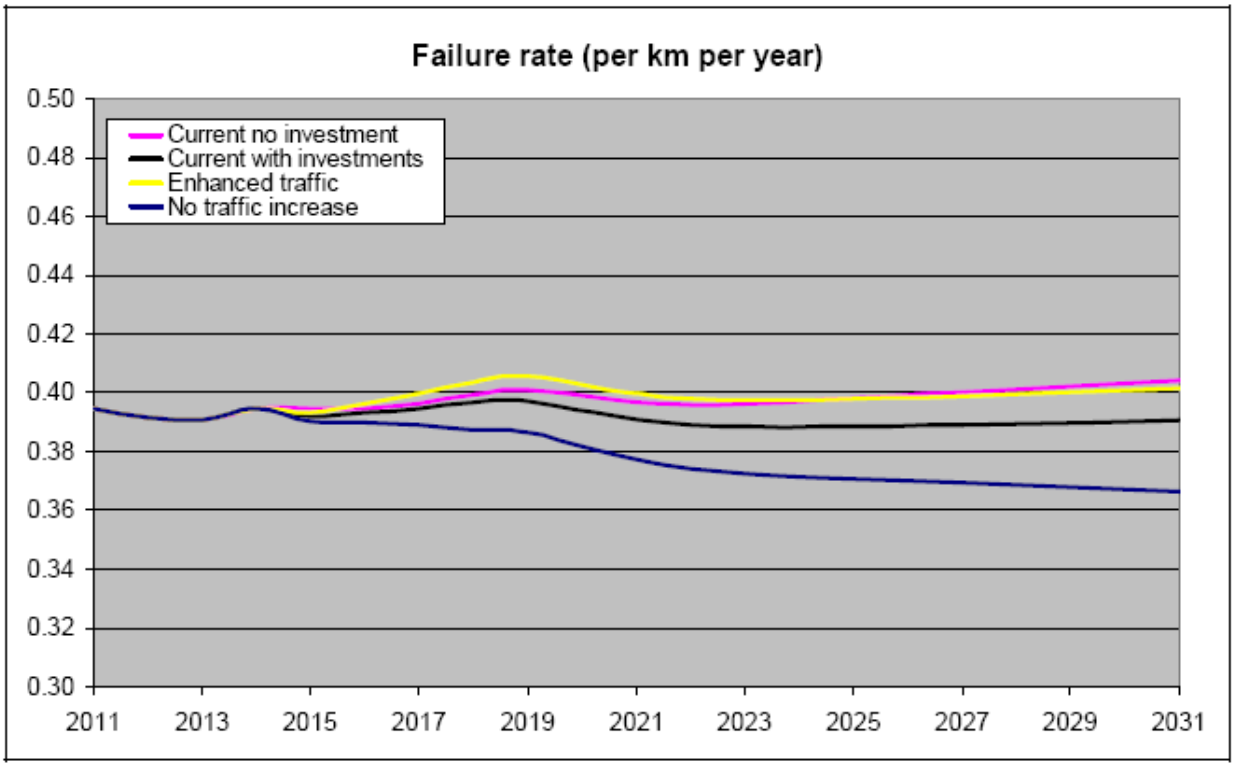

Diagram 13 Failure Rates

These appear to indicate a broadly consistent level of output which would suggest that the Track Asset Policy is sustainable in the longer-term but further analysis of the underlying models that are used to generate these predictions would be necessary before the Track Asset Policy could be proven to be fully sustainable.

4.4 WLWS Efficiency

As discussed in Section 3.5, the embedded efficiencies within the CP5 Asset Policies are scope efficiencies or improved methods of working compared to the practices within the CP4 Asset Policy. The extent to which these embedded efficiencies represent the lowest whole-life and whole-system costs, and the extent to which there may be further scope efficiencies possible through the continued development of the Track Asset Policy, can only be established through a detailed review of the modelling methods, decision support tools and asset information that underpin the Asset Policy and the associated work volumes and costs.

At this stage, this analysis has not been possible and the findings are therefore limited to a review of the documentation within Section 8 of the Track Asset Policy and a review of the Tier 0 and Tier 1 models used to produce the work volumes and costs for the IIP. Diagram 14 below shows the breakdown of how the costs for Track were derived and it can be seen that the majority of these costs were derived from the VTISM model, with approximately 20% being derived from a cost profile approach.

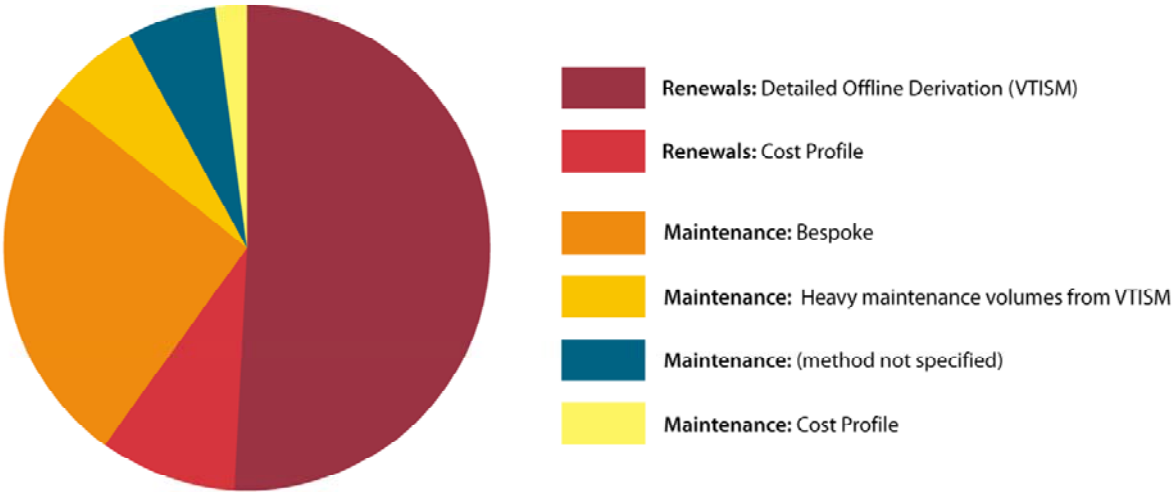

Diagram 14 Track Modelling Methods for IIP Costs

VTISM is a model that is designed to hold and analyse the track system component age and condition information and degradation rates in the form of service lives. VTISM uses volumes of work for all the track in each criticality band, allocates them to each track section, and then aggregates them to SRS level. The work volumes for the criticality band are an input, and VTISM calculates the outputs based on allocating these volumes to the track. The input volumes are then iterated to find the work mix that meets the targets for each criticality band.

It was reported by Network Rail that the service lives used within VTISM are the same as the service lives used in the CP4 policy. Some work has been undertaken on Tier 2 models to undertake whole life cost analysis of these service lives, alongside other asset interventions, but the output from these models has not yet resulted in any changes to the service lives in VTISM. It was also reported that VTISM is more fully developed for plain line than for S&C due to the additional complexities of modelling the S&C systems.

There are also potential opportunities to examine the system-wide approach to the renewal and maintenance of certain key assets that span the asset groups, for example S&C. Some reference is made in the policy to dependencies on other asset groups, but no analysis appears to have been undertaken to assess the benefits of a system-wide approach.

At this stage, further work would be necessary to demonstrate that the Track Asset Policy represents the lowest whole-life whole system approach to the delivery of the required outputs. It is understood that Network Rail is planning to undertake further work in this area prior to the SBP and this will need to be assessed at time of the SBP submission.

The Track Asset Policy describes the development of inspection and maintenance regimes being developed using a FMECA based process but this work does not yet appear to have been undertaken. With the exception of the track inspection efficiencies as a result of the introduction of the plain line pattern recognition technology, it would appear that there is further work to do to demonstrate that the track inspection and maintenance regimes represent the lowest whole-life and whole-system solution.

The fact that the whole-life cost modelling has not yet impacted on the interventions in the Asset Policy would suggest there is the potential for further renewal and maintenance scope efficiencies to be identified for plain line and S&C as Network Rail continues to develop the Tier 2 models up to the publication of the SBP.

4.5 Asset Knowledge

Asset information in Track is relatively mature compared to the other asset groups. However, even in Track, the availability of the appropriate asset information is still holding back Network Rail's ability to develop and implement a fully optimised Asset Policy. Network Rail recognises this and acknowledges that implementation of the Asset Information Strategy (ORBIS) is integral to delivery of the Track Asset Policy in three key areas:

- Better quality asset information will help informed engineering decision making that reduces the volume of work required to meet the outputs;
- Information from inspection and maintenance activities will be used to drive continuous improvement in the management of the Track assets; and
- Management regimes will become more optimal and related to the requirements and criticality of a particular route or asset.

During the challenge workshops Network Rail indicated that improved asset information will deliver savings of around £100m during the course of CP5. The ORBIS Vision and Roadmap document has subsequently identified savings of £191m for Track in CP5 as a result of improved asset information. It is not clear from the policy how these savings were derived and what assumptions have been made. The policy would therefore benefit from better cross referencing between the three key areas listed above, the savings this will deliver and the tasks within the ORBIS programme that will deliver them.

4.6 Proposals for SBP

The proposed developments for SBP for the Track Asset Policy are:

Robustness

As the policy is already deemed to be robust, the key activities prior to the publication of the SBP are to monitor the key risks and mitigations and update these accordingly.

Sustainability

The following would help to demonstrate that the Track Asset Policy is sustainable:

- A definition of the sustainable steady state used life fraction for each of the criticality bands for the high criticality asset types;

- Forecasts that the trend of the used life fraction is tending towards this steady state value within each of the criticality bands; and
- Demonstration of the assumptions that medium refurbishment delivers a 20% increase in service life and that heavy refurbishment delivers a 50% increase in service life.

Efficiency

The following would help to demonstrate that the Track Asset Policy is efficient from a whole-life whole system perspective:

- Continue to develop the Tier 2 models to demonstrate that the proposed interventions are sustainable at lowest whole-life cost, including the updating of service lives where appropriate;
- Examine the potential efficiencies from taking a systems approach for asset types that are shared across asset group, in particular for S&C; and
- Continue to develop the strategy for maintenance to demonstrate how the FMECA based approach is being used and how this will help to align the costs of maintenance and inspection with the risks being mitigated by the maintenance and inspection.

Asset Knowledge

The following should be included in the Track Asset Policy on asset knowledge:

- Documentation of methodology used to determine £191m savings as a result of improvement asset information including the assumptions made; and
- Better cross referencing with ORBIS to demonstrate how the asset information improvements documented within the Track Asset Policy will be delivered by the ORBIS programme.

5 Signalling

5.1 Summary and Changes since CP4

The 2011 Signalling Asset Policy is considered by AMCL to have progressed significantly since the previous documentation, which was the 2007 Asset Policy.

Notably the CP4 work volumes changed significantly between the CP4 SBPu (SBP Update) and the CP4 Delivery Plans despite the fact the 2007 Asset Policy did not change. This was stated by Network Rail as being due to improvements in the available asset condition data. This variance shows that the work volumes within Signalling are very sensitive to changes in asset information within CP4. This needs to be taken into account in the ongoing progressive assurance on the CP5 Signalling Asset Policy and the associated work volumes.

The Asset Policy development for 2011 has followed the 10-stage process previously discussed and this has ensured a well defined and pragmatic approach which is consistent with other asset groups and Network Rail's overall Asset Management Strategy.

Section 1 of the Asset Policy provides an overview of the asset description, including key interfaces with other systems and rolling stock. Overall, this appears comprehensive and provides a good basic description of the relevant assets, although the overall asset count was noted as approximate rather than definitive.

Section 2 provides an historical analysis for the asset group, including consideration of asset age, wrong-side failures, expenditure (for CP4 only) and the high impact of Signalling assets on overall infrastructure delays, as summarised in Diagram 15 below.

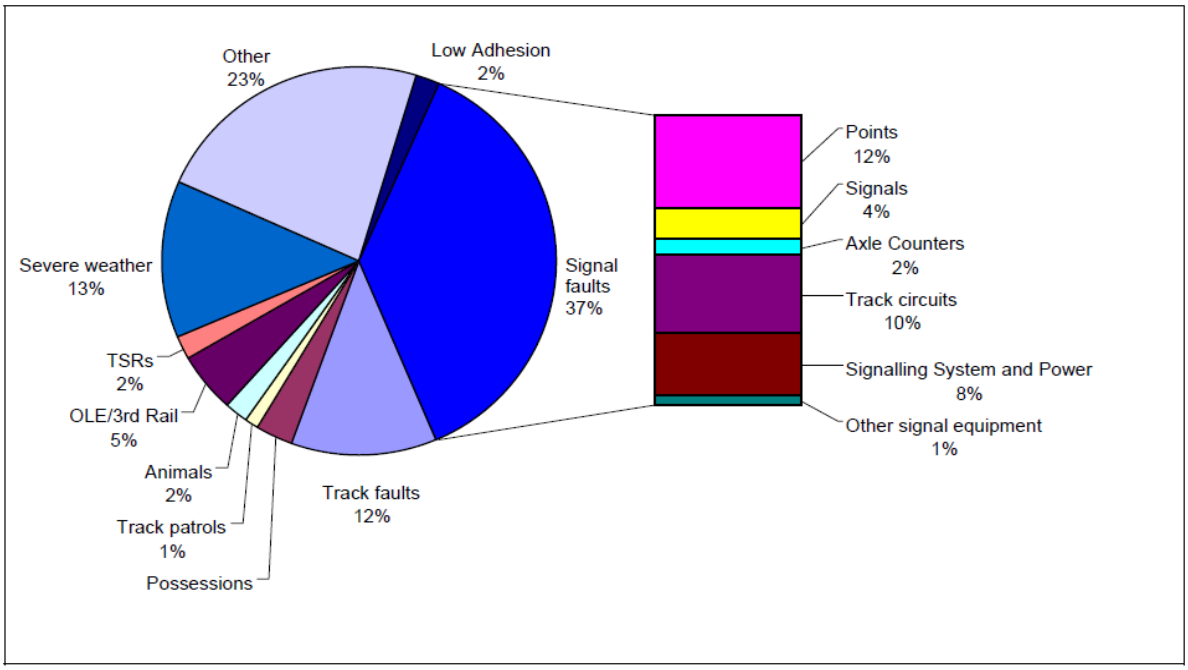

Diagram 15 Signalling Impact - Infrastructure Annual Delays (Minutes): Network Rail

Section 3 identifies the critical assets across the Signalling asset group. The approach considers performance (performance costs), costs (maintenance spend) and risk (safety risk) and lists six critical asset types. Although the identified assets types appear generally sensible and the generic approach of considering performance, cost and risk is sound, the actual application of the approach, the relevant criticality category thresholds and the relative criticality of the identified asset types is not clearly communicated in the policy itself. This is considered to be an area where improvements could be made for SBP (see Section 5.6).

Section 4 considers route criticality and benefits from a comparable approach to that used in other asset groups. Signalling has identified criticality bands by Strategic Route Section (SRS) and clarified the SEU (Signalling Equivalent Unit) count within each band. However, the Asset Policy does note that no clear linkage has been established between failure rates and criticality of routes and, as would be expected, there is a clearer link between service consequences/safety risks and route criticality. As a result, it is noted that although route criticality has influenced the Asset Policy development it has not yet been explicitly adopted in the forecasting of costs and volumes.

Section 5 of the Asset Policy considers asset degradation and its modelling. This and its potential impact on robustness is considered further in Section 5.2 but in summary the development of degradation modelling has progressed significantly over the last year or so but remains ongoing.

The Signalling asset intervention options considered in Section 6 of the Asset Policy appear comprehensive, technically sound and well considered. They include the consideration of a range of intervention types, such as the 'targeted renewals approach' (discussed further in Section 5.2) which lies at the heart of the overall CP5 Asset Policy, interactions between interventions and alignment with wider strategies such as the rollout of ERTMS and the National Operating Strategy (NOS).

Section 7 of the policy outlines the output and funding scenarios for the Signalling asset group. Critically, it identifies that the assumption output target is to maintain the level of network performance forecast at the end of CP4 for CP5 and beyond and that the forecast outputs for the end of CP4 are specified in the 2011/12 CP4 Delivery Plan Update. There are two key considerations relating to this, which are generic and not specific to Signalling:

- Is this level of output performance appropriate for CP5 requirements; and
- If there is a shortfall of output performance at the end of CP4, will the CP5 funding be appropriate to assure the initial recovery of performance to previously forecast levels and the subsequent maintenance of that performance for the remainder of CP5.

Based on this output performance assumption, the remainder of Section 7 of the document considers the proposed intervention regimes, i.e. further arguing the case for the 'targeted renewals approach' identified in the previous section of the policy document and the alignment and interface with the ERTMS and NOS national technology strategies. Section 7 also identifies the following 'scenarios' for Signalling, which should not be confused with the overall scenarios discussed in Section 3.4 of this document:

- Scenario 1: Conventional renewals regime with baseline ERTMS. NOS is not implemented in this scenario.
- Scenario 2: Targeted renewals regime with baseline ERTMS. NOS is not implemented in this scenario.
- Scenario 3: Targeted renewals regime with enhanced ERTMS i.e. the next major intervention on an interlocking or line of route being ERTMS where the majority train fitment will be completed within two years. NOS is not implemented in this scenario.
- Scenario 4: Targeted renewals regime with NOS implemented where there is a positive business case; modular Signalling is also implemented where there is a positive business case. Baseline ERTMS is implemented in this scenario.

- Scenario 5: Hybrid approach. Targeted renewals regime with enhanced ERTMS and NOS combined in such a way that their implementation dates (for a given interlocking or line of route) are aligned without introducing an unacceptable train fitment risk.

The alignment of these 'scenarios' with those identified in the Infrastructure Cost Model and IIP is considered to be ambiguous in the Asset Policy document itself. However, further workshops with Network Rail have clarified that these are effectively a range of 'workbank options' to provide one of two different actual scenarios, as defined in the Infrastructure Cost Model and IIP. As shown in Diagram 16, the CP4 approach of full conventional Signalling renewals based on asset condition is not being proposed for CP5. Instead a Targeted Renewals approach is being proposed to maintain output performance in the basic 'Current Railway' scenario.

For Signalling, the 'Current Railway plus Investments' scenario and the 'Preferred Plan' scenario are the same and are based on the Hybrid Smoothed workbank shown on the right of Diagram 16 below. Therefore, in IIP terms, the costs and volumes for the 'Current Railway' scenario are based on the 'Targeted Renewals' workbank and are based on condition-led activity plus incremental safety enhancements that are applied at time of intervention. The costs and volumes for both the 'Current Railway plus Investments' and 'Preferred Plan' scenarios are based on the 'Hybrid Smooth' workbank and contain the above plus interventions designed to facilitate re-control in accordance with the NOS. This significantly increases the number of interventions in the level crossing workbank due to the volume of manual level crossings on the network. The other workbanks, defined as 'scenarios' in the Asset Policy document are in effect part of the development process to move from the basic 'Current Railway' scenario to the 'Preferred Plan', which includes alignment and integration of ERTMS and NOS.

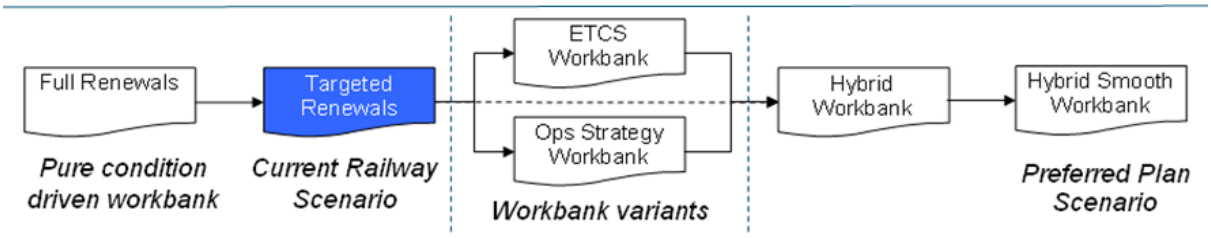

Diagram 16 Signalling Workbanks for Current Railway Scenario and Preferred Plan Scenario

Section 8 of the Signalling Asset Policy clarifies the modelling approach used to support decision making and the identification of costs and volumes. This is considered further in Section 5.4 of this document.

Section 9 of the Signalling Asset Policy document considers investment options and effectively justifies the proposed 'targeted renewals' approach and the 'hybrid smooth' workbank based on

whole-life cycle cost modelling. The arguments appear well justified based on initial modelling and this is discussed further in Section 5.3 of this document, although further development and validation of the whole-life cycle cost model is ongoing and assessment of the model itself was outside of AMCL's scope for this review.

The final Section 10 of the Asset Policy document defines both the policy statements themselves and considers the optimal selection of intervention options based on lowest whole life cost, deliverability and risks. Again, this is considered further in Section 5.3 of this document.

The level of direct application of the latest Asset Policy and associated whole-life cycle cost models (Tier 2) in producing the IIP costs and volumes is still limited at this stage but is anticipated to increase as the Asset Policy continues to develop for SBP.

One area of potential confusion is the inclusion of a range of level-crossing elements within the Signalling Policy whilst a separate Level-Crossing Asset Safety Policy has also recently been developed. The separate Level-Crossing Asset Safety Policy, which is included as enhancement spend in the 'Preferred Plan', contains additional interventions driven by the stated intention to reduce risk exposure and is separate to the level crossings renewals required to facilitate the NOS. The intent for SBP is understood to be that all policy elements relating to level-crossings are incorporated within a Level-Crossing Asset Policy.

In general terms, it is also noted that further development work is required around asset data, degradation modelling and whole-life cycle cost modelling validation and key elements of optimising maintenance such as Failure Mode and Effect Analyses (FMEAs).

With respect to changes since CP4, the key assumption, noted earlier, is that the outputs will be based on the forecast for CP4. The Asset Policy and the work behind the documentation which was presented by Network Rail via subsequent workshops, also considers in some detail the overlay of ERTMS and the NOS during CP5 and beyond.

The core change within the policy itself is the p*roposed move from conventional re-Signalling* (CP4) to a targeted approach (CP5). The targeted approach is intended to maximise the life and availability of assets through condition-led component / asset renewal ahead of, or integrated with, major future interventions emanating from ERTMS and NOS plans. The overall policy also includes plans to:

- Utilise opportunities to consolidate operational control centres when the interlocking needs renewal / reconfiguration;

- Convert areas to ERTMS operation when interlockings require renewal and sufficient rolling stock is equipped;
- Eliminate obsolete equipment and consolidate on preferred technology;
- Select maintenance regimes appropriate to the asset, its configuration and location whilst assuring safety; and
- Enable managers within devolved routes to make informed, whole life cost-based asset management decisions.

The 'Current Railway' scenario would be implemented via the targeted renewals approach with baseline ERTMS, whilst the combined (in the case of Signalling) 'Current Railway plus Investments' and 'Preferred Plan' scenarios would be implemented via the Hybrid Smooth workbank which incorporates the relevant enhanced ERTMS and NOS overlays.

5.2 Robustness

It is considered by AMCL that it is reasonable to believe that the 2011 Signalling Asset Policy is capable of delivering the outputs identified for CP5.

The case for robustness is supported by a number of key elements of the policy, including:

- Technical compliance - the technical approach is considered relatively conservative and, with the partial exception of ERTMS, is largely based on existing technology with minimal risk imposed by novel solutions or 'blue-sky' approaches which would require significant development during CP5. This also considered to support the deliverability of the proposed policy during CP5.
- Targeted renewals approach - this targets those parts of the Signalling system which require renewal at the time the individual component is life expired to maximised the life and availability of overall assets and reduce unnecessary or early renewal of other elements of the overall Signalling system. This is also considered to be a sound and justifiable interim approach for alignment with the forthcoming ERTMS and other major potential schemes such as the NOS.
- Alignment with ERTMS and NOS - based on the information presented in the Asset Policy or in separate workshops to AMCL, considerable effort has been applied to the alignment of the Targeted renewals approach with both of these major strategies, including working collaboratively with the wider industry.

- 10-step development process - the overall development process applied to the Signalling Asset Policy is considered by AMCL to align with good industry practice and provide assurance that appropriate factors have been considered and to some degree, i.e. still developing whole-life cycle cost modelling, demonstrated within the Asset Policy.
- Output requirements - the assumption of output requirements for CP5 remaining as forecast for the end of CP4 sets a relatively achievable continuous target which further assures the robustness of the policy.
- Deliverability - the consideration of deliverability has been demonstrated by Network Rail, particularly with respect to the elements, including resources and access, considered in the 'Hybrid Smooth' workbank identified for the combined 'Current Railway plus Investments' / 'Preferred Plan' scenarios.

Areas where it is considered robustness could be further demonstrated are:

- The clarity and application of asset criticality assessments;
- The clarity of alignment between ERTMS infrastructure plans with rolling stock implementation - it is noted in the Asset Policy that generally the intent is for rolling stock implementation to be in place first and it was also clarified at relevant workshops that this is being managed on an industry basis. However, the Asset Policy does not communicate the alignment between ERTMS costs and volumes with this work and directly identifies rolling stock fitment as a key risk. Network Rail's own Quantified Risk Assessment process has also identified relatively large confidence ranges in the ERTMS numbers during CP5;
- A range of further asset information enhancements are identified within the Asset Policy, including for use in validation of the whole-life cycle cost modelling; and
- The Opex optimisation approach is largely based on the RoSE process but the proposed rollout of this during CP5, particularly for the identified critical assets, is not clear.

5.3 Sustainability

Based on the assumed output requirements for CP5, there is no reason to believe that, should the demand on the network remain steady, the 2011 Signalling Asset Policy would not be sustainable. Notably, it also includes enhancement schemes committed to by the industry, such as ERTMS. However, the policy is currently assessed as Amber in terms of Sustainability as it is not considered to demonstrate the forecasting and modelling of outputs.

Significant progress has been made by Network Rail in the realm of whole-life cycle cost modelling for Signalling, with the policy document clearly demonstrating the analysis of costs through CP5 and beyond to CP11, as shown in Diagram 17 below.

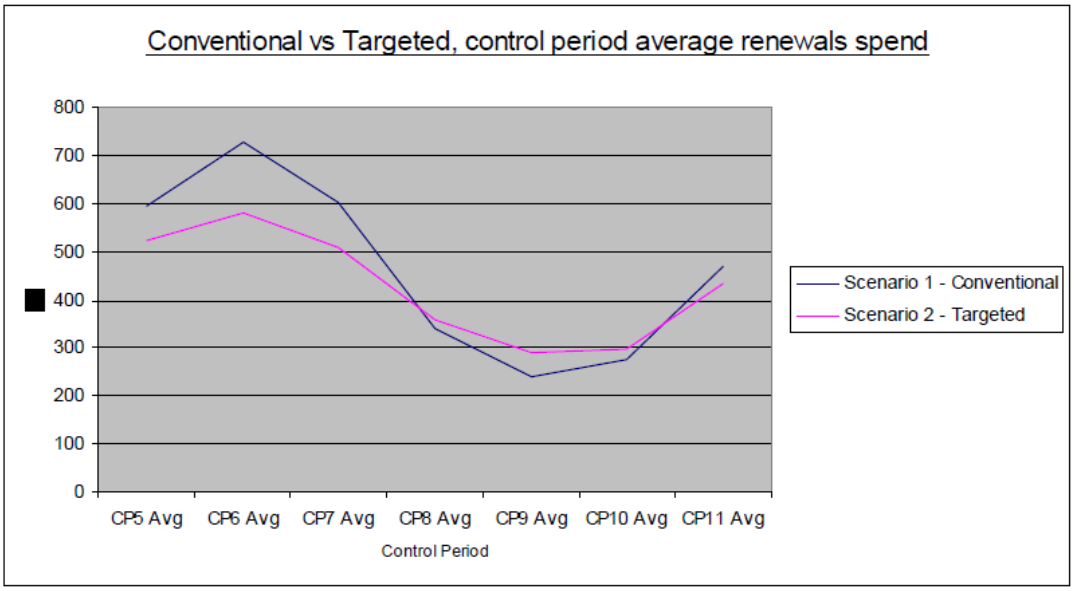

Diagram 17 Network Rail Signalling Cost Modelling

However, the outputs associated with the cost modelling are not currently demonstrably modelled and whilst the current modelling assumes the CP4 exit rate performance outputs, without the modelling of outputs it is not possible to assess or demonstrate the impact of different funding options or other constraints.

The sustainability of the level-crossing elements of the current Signalling Asset Policy will also require further review once these have been consolidated into a comprehensive Level-crossing Asset Policy for SBP.

5.4 WLWS Efficiency

The embedded whole-life whole-system efficiencies of the Signalling Asset Policy are centred on the targeted renewals approach, over conventional resignalling, and demonstrated for both Capex and Opex in terms of costs through to CP11 as shown in Diagram 18.

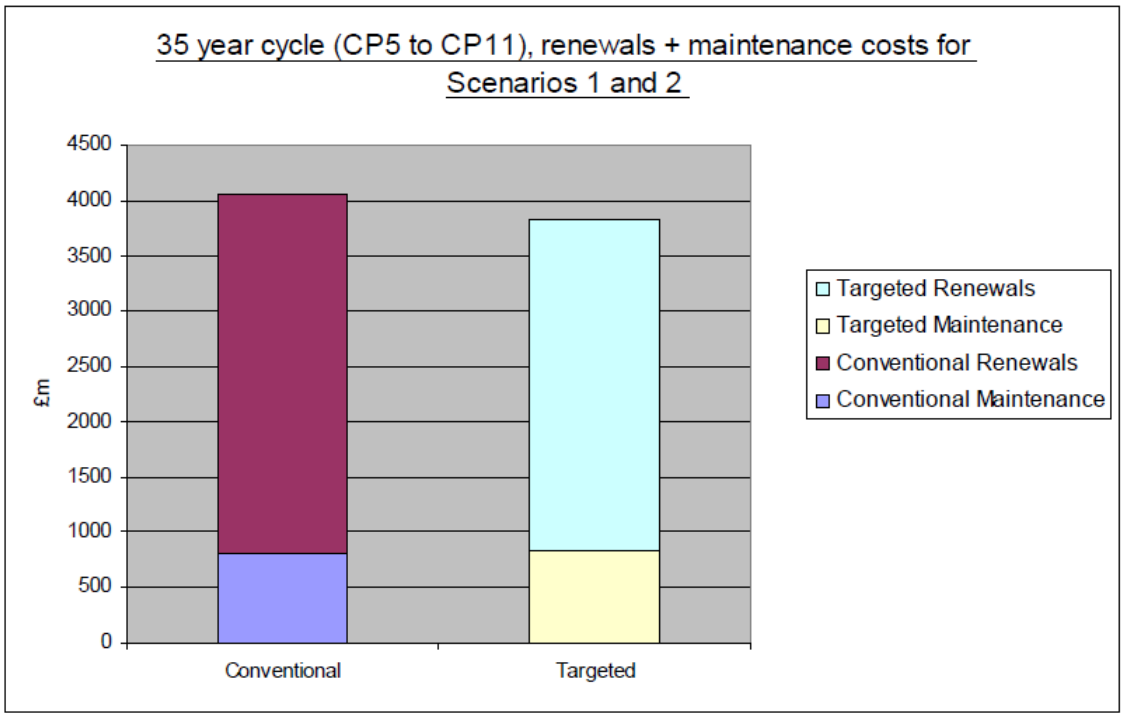

Diagram 18 Network Rail 35-year Cost Modelling

The Signalling asset group utilises an equivalent three-tier modelling approach as Network Rail's other asset groups:

- Tiers 0 and 1 - strategic models of the impact of policy on an asset base which is designed to forecast work volumes and costs for the asset base. The Tier 1 model for the Signalling asset group is the Signalling Infrastructure Cost Model (ICM).
- Tier 2 - is a strategic model which calculates the whole life cost for an asset type, in effect establishing the minimal whole-life cost policy/rules for each individual asset type or assembly.
- Tier 3 - are tactical models which support the identification and prioritisation of maintenance and renewal interventions. The Signalling Infrastructure Condition Assessment (SICA) tool is a prime example for the Signalling asset group.

The costs and volumes submitted for IIP are therefore based on the output of the Tier 1 model. In theory the Tier 1 model would model the selected policy when applied to the relevant workbank which would be developed based on the relevant rules and decision criteria established in the Tier 2 model. The Tier 3 models could then be used during implementation to prioritise work on the ground. At the current stage of development of the CP5 Signalling Asset Policy and associated models it is understood that the Tier 1 model utilises a manually created

workbank based only partly on the outputs of the Tier 2 model and is also informed by SICA information, expert judgement and resource and access constraints. It is also understood that the Tier 2 model is currently being used to validate the proposed interventions, as well as the assumptions within the Tier 2 model itself, via a suite of case studies.

Diagram 19 shows AMCL's analysis of the current status of modelling methodologies in the Signalling ICM, where 'Workbank' represents a bottom-up workbank approach, 'Off-line Derivation' refers to input from a non-ICM source and 'Cost Profile' is based on historical costs.

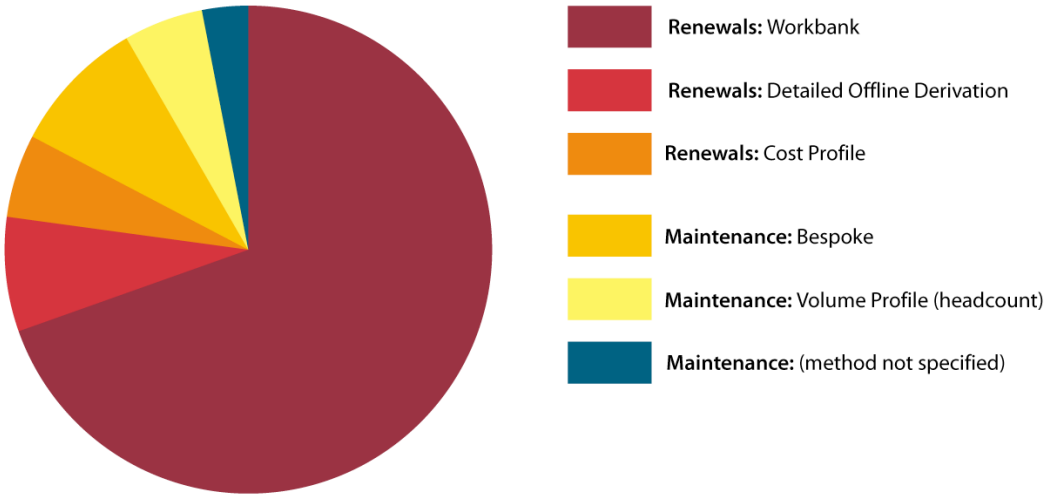

Diagram 19 Signalling Modelling Methods for IIP Costs

Other key findings relating to CP5 Signalling efficiencies are:

- The whole-life cost model (which is subject to on-going validation) justified targeted renewal approach achieves efficiencies by maximising the life/availability of assets/systems through condition-led component/asset renewal.
- Sensitivity testing is understood to have been incorporated within both the Tier 1 and Tier 2 models to date but is subject to ongoing development and refinement.
- The combined 'Current Railway plus Investments' / 'Preferred Plan' scenario for Signalling includes apparently good alignment of enhanced ERTMS and the NOS and is based on the 'Hybrid Smooth' workbank to assure the deliverability profile for CP5 and CP6 as the initial volumes considered the interventions on an individual, rather than portfolio, basis.
- Network Rail's post-efficient overlay and associated Quantified Risk Assessment for Signalling costs and volumes are considered by AMCL to be generally sound.

- For maintenance, the 2011 Asset Policy identifies proposed different approaches for high and low criticality Routes which should provide efficiencies in AMCL's experience, if developed using a good practice cost-risk based approach. However, these approaches still require further clarification at this stage, along with the use of remote condition monitoring and the continued rollout of the RoSE process, which the Asset Policy identifies will be applied to each type of asset.

5.5 Asset Knowledge

The Asset Policy identifies a number of potential gaps in the asset information used in its development, which include:

- Making future improvements in the detail at which the organisation holds its asset information to further facilitate the process of ascribing criticality to interlockings.
- The primary use of the Fault Management System (FMS) is stated as being to manage the response to failures, with accurate recording of the root cause of the failure being secondary, resulting in limited data being available to analyse failures by component and failure mode.
- Due to the impact of the cyclical maintenance regimes there is often no empirical degradation data regarding the long term performance of components or the asset as a whole and expert analysis and judgement is utilised to provide a conservative estimate of the expected reliability and life of the asset. However, this is mitigated to some degree by the use of expert judgement and associated quantifying techniques such as FMECA and RoSE.
- The Intelligent Infrastructure initiative is seeking to establish a set of rules to predict when a failure is likely to occur, allowing for preventative maintenance, however, this initiative is currently hampered by the variance in available data on the same asset type in different locations.
- The analysis in the whole-life cycle cost (Tier 2) is currently based on a combination of existing information on degradation relationships, data analysis and engineering judgement. This is currently subject to further validation.

With respect to unit cost data, the policy identifies an apparently sound range of costs based on the Signalling Equivalent Unit (SEU) or Level-crossing Equivalent Unit (LXEU) breakdown and has been used in both the Tier 1 and Tier 2 models. For maintenance it is noted that for the last five years, the time spent working on assets has been recorded in Ellipse, split into three

categories: planned maintenance, work arising and response. However, clarification of the maintenance unit costs within the Asset Policy document is limited.

5.6 Proposals for SBP

The proposed developments for SBP for the Signalling Asset Policy are:

Robustness

- Further assessment of policy and model sensitivity to data inputs to assure against the impact of asset data changes on volumes seen in CP4;
- Identification and clarification of a failure mode and cost-risk based maintenance strategy/approach;
- Continued and prioritised asset data improvement to support enhanced modelling and maximise confidence levels; and
- Further clarity over alignment of infrastructure costs and volumes with rolling stock ERTMS fitment.

Sustainability

- Modelling of outputs to demonstrate sustainability and facilitate funding options analysis or impact identification; and
- Definition of sustainable targets, such as average remaining life by route criticality.

Efficiency

- The validation of degradation modelling and assumptions and direct application of Tier 2 model to funding submissions; and
- Further rollout of the stated risk-based failure mode and maintenance definition process to identify optimised maintenance tasks and intervals for each asset.

6 Electrical Power

6.1 Summary and Changes since CP4

Overall Network Rail has made significant progress in the development of the Electrical Power Asset Policy in the last 18 months and the depth and detail contained within what is a very substantial document is to be commended. The policy has followed the 10 stage process and a summary of each stage is provided below.

Sections 1 and 2 provide an overview of the Electrical Power assets and the historical performance of these assets. This provides a useful context to the content in the following sections.

Section 3 contains an analysis on asset criticality. The asset criticality is based on CP3 and CP4 expenditure, impact on operational performance, impact on safety, impact on operating costs and impact on system capability. This results in a prioritised list of asset types which is split into those asset types that will be subject to detailed analysis and the other lower criticality asset types.

Section 4 contains an analysis of the route criticality which uses different methods of prioritising the SRSs across the network for the different asset types. The different methods of prioritising are prioritisation by:

- Power consumption;
- Average cost per incident; or
- Average cost per incident cross referenced to the Signalling system prioritisation criteria.

The allocation of the different asset types to these different method of prioritisation appears to be logical and is aligned with the methods used in other asset groups.

Sections 5 and 6 contain an analysis of asset degradation and intervention options which have provided the basis for the policy statements.

Section 7 discusses output and funding scenarios and Section 9 contains the investment options considered both of which are discussed under sustainability in Section 6.3 below.

Section 8 contains the modelling approach which is discussed in Section 6.4 below on whole-life whole-system efficiencies.

Section 10 includes the asset policy statements by criticality band. The key change from CP4 is the move from age-based renewal criteria to condition-based renewal criteria and the fact that the interventions vary by route criticality. This has generally resulted in lower work volumes than CP4 with the exception of Signalling power supplies and conductor rail. Comments on the specific policy statements are provided in the following section.

6.2 Robustness

In general terms, the technical aspects of the electrical power asset policy are considered to be robust and deliverable within CP5. Some specific areas of concern, proposed for review and consideration prior to SBP, are discussed below:

1) Section 7.10.1 includes the statement 'The assumption for CP5 is that Network Rail will install real time load (amps and volts) measurement equipment and associated communications systems on its principal high voltage circuit breakers on the AC and DC electrification systems' which suggests that transducers will not be fitted to 750V DC circuit breakers. However, section 7.10.1 also includes the statement 'Costs will be incurred during CP5 in the installation of electrical measuring equipment (e.g. DC shunts, current and voltage transformers) on new circuit breakers and in retrofitting to existing circuit breakers where both practical and economic to do so', which suggests that transducers may be fitted to 750V DC circuit breakers.
2) Policy statement EP-1 'Network Management' does not address the management of electrification systems in terms of the monitoring of real-time electrical loadings against installed electrification system route capacity and does not address the following statement included in section 7.10.1'. Accurate load flow data will enable precise assessment of network capacity and the ability to respond quickly to the needs of TOCs and FOCs; with the added benefit that this efficiency will feed through to track access charges'.
3) Policy statement EP-11 'Load Monitoring' requires all new circuit breakers be fitted with transducers to capture real time current flows, however, the policy statement only requires existing 'node sites' to be retrofitted where it is economical to do so. The use of the term 'node sites' implies HV systems only and suggests a lack of clarity on what existing circuit breakers will be fitted with transducers. The policy statement lacks clarity and does not fully address the statement made in the final paragraph of section 3.2.2 '660/750V DC conductor rail electrification' on page 96 which states 'As with the 25kV AC overhead electrification the 660/750V DC electrification system is also lacking in real time load

management assets' and is unlikely to achieve the benefits listed in section 7.10 'Customer satisfaction' on pages 227 and 228 within the CP5 timeframe.

4) Policy statement EP-127 'Power Strategy' lacks depth in relation to the longer term bearing in mind the significant growth that has taken place over recent years. The policy statement only requires that a route based traction power strategy be produced for each electrified route and proposes that outline designs for increasing the available headroom of the system should be included in the Power Strategy.

5) EP-129 'Capacity Growth' requires that 'New and renewed assets should economically provide additional capacity and facilitate a minimum of 0.25% increase per year for the design life'. Load growth is known to be on average 1.6% over the last 20 years and electrification equipment asset lives are often in excess of 50 years. As before the use of the word 'should' does not provide a clear indication of commitment and the selection of such a low minimum value as 0.25% suggests that the capacity of new or renewed electrification equipment may well be exceeded before the asset is life expired.

6) To ensure compliance with policy statements such as EP-132 'Redundancy' is less straightforward as a significant amount of work is likely to be required to identify all those single outages, which would result in the inability of the electrification system to support the peak timetable. The policy statement does not address the provision of adequate electrification system route capacity in the short and longer term to meet the current and likely future TOC electrical load demand requirements, nor does it address the provision of electrification system route headroom.

7) For Network Rail to achieve compliance with the many policy statements in relation to the requirements for new or renewed electrification equipment such as EP-39 'New VCBs' and EP-120 'XLPE Cables' requires that the appropriate standards are checked or modified to ensure compliance and that procurement specifications are prepared in accordance with the relevant standards.

Finally, it is worth noting that a related ORR led workstream has been ongoing with respect to the Electricity at Work Regulations 1989 (EAW Regulations) and the lack of clear policy statements in the Electrical Power Asset Policy specifically targeting improving compliance for existing electrification systems and ensuring full compliance for new electrification systems. This was discussed in a separate challenge workshop with Network Rail which specifically discussed policy statement EP-115 'EAWR & BS 7671' which states Network Rail's policy with respect to improved compliance for Signalling power supplies. During this workshop Network Rail agreed

to consider what additional policy statements it could make to improve the compliance of electrification systems.

From an Asset Management perspective, the policy does not fully comply with the definition of robustness in terms of demonstrating that application of the Electrical Power Asset Policy will deliver the CP5 outputs. However, section 2 of the Electrical Power Asset Policy describes the historical performance of the Electrical Power assets which shows that both performance and condition have been relatively stable or improving over the last five years which would indicate that the current CP4 policy is robust in terms of delivering outputs. The key risk relating to the robustness of the Electrical Power Asset Policy is therefore the impact of the change from age-based to condition-based renewals and Network Rail should continue to develop the predicted performance and condition that can be expected from the application of this policy. The modeling of outputs is discussion further in section 6.3 below on sustainability.

6.3 Sustainability

The modelling of outputs within the Electrical Power Asset Policy is limited at this stage making sustainability difficult to demonstrate. The current policy includes some targets for capacity, remaining asset live, condition, reliability, availability and maintainability but it does not indicate whether these will be actually delivered through the application of the policy both within CP5 to demonstrate robustness and in future Control Periods to demonstrate sustainability.

Based on the analysis of CP4 outputs, there is no reason to believe that the policy will not continue to deliver these outputs but Network Rail will need to undertake further modelling work to demonstrate this. The biggest concern in this area relates to the management of capacity which was discussed in the section on robustness above.

6.4 WLWS Efficiency

The Tier 1 model for Electrical Power has used a number of different methods to determine the work volumes and costs within the IIP. Diagram 20 below shows the breakdown of the methods used to derive the renewal and maintenance costs for the ‘Current Railway plus Investments scenario.

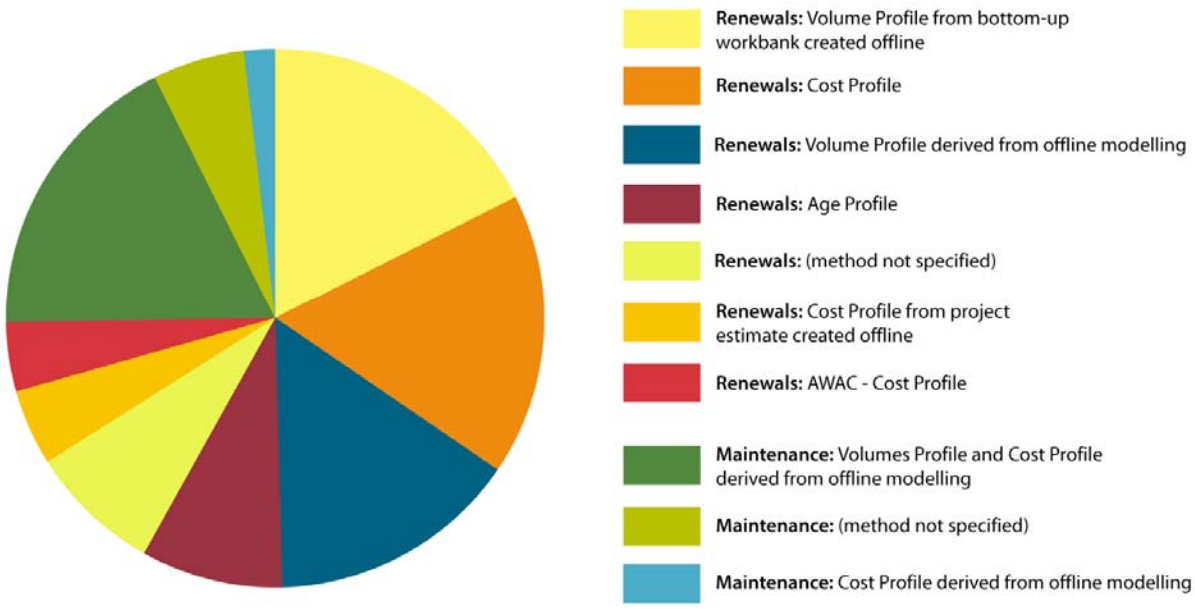

Diagram 20 Electrical Power Modelling Methods for IIP Costs

The sensitivity analysis undertaken by Network Rail on some of the modelled work volumes show that the work volumes and costs are very sensitive to the renewal criteria selected. For example, for conductor rail, the renewal criteria is defined as 25% of rail wear, but if this is changed to 28%, the work volumes and costs for the next five control periods reduce significantly.

Further work needs to be undertaken by Network Rail to identify the renewal criteria that have a large impact on work volumes and costs, and to provide the justification for these renewal criteria being optimal.

Additionally, the QRA that was presented by Network Rail does not appear to reflect the highly sensitive nature of some of the model outputs. This sensitivity, and the fact that the underlying asset information is less mature than for Track, would suggest that the QRA should be showing much higher levels of uncertainty for Electrical Power compared to Track.

Network Rail has developed a suite of Tier 2 models to analyse the whole life costs of different intervention scenarios. The following assets have been included in the first phase of the development of these models as these had been identified as the highest criticality asset types:

- HV switchgear;
- OLE;
- Conductor Rail;

- Signalling Power; and
- HV Cables.

An example output from these models is shown in Diagram 21 below for OLE which shows the whole life costs of different renewal scenarios.

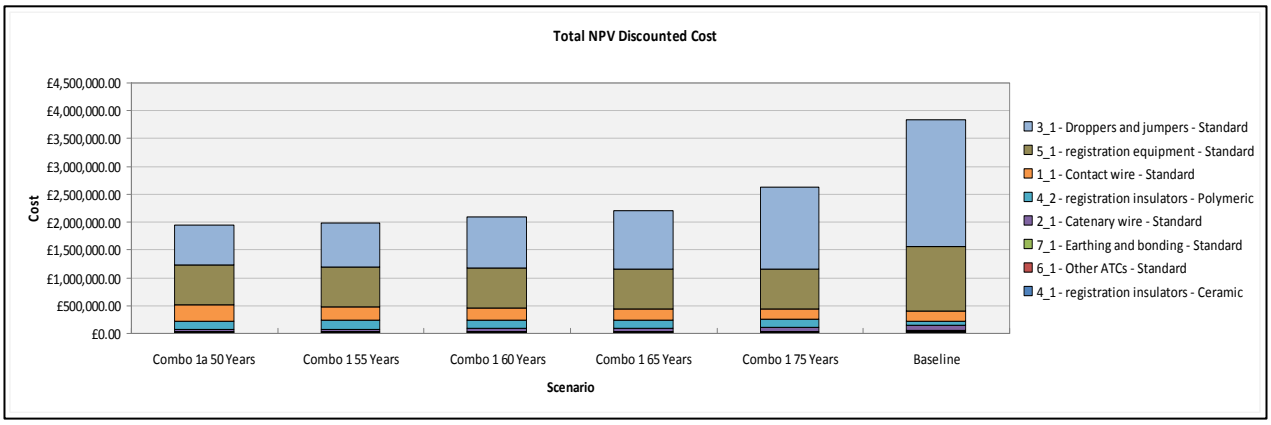

Diagram 21 OLE Whole Life Cost Modelling

At this stage, the application of the CP4 policy has not yet been modelled which will be important to demonstrate the impact of the change in policy from CP4 to CP5. It is understood that the outputs from the Tier 2 models have not been incorporated into the Asset Policy but Network Rail has advised that the early results from the modelling work are validating many of these policy choices. As these Tier 2 models have not been evaluated by AMCL, we cannot verify this at this stage.

In terms of the efficiency of the maintenance and inspection regimes within the Electrical Power asset policy, the work undertaken within OLE on risk-based maintenance represents industry best practice and this should be further developed for the other high criticality asset types.

6.5 Asset Knowledge

The policy appears to contain good basic asset data for populations and types of asset, but not failure and degradation data. A particular limitation is the understanding of the relationship between asset failure and impact on service and other outputs. This has prevented Network Rail from being able to robustly model the expected outputs from the application of the Asset Policy which in turn makes it difficult to demonstrate that the policy is sustainable, as was discussed earlier.

It is understood that the ORBIS project will be addressing these information needs over the next 12 months and that Network Rail's ability to undertake the modelling of outputs should be enhanced by the time of the SBP submission but this has not yet been validated by AMCL.

In addition to these improvements, Network Rail is also predicting savings of £23.3m across CP5 for Electrical Power in the ORBIS Vision and Roadmap document but it is not clear within the Electrical Power Asset Policy what activities in the ORBIS work plan will actually deliver these savings.

6.6 Proposals for SBP

The proposed developments for SBP for the Electrical Power Asset Policy are:

Robustness

- Improvements to demonstrate compliance with the Electricity at Work Regulations
- Improvements to address the concerns relating to the specific policy statements described in section 6.2.
- Improved predictions for condition and performance throughout CP5 that can be expected from the application of the CP5 Electrical Power Asset Policy.
- Clearer evidence that the asset information limitations are being addressed within the ORBIS project to enable Network Rail to demonstrate the electrical power asset policy is robust, sustainable and efficient.
- Provision of the rationale and justification for the 7% efficiency that is assumed, over and above the embedded efficiencies in the current policies, as a result of the improved asset information.
- Clearer evidence that the asset information limitations are being addressed within the ORBIS project to enable Network Rail to demonstrate the electrical power asset policy is robust, sustainable and efficient.

Sustainability

- Modelling of the predicted outputs that would be expected over the next five control periods from the application of the asset policy; and
- Comparison of these predicted outputs to the required outputs described in section 7 of the asset policy.

Efficiency

- Further sensitivity analysis to determine which asset interventions have the biggest impact on work volumes and costs;
- Further analysis of the asset interventions that have a high impact on work volumes and costs to demonstrate that the interventions represent lowest whole life costs;
- Further development of the QRA to more fully reflect the limitations and uncertainties associated with the asset information and modelling tools used to develop the work volumes and costs;
- Further development of the Tier 2 models to support the above analysis;
- Further rollout of the risk-based maintenance approach adopted within OLE to other high criticality Electrical Power asset types; and
- Provision of the rationale and justification for the £23.3m saving across CP5 identified in the ORBIS Vision and Roadmap document and greater clarity on the ORBIS activities that will actually deliver this benefit.

7 Telecoms

7.1 Summary and Changes since CP4

The September 2011 Telecoms Asset Policy is a considerable improvement on the previous policy in that it now follows the structure of the standard 10-step process. As a consequence, the document is more logical to read and provides a clearer argument for the final policy decisions.

Sections 1 and 2 provide an overview of the Telecoms assets including the expected 'exit forecast' for asset volumes at the end of CP4, and consideration of the age profile and condition of these assets. Section 2 includes consideration of the impact that Telecom failures have had on Schedule 8 payments over the period 2008/9 to 2010/11 – it is unclear why these statistics do not extend over a greater period of time as with the other asset groups (e.g. Track has 15 years of historical data). This data shows the 'Power Supply Charger' asset type appears to account for a high proportion of delay cost per incident – this is noted in the policy but not explored further. Safety Related Telecoms Failures (SRTF) are reported but only over the period 2007-2011 which is insufficient to show a meaningful trend.

The issues of systems obsolescence is discussed. It is stated that developments in technology are providing increasingly higher capacity but with limited backwards compatibility, and are therefore driving accelerated obsolescence and re-investment requirements. Cable theft is another issue given prominence as a 'key issue' but its performance impact on IIP is not clear.

Section 3 contains an analysis on asset criticality. The asset criticality is primarily based on safety impact (as measured by SRTF risk ratings) and operational consequences of Telecom asset failures. The asset type definitions show some inconsistency between sections 3.1 and 3.6; in particular the 'Stations Management System Control' type is shown as 'Very High' criticality in Figure 3.1 but this definition is absent from Table 3.6.

Section 4 contains an analysis of the route criticality with Telecoms Systems grouped according to the 'three core' services they provide as follows:

- Network Services - comprising equipment such as transmission systems (including the links for SSI), trunk cables and telephone exchanges that provide a wide area distribution of services;

- Railway Operational Services - services for railway operations such as safety critical voice communications between Signallers and Drivers to fixed lineside telephones and train borne radio systems such as GSM-R; and

- Customer Services - direct methods of communicating information to the travelling public via station information and security systems, and assists Station staff in passenger management.

The policy acknowledges that the route criticality assignments have not yet been explicitly used in the forecasting of work volumes and expenditures but anticipates that these will be by the SBP.

In general the Asset Criticality section would benefit from clearer explanation for SBP of how it will be used together with Route Criticality, and the stated approach to Asset Deterioration in section 5.2.6, in a single combined understanding.

Section 5 contains an analysis of asset degradation, but this is largely qualitative and does not appear to be based on accepted techniques for identifying functional failures, failure modes, and their consequences, such as FMECA (Failure Modes, Effects & Criticality Analysis). As a consequence the resulting summary table in section 5.4 is principally at 'system failure' rather than 'functional failure' level with the consequent risk that intervention strategies are not efficiently targeted; these intervention options are discussed in Section 6. Many unit costs associated with these interventions have not been provided (it is stated they will be available during December 2011) and these will need to be re-examined within the SBP submission.

Section 7 discusses output and funding scenarios, but these do not appear to align with stated IIP scenarios.

Section 8 contains the modelling approach which is discussed in the section below on whole-life whole-system efficiencies.

Section 9 contains the investment options considered.

Section 10 details the Asset Policy statements.

7.2 Robustness

The CP4 Telecoms policy was predominantly condition driven with longer term renewal forecasts based on a pre-defined lifespan (termed notional asset life). Earlier drafts of the policy

were clear on what these notional lives were for each asset type, but this information is referenced only in passing in section 8.3.2 in the CP5 policy, however these notional lives still appear to form a key part of the Tier 3 modelling and the subsequent derivation of renewal volumes.

The technical aspects of the policy appear to be logical and robust, but there is insufficient visibility of how unit costs will / have been used to justify decisions. Neither is it clear how this targeted approach is influenced by the ERTMS and National Operating Strategy (NOS).

The policy is based on an end-to-end service level approach which comprises the following factors:

- Maintenance, failure and renewal intervention requirements;
- Required system performance expressed as an overall service availability;
- Service restoration times and tolerable down times; and
- System status and monitoring requirements.

This approach is sound, however the information on which the analysis is based has not yet been assessed for how it will actually influence the outputs stated in section 7, nor has the impact of data quality on confidence in the outputs been assessed.

Without this analysis, although the methodology outlined in the policy appears technically robust, it is not yet been proven to deliver the CP5 outputs, and therefore the robustness of the policy is unproven.

Areas where it is considered robustness could be further demonstrated are:

- The clarity and application of asset criticality assessments;
- The clarity of alignment between ERTMS infrastructure plans and National Operating Strategy – which are stated as being major drivers for Telecoms renewals.

7.3 Sustainability

Based on the assumed output requirements for CP5, and the demand on the network remaining steady, the 2011 Telecoms Asset Policy should be sustainable. However, the policy is currently assessed as Amber in terms of sustainability as it does not demonstrate the forecasting and modelling of outputs, or show quantitive consideration of the impacts of schemes like ERTMS and NOS.

7.4 WLWS Efficiency

The Telecoms Asset Policy outlines a three-tier modelling approach as for Network Rail's other asset groups:

- Tiers 0 and 1 - strategic models for assessing the impact of policy on an asset base which is designed to forecast work volumes and costs for the whole asset base.
- Tier 2 - strategic models which are reported as being under development for specimen Telecoms asset and that calculate the whole life cost for an asset type, in effect establishing the minimal whole-life cost policy/rules for each individual asset type or assembly.
- Tier 3 - tactical models which support the identification and prioritisation of maintenance and renewal interventions. This is referred to in the policy as the 'Telecoms DST'.

The costs and volumes submitted for IIP are therefore based on the output of the Tier 1 model. In theory the Tier 1 model would model the selected policy when applied to the relevant workbank which would be developed based on the relevant rules and decision criteria established in the Tier 2 model. The Tier 3 models could then be used during implementation to prioritise work on the ground. At the current stage of development it is understood that the Tier 1 model utilises a workbank based primarily on the outputs of the Tier 3 model and is also informed by 'expert panel' judgement.

Whilst it is acknowledged that Tier 2 Whole Life Cost Models are being developed to better determine the appropriate notional lives, it appears that there are two potential disconnects for the IIP as follows:

1. The Tier 2 model doesn't currently prove that notional lives are the 'right' values for lowest whole life cost, other than in some initial examples.

2. The notional life is used as an input to the Tier 3 DST model, but is only sometimes the output. Whilst the DST output is normally influenced by notional life it appears it can be also be heavily influenced by periodic condition assessment whereupon the remaining life can be amended.

Diagram 22 shows AMCL's analysis of the current status of modelling methodologies in the Telecoms ICM, where 'Workbank' represents a bottom-up workbank approach, 'Off-line

Derivation' refers to input from a non-ICM source and 'Cost Profile' is based on historical costs.

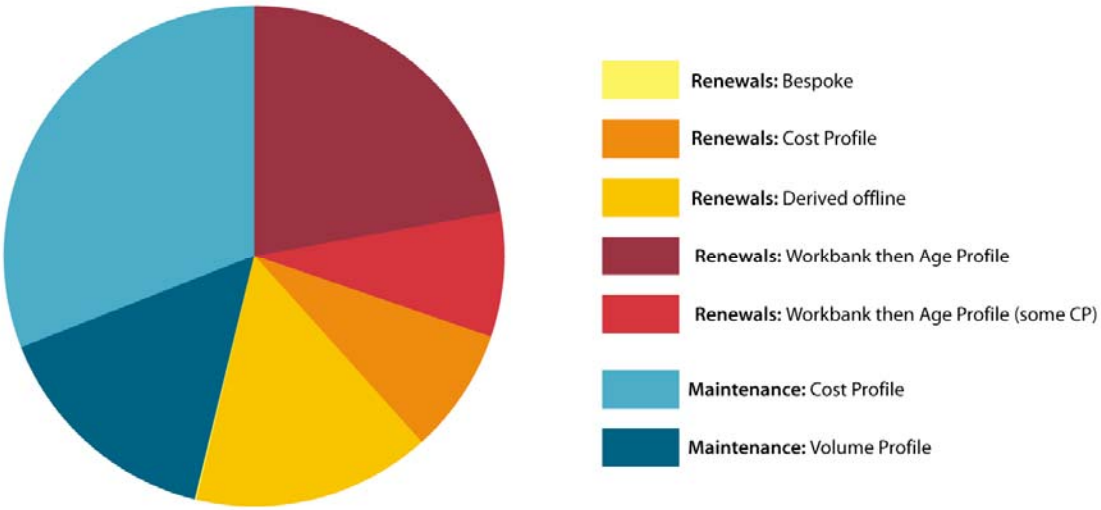

Diagram 22 Telecoms Modelling Methods for IIP Costs

This shows that a high proportion of IIP costs are not yet cost justified, but instead justified through historical cost profiling or derived from the Telecoms DST.

7.5 Asset Knowledge

The Asset Policy identifies a number of potential gaps in the asset data/information used in its development. It is reported in section 9.4 that the capabilities of the Tier 2 model are limited by the maturity of the unit cost and deterioration data. Confidence ratings will therefore need to be addressed prior to SBP.

It is reported that there is little or no empirical degradation data regarding the long term performance of components or assets as a whole and, hence expert analysis and judgement is utilised to provide a conservative estimate of the expected reliability and life of the asset.
Long term asset performance modelling will need to be undertaken to evaluate the impact of the proposed intervention regimes on asset degradation, and extension of techniques used within the Signalling discipline, such as RoSE and FMECA, should be considered.

7.6 Proposals for SBP

The proposed developments for SBP for the Telecoms Asset Policy are:

Robustness

- The clarity and application of asset criticality assessments; and
- The clarity of alignment between ERTMS infrastructure plans and National Operating Strategy – which are stated as being major drivers for Telecoms renewals.

Sustainability

- Demonstrate through forecasting and modelling that the stated interventions will deliver the required outputs;
- Show quantitative consideration of the impacts of schemes like ERTMS and NOS; and
- The acceptability of the stated service levels to customers, whether within NR or with TOCs/FOCs should be explicit.

Efficiency

- Develop and apply Tier 2 modelling to key asset types to demonstrate notional lives are the 'right' values for lowest whole life cost; and
- Demonstrate the alignment between the Tier 3, Tier 2, and Tier 1 models.

Asset Knowledge

- Maintenance Unit Costs (MUC) for each asset intervention should be provided;
- Response Unit Costs (RUC) for each asset intervention should be provided;
- Renewal Unit Costs (RWI – Repeatable Work item) for each asset intervention should be provided;
- The unit costs identified above should be used to confirm the cost justification of service levels and the means by which these have been chosen / selected; and
- The impact of data quality on confidence in the outputs should be addressed in conjunction with the ORBIS programme.

8 Conclusions

At this stage of the periodic review process for CP5, the 2011 Asset Policies represent good work-in-progress towards the development of robust, sustainable and efficient Asset Policies in time for the SBP. As well as the 10-stage development process, Network Rail has developed a three-tier modelling approach and notably a new suite of Tier 2 whole-life cycle cost models for each asset group. However, the strategic framework that defines how the different tiers of models and the Asset Policies are integrated as part of a holistic Asset Management process is still not fully developed and the interfaces between the models and the Asset Policies are not yet fully effective.

A summary of our findings are shown in Diagram 23 below, with a key as follows:

- **GREEN** indicates that, in our opinion, the policy fully meets the criteria for Robustness, Sustainability and Efficiency.
- **AMBER** means partially meets the criteria for Robustness, Sustainability and Efficiency but does not yet fully demonstrate compliance; and
- **RED** means there is little evidence that the criteria have been met.

It should be noted that the asset groups are listed in order of proposed spend for CP5, with Track having the highest proposed spend and Telecoms the lowest.

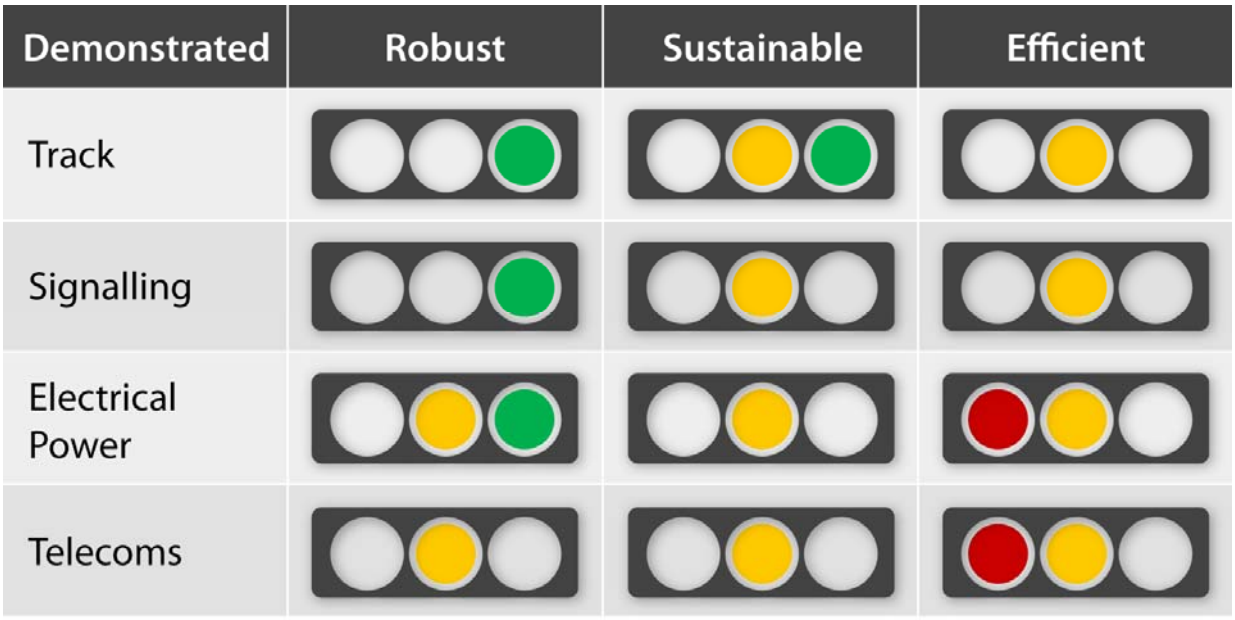

Diagram 23 Summary of Findings

This shows, for the asset groups within the scope of this mandate, that Network Rail has developed the Asset Policies furthest for those asset types with the highest expenditure, demonstrating a criticality based approach to the development process.

In terms of how this relates to expenditure in CP5, Diagram 24 below shows the proportion of CP5 expenditure that can be considered to be Robust, Sustainable and Efficient across the asset groups assessed by AMCL using the same key as above.

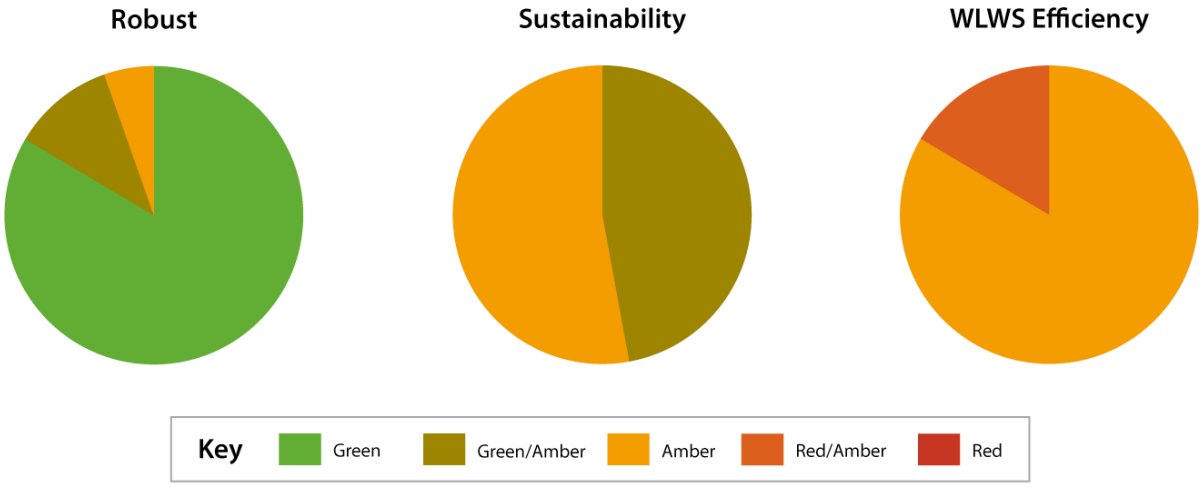

Diagram 24 Proportion of CP5 Expenditure by RAG category

This represents a reasonable position for Network Rail to have developed the Asset Policies by at this point in time but it also shows there is considerable work to do by the SBP if the majority of expenditure is going to be demonstrably Robust, Sustainable and Efficient.

Proposals have been made in the main body of this report for the further development of the Asset Policies prior to their next issue in January 2013, as part of the SBP submission. The following summarises AMCL's generic proposals for implementation prior to SBP which apply to all the Asset Policies reviewed:

- Development of the Asset Policies and models to consider a whole system approach, including interfaces with other asset groups and analysing the whole life costs of the overall system.
- Further development of Route Asset Management Plans to demonstrate a clear 'line of sight' between the Asset Policies and the bottom up costs and work volumes.

- Further development of the Tier 2 whole-life cycle cost models to validate the assumptions within the models, including degradation rates, and the intervention volumes proposed.
- Further integration of the Tier 1 and Tier 2 models and provision of greater assurance that the workbanks have been developed in accordance with the rules defined by the Tier 2 models and captured within the Asset Policies.
- Definition of the levels of outputs and remaining life that represent a sustainable level of investment.
- Modelling of relevant outputs that are expected to be delivered by the application of each of the Asset Policies over the next five control periods and comparison of these to the sustainable levels defined above.
- Further development of the Quantified Risk Assessment, which outlines uncertainty ranges for volumes and efficiencies, as an integral and clearly linked element of the models and Asset Policies.
- Greater clarity on the required improvements in asset information used to inform the Asset Policies and models for SBP and how these will be delivered through the ORBIS project.
- Greater clarity on the derivation of the efficiencies that will be delivered as a result of the improved asset information delivered through the ORBIS project.
- Clearer quantification of the embedded efficiencies within the CP5 Asset Policies when compared to the CP4 Asset Policies.
- Further development of maintenance strategies and the optimisation of maintenance and inspection activities on a cost-risk basis to achieve further scope efficiencies during CP5.
- Improved clarity on the nomenclature relating to the different options identified in Asset Policies to achieve specific output scenarios.

Specific proposals for development for Policies for each asset group prior to SBP are provided at the end of each asset group specific section (sections 4 to 7) and summarised in general form in section 3.

AMCL would like to thank contributing Network Rail staff for their time and patience in explaining the Policies and answering questions through both workshops and correspondence.