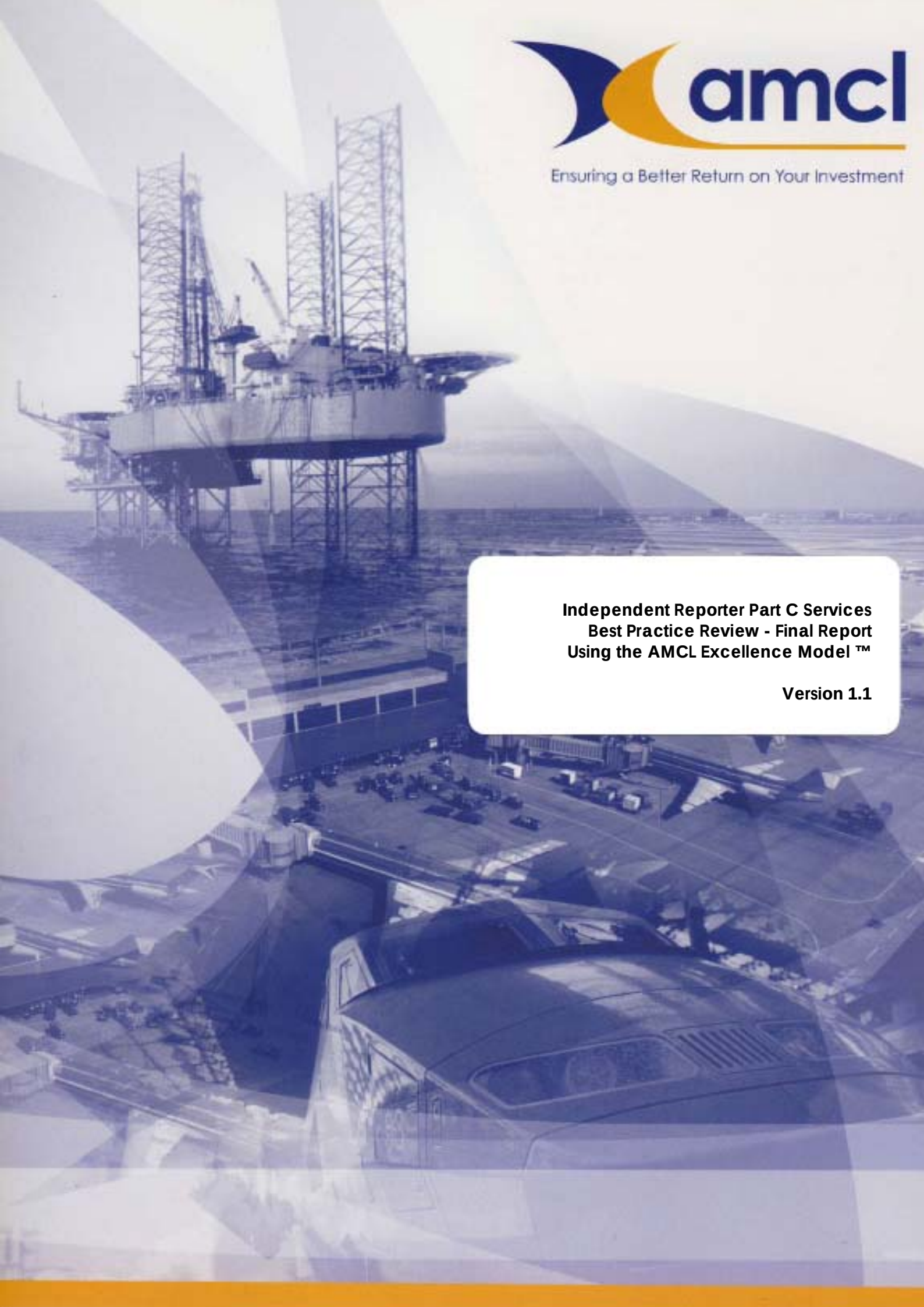

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Ensuring a Better Return on Your Investment

Independent Reporter Part C Services
Best Practice Review - Final Report
Using the AMCL Excellence Model ™

Version 1.1

A report for **Network Rail** and the **Office of Rail Regulation**
From
Asset Management Consulting Limited (AMCL)

6th February 2007

Independent Reporter Part C Services
Best Practice Review - Final Report
Using the AMCL Excellence Model ™

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Version	**Date**	**Amendment Details**
Draft A	21st Dec 2006	Initial issue for comment
1.0	5th Feb 2007	Updated following comments from Network Rail
1.1	6th Feb 2007	Further updates following comments from Network Rail

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Executive Summary

Asset Management Consulting Limited (AMCL) has been appointed as the Independent Reporter for Asset Management to both Network Rail and the Office of Rail Regulation (ORR). These services include the review and assessment of Network Rail's Business Planning and Asset Management activities.

In order to undertake this assessment in an objective manner, AMCL utilised the proprietary *AMCL Asset Management Excellence Model* ™ (AMEM). This model enables clients to assess their organisational capability against the twenty activities which span the range of technical, organisational and human capabilities needed to achieve world-class Asset Management.

During early 2006, AMCL undertook a high level assessment of Network Rail's Asset Management capabilities using the model. The preliminary outputs gave Network Rail and the ORR sufficient confidence to commission a full assessment which subsequently commenced in June 2006 and completed in December 2006.

This report contains the full assessment findings across the twenty activities.

Completion of the full assessment has confirmed our view that Network Rail has a high level of motivation and commitment to delivering improvements in its Asset Management objectives at both corporate and individual levels and that Network Rail appears to have made good progress towards a coherent and holistic Asset Management regime.

This review of Network Rail has led us to conclude that, in our opinion, Network Rail's maturity in Asset Management is at least comparable to that of other major infrastructure owners in the UK.

The development and implementation of Asset Policies has been confirmed as an area for significant further consideration. The impact that these policies have on corporate expenditure is extensive and developing optimised Asset Policies could deliver significant savings in both capital and operational expenditure. Some analysis on the potential size of this opportunity is included in section 10.2.

The following recommendations are made within the report:

1) It is recommended that the development of the Asset Policies and justifications is accelerated by significantly increasing the contribution of resources, time and effort, in particular for high criticality assets, in order to bring forward the savings that could be achieved through more focused and optimised policies;
2) It is recommended that feasibility studies should be undertaken to confirm the potential benefits available to Network Rail from adopting the Risk-Based Maintenance and Inspection opportunities identified in Network Rail's Asset Policies and consideration then given to accelerating this programme of work based on the results of these feasibility studies;
3) It is recommended that further work is carried out to fully map the processes within the Civil Engineering function to develop a more transparent understanding of how the Asset Policies are used to develop the work volumes and costs for structures and how these processes interface with the day to day operations within the Territories;
4) Finally, it is recommended that consideration should be given to the other findings and opportunities identified in Section 10.3 of this report.

AMCL would like to take the opportunity to thank all those in Network Rail who have participated for their cooperation and assistance with this assessment during 2006.

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1 Background and Provenance of the AMEM

Asset Management Consulting Limited (AMCL) has been appointed as the Independent Reporter for Asset Management to both Network Rail and the Office of Rail Regulation (ORR). These services include the review and assessment of Network Rail's Business Planning and Asset Management activities.

In order to undertake this assessment in an objective manner, AMCL utilised the proprietary *AMCL Asset Management Excellence Model* ™ (AMEM). This model enables clients to assess their organisational capabilities against the 20 activities which span the range of technical, organisational and human capabilities needed to achieve world-class Asset Management.

The AMEM has its origins in 10 years of best practice development from around the world. Perhaps the most notable source is the *International Infrastructure Management Manual*, originally published by the National Asset Management Societies of Australia and New Zealand. This has since been updated and published as the UK edition by the Institute of Asset Management (IAM)[1]. Many of the assessment criteria within the AMEM are derived from this.

More recent sources include the British Standards Institute's PAS 55, The *Specification for Optimised Management of Physical Infrastructure Assets* [2], produced in association with the Institute of Asset Management in 2004. The requirements of BSI PAS 55, along with other good practice tools and techniques identified by AMCL, were incorporated into the AMEM in 2005.

[1] The International Infrastructure Management Manual (UK Edition) is published by the IAM
[2] PAS 55 Part 1 (ISBN 0 580 42765 X) and PAS55 Part 2 (ISBN 0 580 42766 8) are published by BSI

2 Content and Structure of the AMEM

The AMEM has the following components:

- **Activities** provide a breakdown of the components of the Asset Management lifecycle
- **Assessment Criteria** describe how well organisations should perform to meet best practice
- **Questions** are designed to generate assessment evidence
- **Scoring scales** provide the means of judging the assessment evidence

2.1 Activities

The AMEM identifies 20 activities which together represent the breadth and depth of organisational capability needed to deliver best practice Asset Management. These are listed in Table 1 below.

Ref	Activity	Ref	Activity
0	Policy & Strategy Development	1.10	Asset Maintenance
1.1	Demand Analysis	1.11	Resource & Possession Management
1.2	Asset Knowledge Standards	1.12	Review & Audit
1.3	Asset Costing & Accounting	2	Asset Information Systems
1.4	Strategic Planning	3	Asset Data & Knowledge
1.5	Capital Expenditure Evaluation & Approval	4	Contract & Supply Management
1.6	Risk Assessment & Management	5	Organisational Structure & Performance
1.7	Asset Creation & Acquisition	6	Individual Competence & Behaviour
1.8	Asset Rationalisation & Disposal	7	Asset Management Plans
1.9	Incident Response	8	Sustainable Development

Table 1 Activities within the AMEM

These activities are prioritised for client organisations by examining the contribution each activity contributes to the Asset Management business objectives. This enables the assessments to focus on the assessment criteria for the high-priority activities of the business.

2.2 Assessment Criteria

Each activity within the model has between 3 and 20 assessment criteria that describe best practice Asset Management. The number of assessment criteria varies depending on the complexity of the activity. For example, Table 2 below shows the 5 assessment criteria associated with the activity *Demand Analysis*.

Activity	Assessment Criteria
Demand Analysis	1. Historical demand and traffic level data is managed and analysed efficiently and effectively
	2. Key demand drivers and their individual parameters are defined and understood within the business
	3. The process for future demand analysis is robust
	4. Gap analysis is undertaken to establish how to meet future demand requirements, including any historical shortfall
	5. The current and future state of infrastructure, assets and resources is considered as an integral part of demand analysis

Table 2 Assessment Criteria for Demand Analysis

2.3 Questions

Each assessment criterion has a number of questions that are used to assess an organisation's capabilities against the assessment criteria. For example, assessment criteria and questions for the assessment criteria *Historical Demand Data* are shown in Table 3 below.

Assessment Criteria	Questions
Historical demand data is managed and analysed efficiently and effectively	1. Is there an up-to-date database to store passenger demand data?
	2. Is there a process to ensure the passenger demand database is kept up to date and new sources utilised?
	3. Key demand drivers and their individual parameters are defined and understood within the business
	4. Gap analysis is undertaken to establish how to meet future demand requirements, including any historical shortfall

Table 3 Questions for Example Assessment Criterion

2.4 Scoring Scales

Reponses to the questions are based on a 0 to 4 scale and guidelines and example answers are provided to the assessors to ensure they evaluate an organisation's capabilities in a consistent manner. There are a number of scoring scales used depending on the type of question and Table 4 below shows the scoring scales for the questions relating to *Historical Demand Data*.

Questions	Scoring Scale
Is there an up-to-date database to store passenger demand data?	0 - Not at all 1 - Under development 2 - Partially developed 3 - Mostly developed 4 - Fully developed n/a - not applicable
Is there a process to ensure the passenger demand database is kept up to date and new sources utilised?	0 - Not at all 1 - Under development 2 - Partially developed 3 - Mostly developed 4 - Fully developed n/a - not applicable
Key demand drivers and their individual parameters are defined and understood within the business	0 - Never 1 - Rarely 2 - Some of the time 3 - Most of the time 4 - Always n/a - not applicable
Gap analysis is undertaken to establish how to meet future demand requirements, including any historical shortfall	0 - Not at all 1 - Superficially 2 - Just Adequate 3 - Fairly rigorously 4 - Very rigorously n/a - not applicable

Table 4 Example Scoring Scales

3 Description of the 20 AMEM Activities

The 20 activities that are assessed using the AMEM are described in more detail below.

1. Policy & Strategy Development

Policy and Strategy Development focuses on the ability of the organisation to develop and deliver effective Asset Management Policies and strategies. It examines the organisation's Asset Management policy and strategy, the process by which policies and strategies are decided and evaluated, the quality and relevance of the data and information used, the range of issues and options that are taken into account, and how well suited the senior team is to making these kinds of decisions.

2. Demand Analysis

Demand Analysis examines the processes used to assess the performance an organisation requires from its assets in terms of utilisation, capacity, reliability and safety. This includes comparing historical performance with historical demand and understanding the impact this demand places on assets. It also includes the assessment of future demand, the development of infrastructure requirements based on this demand and assessing the gap between the capacity and performance of the current assets and these infrastructure requirements.

3. Asset Knowledge Standards

Asset Knowledge Standards examines how well an organisation has defined a consistent structure and format for collecting and storing asset knowledge. This includes the definition of a common asset hierarchy, standards that define condition grades, common methods for categorising and recording asset defects and failures and the processes for consistently recording the performance and utilisation of assets.

4. Asset Costing and Accounting

Asset Costing and Accounting examines how well an organisation's processes for defining and capturing assets costs and risks support Asset Management decision making. This includes defining and capturing unit costs at an appropriate level to enable activity based costing, whether costs and asset valuations are determined on a whole-life cost basis and whether risks associated with asset renewals and other asset liabilities are systematically identified.

5. Strategic Planning

Strategic Planning examines the processes an organisation uses to undertake strategic Asset Management planning and how these processes are used to determine long-term renewal, enhancement and maintenance requirements. This includes assessing how the organisation addresses stakeholder requirements, demand analysis and performance requirements, including any financial and resource constraints, in developing these requirements. It also examines the techniques used in the strategic planning process to ensure an appropriate level of analysis has been undertaken to justify the renewal, enhancement and maintenance work volumes and costs based on the criticality of different assets. Finally, it assesses how the output from this analysis is documented in renewal and maintenance policies.

6. Capital Expenditure Identification, Evaluation and Approval

Capital Identification Expenditure Evaluation and Approval examines the processes for determining the capital expenditure requirements necessary to deliver the strategic plans and the approval and management of the relevant funding. This includes whole-life cost and benefit analysis to an appropriate level of detail based on the criticality of different assets, consideration of resource requirements, development of business cases to an appropriate level of confidence and the consideration of efficiencies through packaging of multiple investments. It also assesses the processes for the approval and releasing of funding, the monitoring and capture of actual costs and benefits and the processes of utilising historical performance to improve the capital evaluation of future projects.

7. Risk Assessment and Management

Risk Assessment and Management examines the policies and processes for identifying, quantifying and mitigating business risks. This includes the extent to which business and safety risk management processes are adopted across the organisation, how well risks are identified and quantified including probability and consequence analysis, how risks are mitigated to ensure they are ALARP and how risk mitigations are monitored and controlled. It also examines how an organisation addresses strategic and corporate risks and how these processes are integrated into other Asset Management business processes.

8. Asset Creation & Acquisition

Asset Creation & Acquisition examines how well an organisation's processes for acquiring and installing assets follow a systems engineering approach. This includes the consideration and apportioning of RAMS requirements, the consideration of interfaces with existing infrastructure, the functional and technical specifications, installation processes and acceptance processes including the comparison of delivered infrastructure with original RAMS requirements. This will also assess the overall project and programme management capabilities, including the consideration of systems engineering techniques.

9. Asset Rationalisation & Disposal

Asset Rationalisation & Disposal examines the processes an organisation uses to rationalise and dispose of assets. This examines opportunities for asset rationalisation due to changes in performance and capacity requirements, the consideration of costs and benefits of rationalisation using a whole life approach, the impact of asset rationalisation on other infrastructure and the processes for disposal of assets.

10. Incident Response

Incident Response examines the ability of an organisation to predict and respond to asset failures and non-infrastructure incidents in a systematic manner. A best practice incident response lifecycle is used to structure this assessment. This covers incident detection and identification, identification of appropriate response resources, information management and communications, competence of response teams, use of standard responses, temporary and permanent repair procedures, site access and handback, reporting, updating of asset information systems and response evaluation.

11. Asset Maintenance

Asset Maintenance examines both the processes used by an organisation to define appropriate maintenance requirements and the processes for ensuring these maintenance requirements are undertaken. The former include examining maintenance strategies and the extent to which these comply with Asset Management policies, criticality analysis to prioritise assets, the identification of risks and maintenance / inspection activities to mitigate the risks, the extent to which maintenance and inspection periodicities are based on an assessment of costs risks and the safety justification of the resulting maintenance requirements. The latter include examination of maintenance specifications and schedules, maintenance execution procedures, procedures for missed maintenance, resourcing

requirements and the capture and utilisation of maintenance and inspection measurements and results.

12. Resource and Possession Management

Resource and Possession Management examines how well an organisation plans and allocates resources to Asset Management activities and manages rail possessions to enable work to be carried out efficiently and safely. It covers analysis of current resources (people, plant, tools and materials) against future work demands, evaluation of work priorities and risks, use of project management tools and techniques to ensure efficient use of resources, optimisation of spares and inventory management, work programming, resource continuity and investment appraisal.

13. Review & Audit

Review & Audit examines an organisation's processes for reviewing and auditing the effectiveness of its asset management processes. It assesses the management processes for reviewing the performance of asset management activities including asset performance, asset condition, compliance with legislation and standards and the effective use of key performance indicators. It also examines internal assurance processes, audit policies and procedures, processes for internal audits, the use of third party audits, processes for reviewing audit findings and corrective actions and the use of external benchmarking.

14. Asset Information Systems

Asset Information Systems examines the systems an organisation has in place to support the Asset Management activities and decision making processes. This includes the identification of asset information requirements, examining how an asset information strategy and plan will deliver these requirements, the selection of appropriate technology for each system, the role of user groups. All key systems are then assessed against a range of assessment criteria to examine the extent to which they will deliver the requirements of the asset information strategy.

15. Asset Data and Knowledge

Asset Data and Knowledge examines the data and knowledge held within an organisation's asset information systems or in other media. This includes an assessment of data quality standards, the requirements for the population of different asset information systems in terms of population and level of quality defined within asset information plans and the assessment of asset data against these requirements.

16. Contract & Supplier Management

Maintenance organisations often depend on the capability of supplier organisations. This assessment addresses how well decisions are made on what should and should not be contracted out, requirements are defined, different forms of contract are used, suppliers are appraised and selected, supplier performance is assured, contractual and line management difficulties are resolved, supplier relationships are developed.

17. Organisational Structure and Performance

This concerns how well an organisation measures, develops and monitors its overall competence and performance across the range of technical, organisational and human capabilities needed to deliver world class Asset Management. The assessment focuses on the roles and responsibilities of key groups and individuals tasked with planning, implementing and evaluating Asset Management policy and strategy.

18. Individual Competence & Behaviour

This examines the ability of an organisation to systematically develop and maintain an adequate supply of competent and motivated people to fulfil its Asset Management objectives. The assessment addresses organisational culture, workforce attitudes and competence management. It covers recruitment and selection, training and development, assessment and appraisal, accreditation and control of work performance.

19. Asset Management Plans

Asset Management Plans examines how well an organisation has implemented its various Asset Management processes to produce a robust plan of activities for the forthcoming year across all disciplines. This includes the extent to which the activities and cost / risk schedules have been defined, the resource requirements necessary to undertaken the activities, evidence of whole life cost analysis, evidence that external stakeholder requirements and performance / condition requirements will be delivered and an assessment of how the organisation uses Research & Development and other sources of good practice to improve the efficiency and effectiveness of its operations.

20. Sustainable Development

Sustainable Development examines the processes an organisation has put in place to evaluate the social and environmental impact of its operations with a view to developing more sustainable methods of operation. This includes the evaluation of an organisation's

strategy for sustainable development including the impact of future legislation on costs and incentives on energy and emissions, its use of triple bottom line accounting and an evaluation of its operations against the five capitals model.

4 AMEM assessment methods

AMEM assessments involve gathering evidence, data, and other information through:

- Assessments undertaken by AMCL assessors; and
- Analysis of documents, data and other evidence.

The evidence gathered includes:

- Self-ratings produced using the scoring scales which accompany the question sets that are associated with each assessment criterion;
- Information given by individuals and teams to justify responses to questions; and
- Issues and concerns identified and discussed in the course of the process.

4.1 Types of assessment

Three types of assessment are carried out as follows:

- **High Level Assessments** provide a quick way of gaining an overview of organisational capability across the AMEM activities. They involve top teams being facilitated through self-assessment sessions and individual members of these teams completing self-assessment questionnaires. A cut down version of the AMEM is used. Document analysis and comparisons with published data and performance reports are used to check the reliability of assessment results.
- **Detailed Full Assessments** involve self assessments by top teams, activity related teams and/or groups of individuals. The results of all assessments are compared and compiled to establish overall results which are in turn compared with the findings of document analysis, published data and performance reports to check their reliability.
- **Detailed Activity Assessments** make use of the same methods and reliability checks as Detailed Full Assessments but focus only on AMEM activities which are considered most critical or where confidence is lowest.

For all types of assessment the scores for each question within an assessment criterion are averaged, and the scores for each assessment criterion within an activity are averaged to give an overall score for each activity.

4.2 Assessment outputs

Scores for each activity are presented using the maturity scale defined in the *International Infrastructure Management Manual*, which is shown in Diagram 1 below.

Question Scales	State of Maturity	Percentage
4	Excellence	100
		95
		90
		85
		80
		75
		70
3	Competence	65
		60
		55
		50
		45
		40
		35
		30
2	Systematic Approach	25
		20
1	Awareness	15
		10
0	Innocence	5

Diagram 1 IIMM Maturity Scale

Assessment results are presented in a graphical form, which readily demonstrates the strengths and weakness in an organisation's Asset Management capability.

5 Identifying improvements

Once an assessment has been completed, the outputs can be used to identify a structured programme of improvements. This is done using a five-stage process as follows:

Stage	Task	Note
1	Review weightings for each activity	Weightings are used to represent the level of importance of each activity to a particular organisation and is normally expressed as a percentage value chain. Different weightings can be assigned for the short-term (say 12 months) and long-term (say 5 years).
2	Set targets that define the level of capability an organisation is aiming to achieve for each activity	Again, short-term and long-term targets can be defined. These targets represent the improvement an organisation and its stakeholders which to achieve for each activity.
3	Establish the size of the gap between the current score and the target scores.	The size of the gap is then multiplied by the % weighing to give a weighted gap, which produces a prioritised list of improvements by activity.
4	Identify improvements that the organisation would need to put in place to close the gaps.	Guidance is available on how clients can choose the actions most likely to result in improvements in those activities where AMEM assessment results suggest they are weakest. This takes the form of decision flow charts based on an analysis of correlations between organisational characteristics, performance and AMEM results.
5	Determine the costs and benefits associated with these improvements	This is done to ensure there is sufficient payback and takes account of the costs and benefits other organisations have achieved through similar improvements.

An alternative approach to determining the short and long term targets is to identify all the improvements that an organisation would like to have in place by a given date, calculate the improved score those improvements would deliver and set that as the target for the appropriate year.

Follow-up AMEM assessments, typically on an annual basis, are used to review progress against the identified improvements.

6 Application of AMEM in Network Rail

6.1 Background to Commission

AMCL was appointed as the Independent Reporter for Asset Management to both Network Rail and the Office of Rail Regulation (ORR) in December 2005. These services include the review and assessment of Network Rail's Business Planning and Asset Management activities utilising AMEM.

A risk-based approach was taken to planning and conducting AMEM assessments to ensure they were proportional to the importance of each activity to Network Rail. A high level assessment was first undertaken in March 2006 to ensure that subsequent effort was expended in the assessment of activities which were considered more critical to performance, or where over-confidence, or a lack of confidence, was apparent. A joint review of the high level output by Network Rail and ORR led to a full assessment being undertaken with the outputs prioritised between June 2006 and December 2006.

This report details the assessment findings for all twenty activities.

6.2 High Level Assessment

The high level assessment was carried out in March 2006 and involved facilitated workshops with key Network Rail Managers (Andrew Newby, Gareth Jenkins, Martin Frobisher and Paul Wiseman). These workshops concentrated on scoring the high level version of the AMEM using these managers as a proxy for the whole of Network Rail. The output was used to help prepare for the full assessment by prioritising activities, identifying the correct people to interview within Network Rail, and identifying the evidence that could be used to validate the scores. The results are shown in Diagram 2 below.

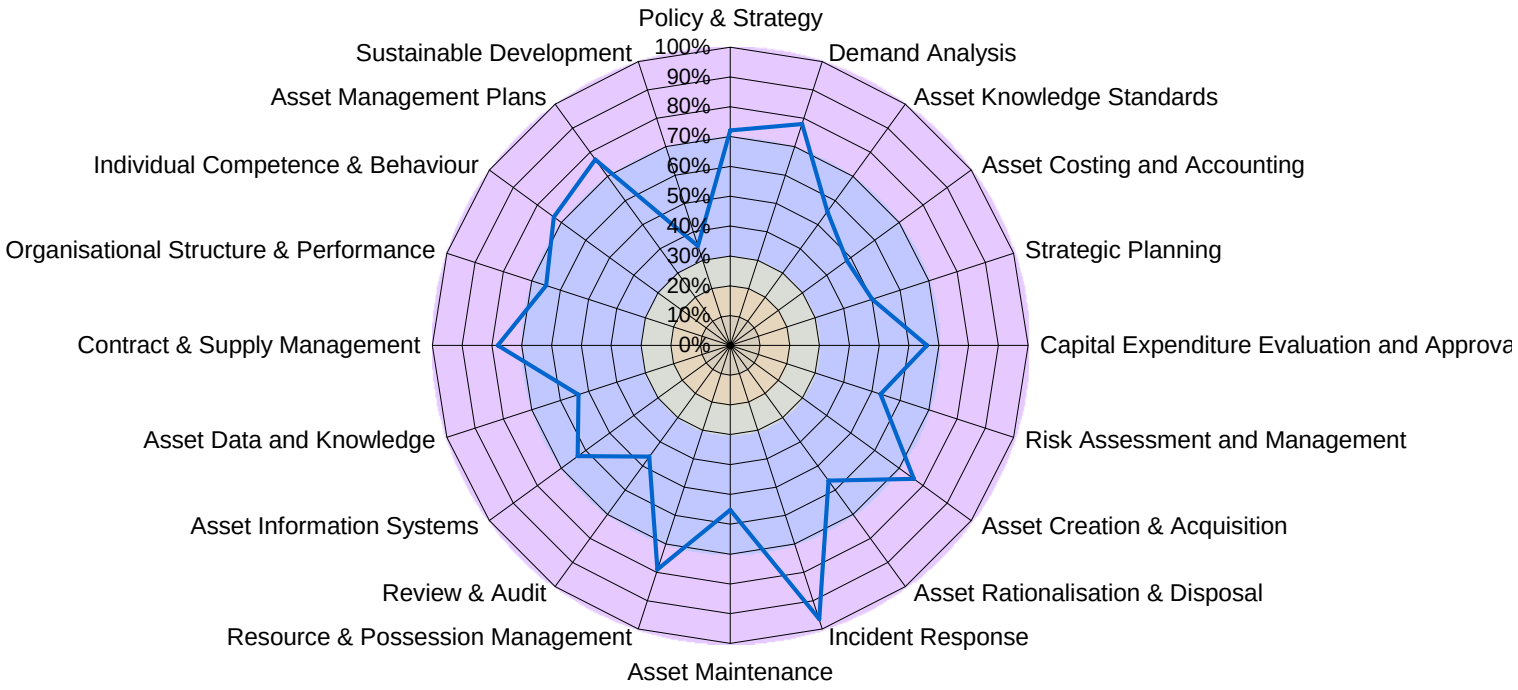

Diagram 2 High Level Assessment Output

6.3 Full Assessment

The full assessment began in June 2006 and was completed in early December 2006. It was structured into two phases as outlined in Table 5 below. The planned interview schedule included a total of 95 interviews which were spread across 91 personnel within Network Rail. The full assessment involved asking a more detailed set of questions, focused on each individual's responsibilities, and collecting specific documentation to evidence the scores.

AMEM Activity	Completion Date	No. of Interviews
Policy and Strategy Development	Phase 1 to September 2006	46
Demand Analysis		
Asset Costing & Accounting		
Asset Management Plans		
Asset Knowledge Standards		
Strategic Planning		
Capital Expenditure Identification, Evaluation and Approval Process		
Risk Assessment and Management		
Sustainable Development		
Asset Creation & Acquisition	Phase 2 to December 2006	49
Asset Rationalisation and Disposal		
Incident Response		
Asset Maintenance		
Resource & Possession Management		
Review & Audit		
Asset Information Systems		
Asset Data and Knowledge		
Contract and Supplier Management		
Organisational Structure & Performance		
Individual Competence and Behaviour		
	Total	**95**

Table 5 Full Assessment Timetable

Appendix A contains a list of the people interviewed and Appendix B contains a list of evidence collected in support of the statements given by interviewees.

7 Analysis and Interpretation of AMEM scores

A number of different scores can be derived from the AMEM question responses and these scores can be aggregated in a number of different ways. In the full assessment, the primary scores shown on the 'spider charts' are an un-weighted average of all ratings on all questions within an asset management activity. These scores give an overall indication of how well each asset management activity is undertaken.

However, these primary scores can disguise significant variation in performance within an activity. Two key sources of variance are taken into account in the assessment scoring:

1. Variability between sources for ratings for the same question within an assessment criterion - there are two causes of high variability amongst sources:

    a) Performance is inconsistent and varies considerably across different parts of the organisation, e.g. between track, signalling and structures;
    b) The sources themselves vary in quality and thus in the reliability of their evidence.

2. Variability between ratings for the various questions within an assessment criterion. The main source of variability between ratings on different questions is that the organisation has only partially developed its processes and systems for managing a particular assessment criterion. This indicates different levels of maturity within an assessment criterion itself.

These two sources of variability are tabulated below the 'spider charts' for each area of activity. The first figure indicates the variability in ratings between sources (based on interviewees and evidence), and the second the variability in scoring between the different questions within an assessment criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. This classification system is based on the average deviation statistic and tables of critical values developed by Dunlap et al (2003)[3].

[3] Dunlap, W. P., Burke, M.J. and Smith-Crowe, K. (2003) Accurate tests of statistical significance for r_{wg} and average deviation interrater agreement indexes. Journal of Applied Psychology, 88, 2, 356 – 362.

8 Assessment Findings

The summary results from the full assessment of the twenty activities are shown in Diagram 3 alongside the results from the high level review undertaken in March 2006.

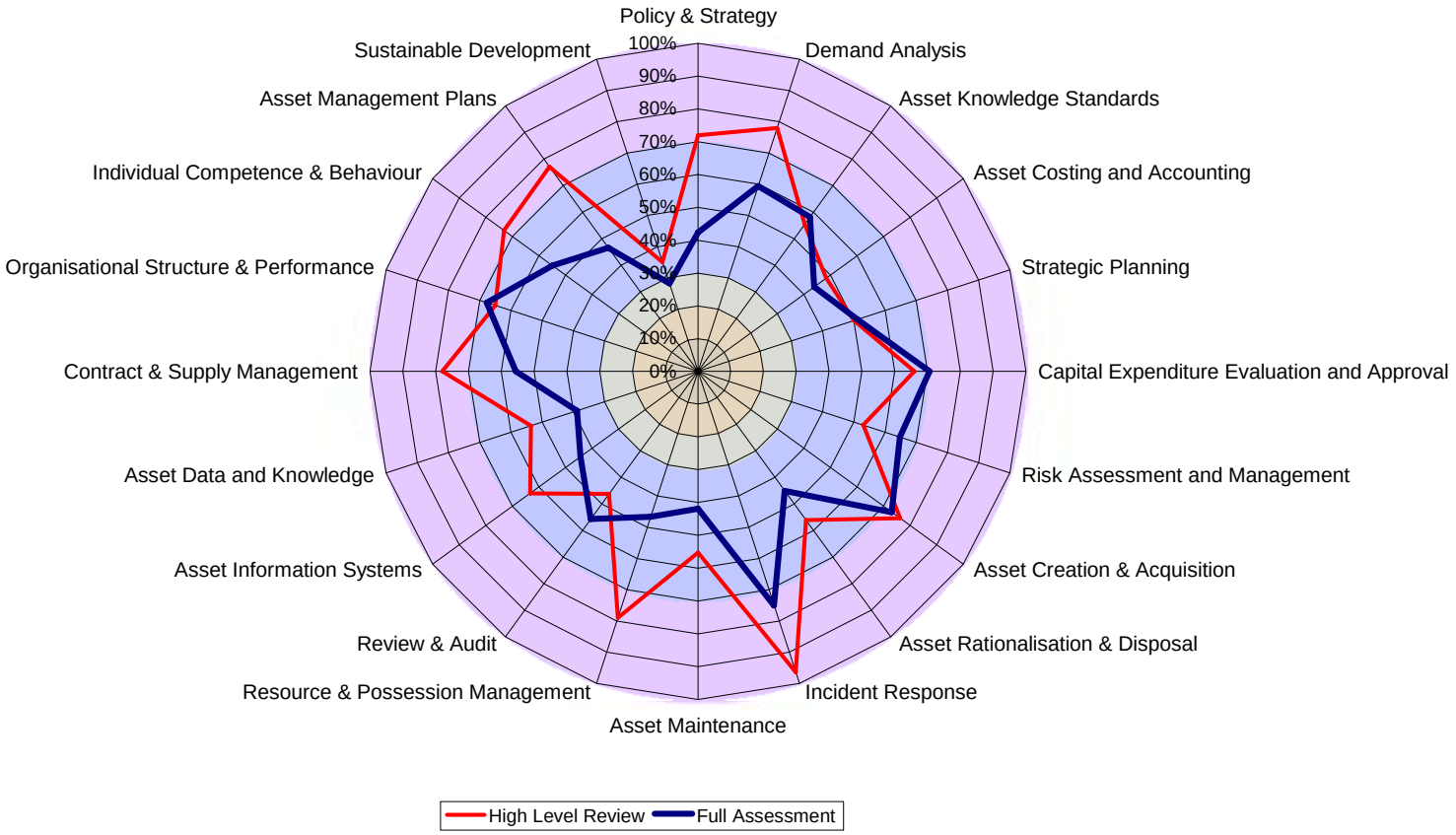

Diagram 3 Summary Results

As can be seen from the diagram, there are some differences between the high level assessment ratings and the ratings from the full assessment, but the relative strengths and weaknesses of the different activities is fairly consistent.

A detailed commentary on each of the twenty activities is included in the following sections.

8.1 Policy & Strategy Development

Policy and Strategy Development focuses on the ability of the organisation to develop and deliver effective Asset Management policies and strategies. It examines the organisation's overall Asset Management policy and strategy, the process by which policies and strategies are decided and evaluated, the quality and relevance of the data and information used, the range of issues and options that are taken into account, and how well suited the senior team is to making these kinds of decisions.

The results from the full assessment of *Policy and Strategy Development* are shown in Diagram 4 below alongside the results from the high level review undertaken in March 2006.

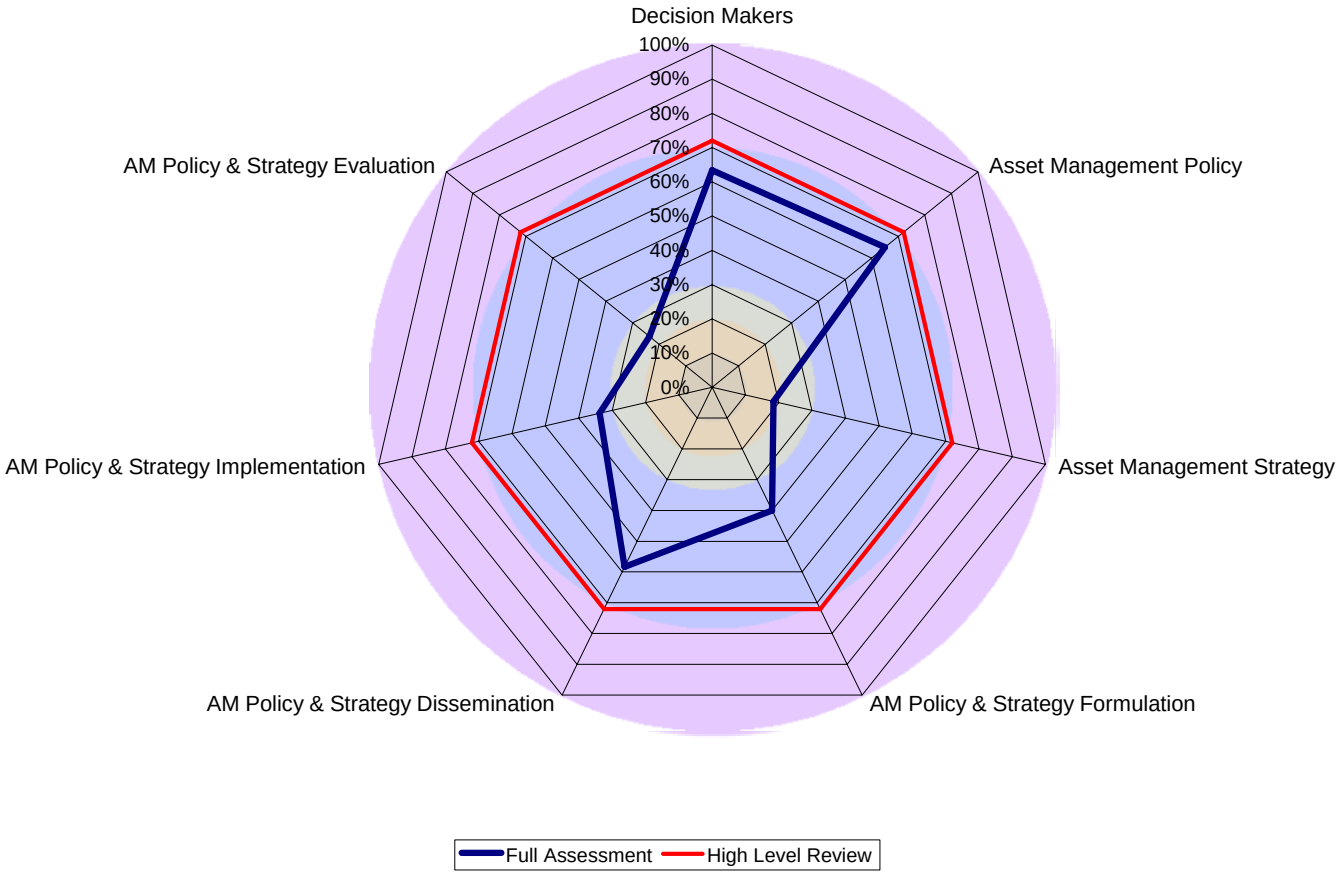

Diagram 4 Policy & Strategy Development

Table 6 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criterion. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Decision Makers
●	●	Asset Management Policy
●	●	Asset Management Strategy
●	●	AM Policy & Strategy Formulation
●	●	AM Policy & Strategy Dissemination
●	●	AM Policy & Strategy Implementation
●	●	AM Policy & Strategy Evaluation

Table 6 Variance confidence levels

The two highest scoring assessment criteria are *Decision Makers* and *Asset Management Policy*. The assessment highlighted that the senior team is committed to the advancement of Network Rail's Asset Management capability as evidenced for instance by the formation of the Asset Management Strategy Steering Group (AMSSG) chaired by the Director of Projects & Engineering, Peter Henderson.

An Asset Management policy, along with a suite of engineering discipline Asset Policies, was issued in June 2006. These have captured the engineering knowledge and experience that will deliver significant benefits to Network Rail through ensuring renewal and maintenance activities are undertaken in a uniform manner across the organisation. These policies, together with the other supporting processes, e.g. Business Planning Criteria, provide a strong foundation for further development.

The criterion that focuses on an organisation's Asset Management Strategy scored relatively low as Network Rail have not yet developed an overall Asset Management Strategy. Work has commenced on the development of an overall vision for engineering and Asset Management as part of Network Rail's world-class organisation programme. This work is identifying some significant opportunities for Network Rail that could be delivered through a step changes in technologies. An example given was the improved safety achieved from

both the introduction of ERTMS and the replacement of level crossings can be used to justify lighter trains, which in turn would significantly reduce the whole life costs of ownership of the track infrastructure. This longer-term vision is providing some challenges to the engineering organisation in terms of developing solutions at the right cost that will help to deliver the vision.

However, Network Rail have not yet produced an Asset Management Strategy that provides the route map to achieving this vision, including the strategy to further develop the existing Asset Policies to support the future vision. An Asset Management Strategy is a key element of best practice within the Asset Management Excellence Model. This element cross-references the requirements in section 4.2.2 of BSI PAS 55 [4] which states the following in respect of an Asset Management Strategy :

> *"The organisation shall establish and maintain a long-term asset management strategy. The Strategy shall:*
>
> *a) be derived from and be consistent with the asset management policy and the organisational strategic plan;*
> *b) be consistent with other organisational strategies;*
> *c) identify and clearly state the function(s), performance and condition requirements of its assets, asset types or asset systems as appropriate;*
> *d) take account of the risk assessment and identify those assets or asset systems that are critical;*
> *e) be optimised;*
> *f) provide sufficient information and direction, including an action plan with defined timescales and responsibilities, to enable effective asset management objectives, targets and plans to be produced;*
> *g) consider the lifecycle of the assets, asset types or asset systems;*
> *h) be reviewed periodically to ensure that it remains effective and consistent with the asset management policy and organisational strategic plan."*

The implementation of Asset Policies was also found to be inconsistent. For instance, there was a good level of awareness of the Signalling Asset Policy within the Network Rail Territories, but there was an inconsistent understanding of the status of the Track Asset Policy in both Headquarters and Territory staff; for example, the Area Track Engineer for Thames Valley was not aware that the June 2006 Track Policy even existed.

[4] PAS 55 Part 1 (ISBN 0 580 42765 X) and PAS55 Part 2 (ISBN 0 580 42766 8) are published by BSI

Another assessment criterion that scored relatively poorly was the evaluation of the Asset Management Policy and Engineering Policies. There appears to be no clear process to define success criteria and expected outcomes from the application of Asset Policies and to evaluate the success of the policies against the defined success criteria. An example of this is the maintenance organisation trying to reduce signalling failures to a predetermined target, but this target not necessarily being aligned with the expected reliability that would be achieved from the application of the signalling maintenance policies.

This is largely due to the fact that the current Asset Policy Justifications do not yet include the level of analysis that can demonstrate the expected costs, asset lives and reliability that will result from the application of these policies.

Improvement to Asset Policies, and in particular Policy Justifications, is potentially one of the biggest opportunities available to Network Rail. The policies were presented as evidence against several of the asset management activities. A particular opportunity is for the development of more robust Policy Justifications that undertake lifecycle cost analysis to identify optimum whole life costs and risks whilst taking account of the resource and funding constraints. These are called for in the pre-amble to the policies themselves, but have not yet been developed. A further opportunity is to provide greater clarity on the expected outputs from the adoption of a policy, e.g. expected life and expected reliability of the infrastructure. This will allow the formulation of success criteria to evaluate the outcomes of policy implementation.

The need for developing more robust justifications for these policies has been recognised by Network Rail and it is acknowledged that additional guidance is being prepared for further development of the Asset Policies and Policy Justifications that will address the above issues. These opportunities for further development of Asset Policies and Policy Justifications are potentially very significant and are discussed further in Section 10.2. When these improvements have been implemented, this will have a significant impact on improving the scores across a number of the activities in this best practice review.

8.2 Demand Analysis

Demand Analysis examines the processes used to assess the performance an organisation requires from its assets in terms of utilisation, capacity, reliability and safety. This includes comparing historical performance with historical passenger and freight demand and understanding the impact this demand places on assets. It also includes the assessment of future passenger and freight demand, the development of infrastructure requirements based on this demand and assessing the gap between the capacity and performance of the current assets and these infrastructure requirements.

The results from the full assessment of *Demand Analysis* are shown in Diagram 5 below alongside the result from the high level review undertaken in March 2006.

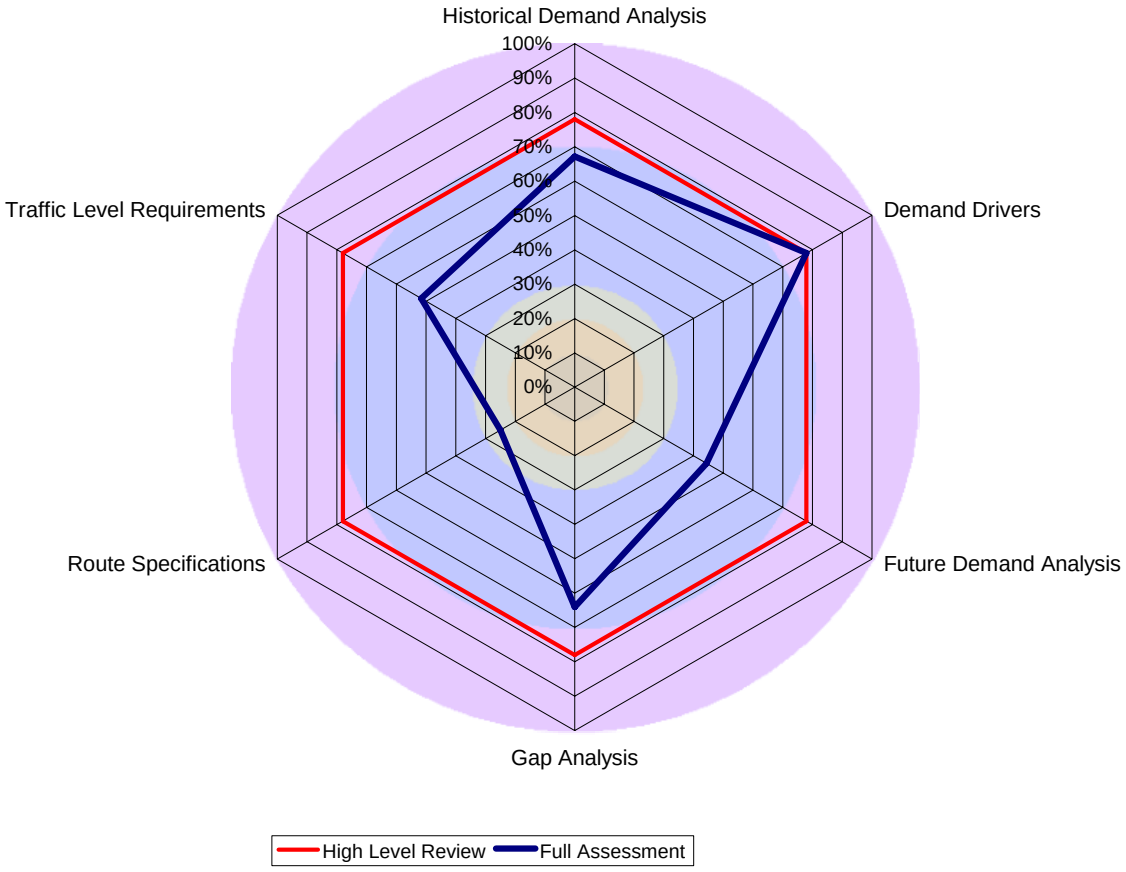

Diagram 5 Demand Analysis

Table 7 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Historical Demand Analysis
●	●	Demand Drivers
●	●	Future Demand Analysis
●	●	Gap Analysis
●	●	Route Specifications
●	●	Traffic Level Requirements

Table 7 Variance confidence levels

Demand analysis within the rail environment is made up of two distinct stages. Firstly, the understanding of changes in the levels of passenger and freight traffic must be achieved. Secondly, the impact these changes have on the infrastructure must be understood, so that maintenance and renewal strategies can be developed accordingly. Network Rail scores well on the first stage, but less well on the second. The current objective of the demand analysis process is to understand the traffic levels that will result from nationally increasing passenger and freight demand, and to use these to inform the TOC franchise agreement process and the setting of an affordable level of service by the Government.

Route Specifications is one of the key assessment criteria within *Demand Analysis* and had the weakest score within this area. This criterion requires the development of clear route specifications setting out the physical demands on the organisation's assets, and how this will affect their maintenance and replacement in the future. At the moment, the passenger and freight demand analysis results are captured in a range of systems and reports, for example POLKADOT, Route Plans and Route Utilisation Strategies, but these are not yet converted into route specifications that specifically define the requirements that the infrastructure needs to fulfil.

8.3 Asset Knowledge Standards

Asset Knowledge Standards examines how well an organisation has defined a consistent structure and format for collecting and storing asset knowledge. This includes the definition of a common asset hierarchy, standards that define condition grades, common methods for categorising and recording asset defects and failures and the processes for consistently recording the performance and utilisation of assets. The results from the full assessment of *Asset Knowledge Standards* are shown in Diagram 6 below alongside the result from the high level review undertaken in March 2006.

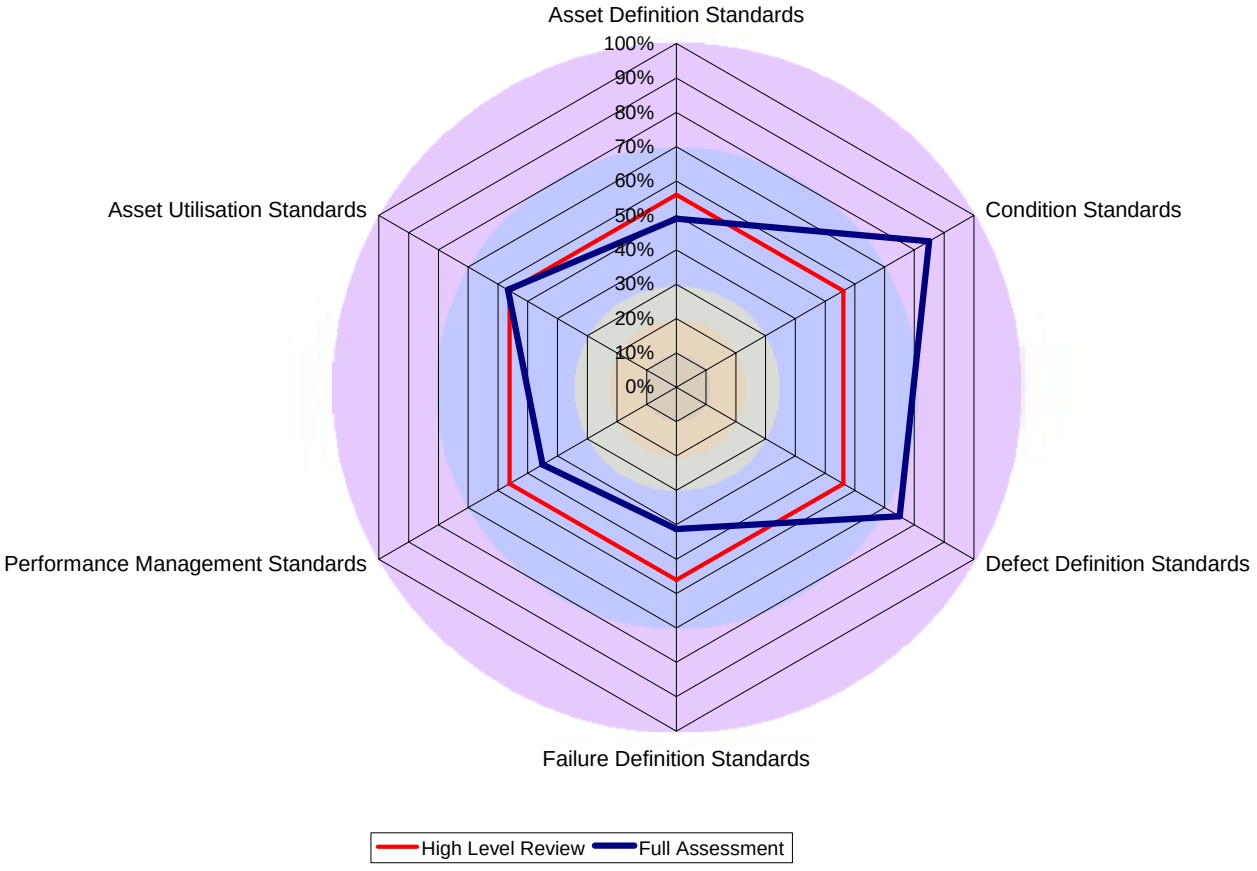

Diagram 6 Asset Knowledge Standards

Table 8 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot

modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Asset Definition Standards
●	●	Condition Standards
●	●	Defect Definition Standards
●	●	Failure Definition Standards
●	●	Performance Management Standards
●	●	Asset Utilisation Standards

Table 8 Variance confidence levels

Asset definition standards, which covers the definition of asset hierarchies and the data dictionary and assesses the consistency of definitions across the organisation, has scored relativity low compared to some of the other criteria in this area. However, weaknesses in these areas have already been recognised by Network Rail and the Asset Information Strategy project is addressing these areas of weakness.

Network Rail are particularly strong in the definition of standards and processes that define the mechanism for capturing asset condition, and the periodicity at which assessments should be undertaken, across all three asset groups assessed.

Although defect definition standards rates in the excellent band, this actually masks the fact that track and civils scored very highly but signalling relatively lower. The management of defects for track and structures are well documented in company standards. The management of defects for signalling is less well defined, although a company standard is currently being produced that will define how signalling defects, and the minimum actions associated with these defects, should be captured and managed within MIMS.

The weakest area in this section is the availability of standards and processes that define a common method of capturing asset failures, and more importantly, the failure modes or root causes of failure. Network Rail are in the process of publishing a company standard that will provide guidelines for data entry to FMS, the system where all failures are recorded. However, FMS has been in operation for two years and the absence of this standard until now is likely to have led to variable data quality in FMS. This will be further assessed in the *Asset Data and Knowledge* part of the assessment.

The method of capturing and managing performance data is well documented and clear specifications exist for recording train delay and the costs associated with this delay. One area of weakness relates to the combination of failure, defect and performance information. The information is collected in different systems and there are no standards in place to ensure that data from FMS and TRUST (for example) can be combined and analysed. There is a significant opportunity to develop specifications for how these information sets can be combined to ensure maximum value can be derived from historical data.

Asset Utilisation Standards cover the specification of how information relating to drivers of asset deterioration, other than age, is captured. This is well defined for track, where the key driver is tonnage and standards exist to ensure tonnage is defined and captured in a consistent way across the business. The drivers of deterioration for structures tend to be more complex and work is underway to assess the impact of other potential drivers such as the impact of severe weather and climate change. Once these are better understood, it will be necessary to define standards to ensure this information is captured in a consistent way.

For signalling, the main driver of deterioration is assumed to be time, although some early work has started in the fitment of data loggers on signalling equipment to capture usage information. No standards yet exist in this area for signalling.

8.4 Asset Costing and Accounting

Asset Costing and Accounting examines how well an organisation's processes for defining and capturing assets costs and risks support Asset Management decision-making. This includes defining and capturing unit costs at an appropriate level to enable activity based costing, whether costs and asset valuations are determined on a whole-life cost basis and whether risks associated with asset renewals and other asset liabilities are systematically identified. This part of the assessment is not examining actual unit cost data which is assessed under the *Asset Data and Knowledge* part of the assessment process.

The results from the full assessment of *Asset Costing and Accounting* are shown in Diagram 7 below alongside the result from the high level review undertaken in March 2006.

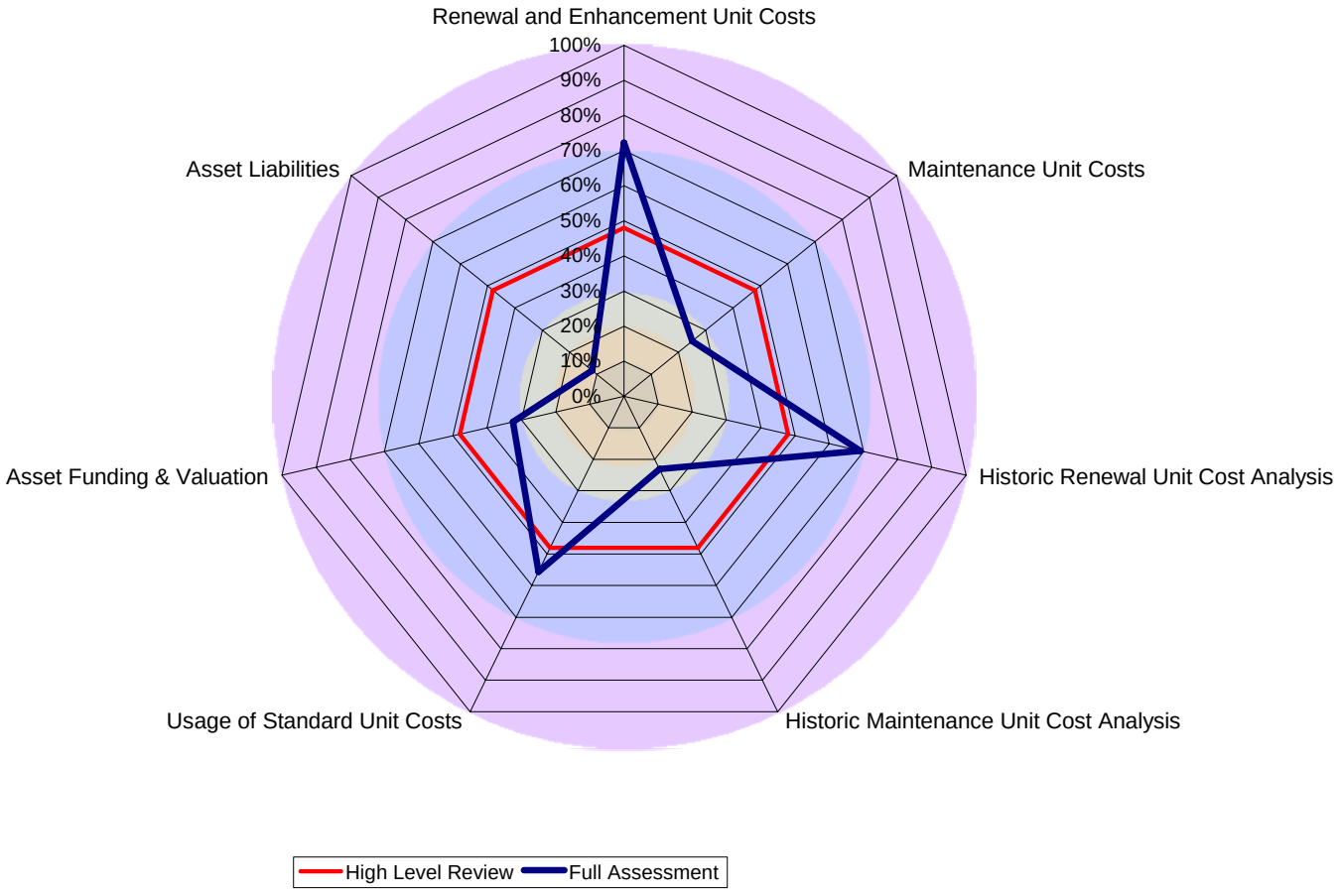

Diagram 7 Asset Costing and Accounting

Table 9 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟢	🔴	Renewal and Enhancement Unit Costs
🟢	🟢	Maintenance Unit Costs
🟢	🟡	Historic Renewal Unit Cost Analysis
🟢	🟢	Historic Maintenance Unit Cost Analysis
🟢	🟢	Usage of Standard Unit Costs
🟢	🟢	Asset Funding & Valuation
🟢	🔴	Asset Liabilities

Table 9 Variance confidence levels

A cost analysis framework has been developed by Network Rail to ensure renewal and enhancement unit costs are both defined and collected in a consistent manner. Network Rail score relatively highly in the two assessment criteria relating to defining renewal and enhancement unit costs and for having processes in place for capturing actual costs from projects undertaken. There is a clear definition of what is included in the definitions of unit costs although factors that cause unit costs to vary between projects are not yet fully understood. It is estimated by Network Rail that it will take between 3 and 5 years to collect enough reliable data to fully understand how different parameters affect the unit cost. Unit costs are held within the RIB database and regular reports are produced on both the value of the unit costs and also the variance. One observation is that the cost breakdown structure used for capturing renewal and enhancement unit costs does not always correlate well with the asset definitions and hierarchy defined in the Asset Information Strategy.

The process for defining and capturing unit costs for maintenance has scored significantly lower. The process is not as well defined or established and has currently only been defined for 18 key activities, 15 within track and 3 within signalling. The process for deriving the maintenance unit costs requires work volumes to be extracted from MIMS and cost data from BMIS and these are then combined. This ensures that the unit costs will be collected in a structure consistent with the Asset Information Strategy. Network Rail has already

identified a number of issues, in particular inconsistencies in work processes between areas and the quality of data within MIMS. There is an opportunity to extend this process to cover all key maintenance activities, but it would be beneficial to resolve the issues relating to the data quality and variability before extending the process to other key activities.

The best practice approach for determining long-term funding requirements and undertaking asset valuation requires future costs of ownership to be determined over the expected lives of the assets. These costs should then be discounted back to today's prices and the value of an annual annuity determined which is equivalent to this discounted cost. This provides a smooth funding requirement for the ongoing maintenance and renewal an organisation's infrastructure. This approach is also used as the basis for asset valuation in a similar way to the way the regulated asset based is calculated for Network Rail. Guidance has been developed by the National Asset Management Society (NAMS) of New Zealand to help organisations develop these best practices [5]. Although Network Rail undertake some of these activities, in common with most other UK organisations, it does not follow many of these guidelines and has been scored low accordingly. Although unlikely to be a short term priority, it would be beneficial to consider adopting the practices set out in this guidance to ensure future asset funding requirements and asset valuations for Network Rail's infrastructure are sustainable in the long term.

Network Rail has also scored relatively low on asset liabilities. This assessment criterion examines how well an organisation understands any future liabilities relating to its assets and how these are accounted for in the organisation's balance sheet. An example of this type of asset liability would be gauge corner cracking before the extent of the problem was understood and the appropriate mitigations were put in place. Although Network Rail identifies corporate risks, those that relate to future asset liabilities are not included in either the corporate balance sheet, or an 'Asset Management' balance sheet, as potential liabilities.

[5] NAMS Infrastructure Asset Valuation and Depreciation Guidelines, Edition 2.0, 2006

8.5 Strategic Planning

Strategic Planning examines the processes an organisation uses to undertake strategic Asset Management planning and how these processes are used to determine long-term renewal, enhancement and maintenance requirements. This includes assessing how the organisation addresses stakeholder requirements, demand analysis and performance requirements, including any financial and resource constraints, in developing these requirements. It also examines the techniques used in the strategic planning process to ensure an appropriate level of analysis has been undertaken to justify the renewal, enhancement and maintenance work volumes and costs based on the criticality of different assets. Finally, it assesses how the output from this analysis is documented in renewal and maintenance policies.

The results from the full assessment of *Strategic Planning* are shown in Diagram 8 below alongside the result from the high level review undertaken in March 2006.

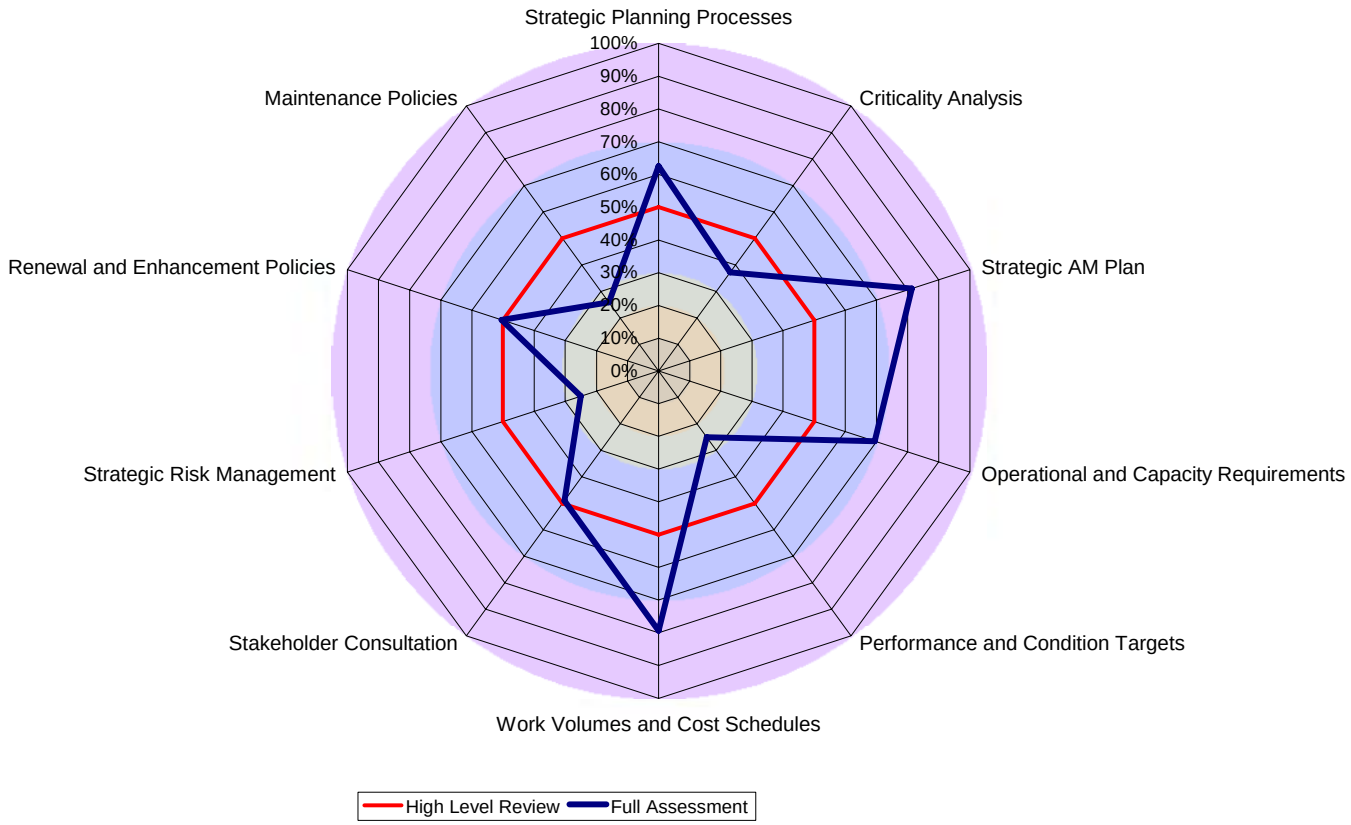

Diagram 8 Strategic Planning

Table 10 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Strategic Planning Processes
●	●	Criticality Analysis
●	●	Strategic AM Plan
●	●	Operational and Capacity Requirements
●	●	Performance and Condition Targets
●	●	Work Volumes and Cost Schedules
●	●	Stakeholder Consultation
●	●	Strategic Risk Management
●	●	Renewal and Enhancement Policies
●	●	Maintenance Policies

Table 10 Variance confidence levels

Network Rail score well on the strategic planning process as the Business Planning Criteria provide principles and guidance for the development of a strategic business plan. This document aligns well with good practice Asset Management and provides useful guidance for the development of business plans and Asset Policies.

The Initial Strategic Business Plan (ISBP) meets many of the requirements of a strategic Asset Management plan which includes work volumes and cost schedules and provides a strategic plan for each route. Two criteria have scored strongly based on the ISBP, the strategic Asset Management plan and the work volume and cost schedules. These strategic route plans will be further developed once all the Route Utilisation Strategies are complete.

Network Rail has decided to develop Asset Policies that set out the choice of technology, the renewal criteria and the maintenance regimes for each route category and major asset type. It is intended that for the majority of renewal and maintenance decisions, the analysis to determine the most appropriate, lowest whole life cost solution, will be undertaken once and included in the Asset Policy Justifications rather than repeat the analysis each time. The

work volumes and costs within the ISBP are derived using Network Rail's Infrastructure Cost Model (ICM) which applies these Asset Policies to Network Rail's infrastructure. AMCL has recently undertaken an audit of the ICM and the findings and recommendations from this audit can be found in the two audit reports [6].

There is therefore a very high reliance on the Asset Policies and Policy Justifications in determining the long-term work volumes and costs within the ISBP and on demonstrating whether these activities will deliver the required level of capacity, performance and asset condition. However, as discussed in Section 8.1, the Asset Policy Justifications need significantly more work in order to demonstrate the work volumes and costs within the ISBP are required and that these activities will deliver the required level of capacity, performance and asset condition.

The following assessment criteria have a low score to reflect the status of the Policy Justifications:

- Criticality analysis;
- Operational and capacity requirements;
- Performance and condition targets;
- Strategic risk management;
- Renewal and enhancement policies; and
- Maintenance policies.

As discussed earlier, these opportunities for further development of Asset Policies and Policy Justifications are potentially very significant and are discussed further in Section 10.2.

Additionally, the processes used within the Civil Engineering department for determining work volumes and costs for structures within the ISBP were found to be difficult to fully understand from the interviews undertaken and the evidence evaluated to date. Concerns were also raised in the ICM reports mentioned above that the methods used to determine the work volumes and costs for structures were not transparent. It is therefore recommended in Section 10.2.3 of this report that the Decision Support Tools and processes used to determine these work volumes and costs should be examined further in order to obtain a greater level of confidence in the processes used.

[6] ICM Phase 1 Audit Report, Version 1.2, 25th July 2006 & ICM Phase 2 Audit Report, Version 1.0 25th August 2006

8.6 Capital Expenditure Identification, Evaluation & Approval

Capital Expenditure Identification, Evaluation and Approval examines the processes for determining the capital expenditure requirements necessary to deliver the strategic plans and the approval and management of the relevant funding. This includes whole-life cost and benefit analysis to an appropriate level of detail based on the criticality of different assets, consideration of resource requirements, development of business cases to an appropriate level of confidence and the consideration of efficiencies through packaging of multiple investments. It also assesses the processes for the approval and releasing of funding, the monitoring and capture of actual costs and benefits and the processes of utilising historical performance to improve the capital evaluation of future projects.

The results from the full assessment of *Capital Expenditure Identification, Evaluation and Approval* are shown in Diagram 9 below alongside the result from the high level review undertaken in March 2006.

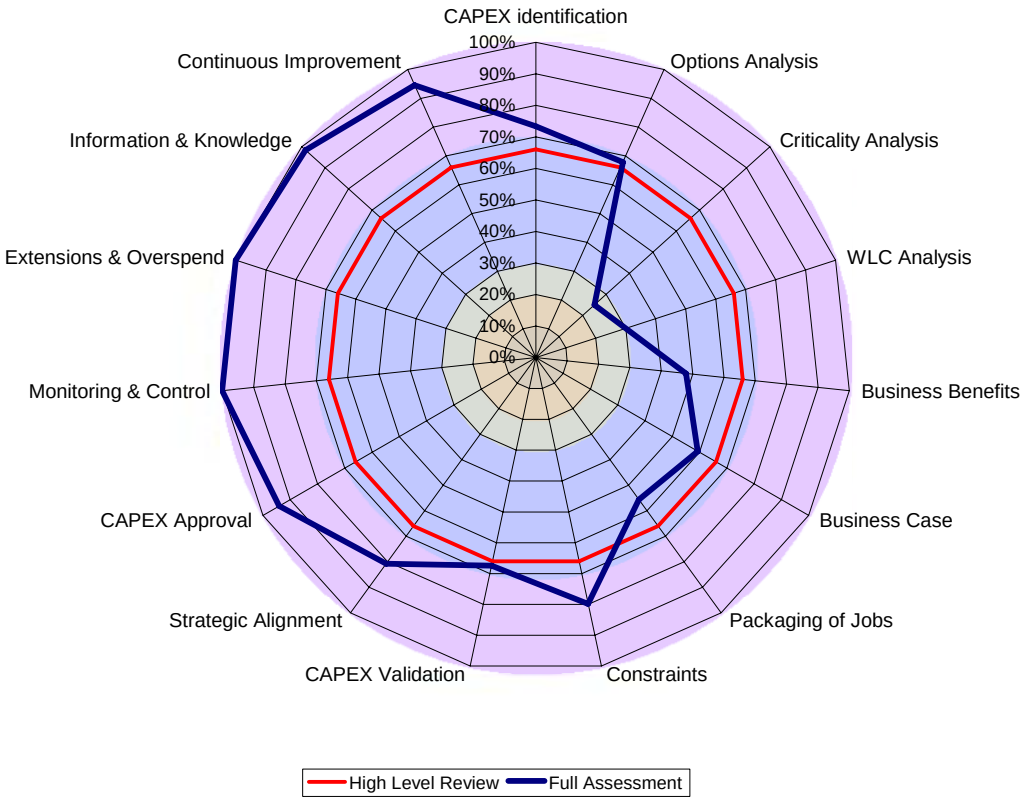

Diagram 9 Capital Expenditure Identification, Evaluation & Approval

Table 11 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟢	🟡	CAPEX identification
🟢	🟡	Options Analysis
🟢	🟢	Criticality Analysis
🟢	🟡	WLC Analysis
🟢	🟢	Business Benefits
🟡	🟢	Business Case
🟢	🟢	Packaging of Jobs
🟢	🟡	Constraints
🟢	🟡	CAPEX Validation
🟡	🟢	Strategic Alignment
🟢	🟢	CAPEX Approval
🟢	🟢	Monitoring & Control
🟢	🟢	Extensions & Overspend
🟢	🟢	Information & Knowledge
🟢	🟢	Continuous Improvement

Table 11 Variance confidence levels

The process for identification of renewals has scored relatively highly as the Asset Policies for signalling, track and structures provide reasonably clear criteria for renewals. Network Rail has well-established processes for the validation of potential renewals through a process of peer review by Territory Engineers and sample checks from Headquarters Engineers. Work banks for proposed renewals are developed several years in advance and are reviewed by other stakeholders within Network Rail, e.g. Route Directors.

Network Rail's Investment Regulations IR01 and IR02 set out the requirements for analysing whole life costs and developing business cases for asset renewals and enhancements. These regulations state that condition-led renewals that are compliant with Asset Policies do not require any further justification. This means the Asset Policies are key to determining appropriate criteria for renewal and the optimum choice of technology. It is also crucial, therefore, that the Policy Justifications demonstrate that the policies will deliver the required

capacity and performance at the lowest whole life cost of ownership within the financial and resource constraints upon Network Rail. It is estimated that 80 to 90% of Network Rail's renewals fall into this category and do not require individual justifications and business cases.

It is therefore important that the Asset Policy Justification provides at least the same level of justification as that required by the Investment Regulations. As previously discussed, the current Policy Justifications do not yet include this level of analysis and the following areas were therefore scored weakly:

- Criticality analysis;
- Whole Life Cost Analysis;
- Business Benefits;
- Business Case;
- Packaging of Jobs.

The *Guide to Railway Investment Projects* (GRIP) is a process supported by a suite of documentation that describes how Network Rail manages and controls projects that enhance or renew the infrastructure. It covers the project process from inception through to the post-implementation realisation of benefits. The GRIP, in accordance with the Investment Regulations, does require a more rigorous analysis to be undertaken to justify enhancements or renewals that are not compliant with the Asset Policies. The scores for the above assessment criteria reflect that this level of analysis is undertaken for this type of investment.

As discussed above, strategic processes for identifying, evaluating, filtering and prioritising investment needs, or the initial development of the outline business case for a project prior to its inception are not dealt with in GRIP.

Network Rail has developed this approach to managing investment projects in order to minimise and mitigate the risks associated with delivering such projects on an operational railway. The approach defines the investment project lifecycle, key products and controls that are mandatory when undertaking network investment schemes.

The approach is based on best practice within Network Rail, other industries that undertake major infrastructure projects and practice recommended by the major professional bodies. These include the Office of Government Commerce (OGC), the Association of Project Management (APM), PRINCE and the Chartered Institute of Building (CIOB). During the assessment, candidates demonstrated their familiarity with GRIP, and the evidence of compliance is abundant as it has now been established some time. As a consequence, assessment scores for these assessment criteria are high.

It was reported that a further development, *GRIP Lite*, was underway which would reduce the number of GRIP products required to be delivered depending on the value, risks, and standard nature of smaller investment projects by using a more templated approach.

Section 8.8 *Asset Creation & Acquisition* provides further detail on the application of the GRIP process, internal maturity assessments undertaken, and opportunities for the further development of GRIP.

8.7 Risk Assessment and Management

Risk Assessment and Management examines the policies and processes for identifying, quantifying and mitigating business risks. This includes the extent to which business and safety risk management processes are adopted across the organisation, how well risks are identified and quantified including probability and consequence analysis, how safety risks are mitigated to ensure they are ALARP and how risk mitigations are monitored and controlled. It also examines how an organisation addresses strategic and corporate risks and how these processes are integrated into other Asset Management business processes.

The results from the full assessment of *Risk Assessment and Management* are shown in Diagram 10 below alongside the result from the high level review undertaken in March 2006.

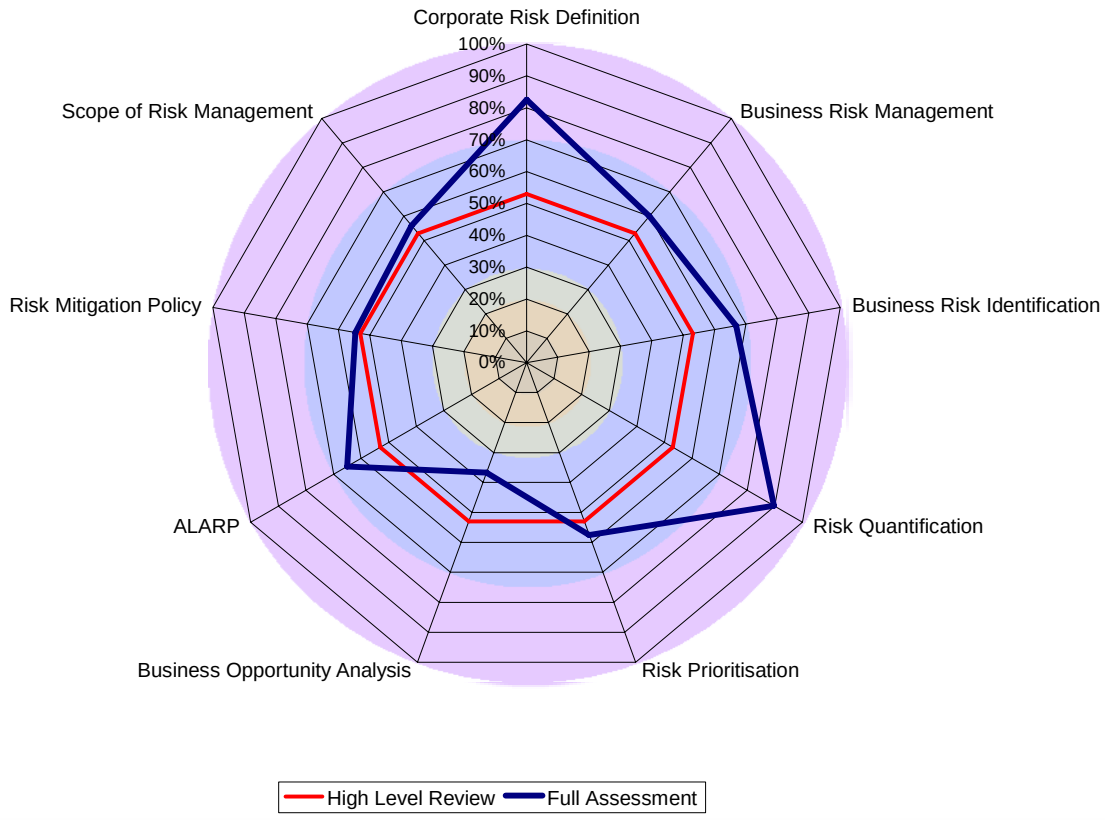

Diagram 10 Risk Assessment and Management

Table 12 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Corporate Risk Definition
●	●	Business Risk Management
●	●	Business Risk Identification
●	●	Risk Quantification
●	●	Risk Prioritisation
●	●	Business Opportunity Analysis
●	●	ALARP
●	●	Risk Mitigation Policy
●	●	Scope of Risk Management

Table 12 Variance confidence levels

The Risk Assessment and Management processes within Network Rail are quite new, and are using some best practice processes and tools. However, because these have only been introduced over the past 18 months, there is some work to do before they are embedded in the organisation and used to their full potential.

The Active Risk Manager (ARM) system is a well established and best practice tool for the management of risk across large organisations. The use of ARM within Network Rail originated within MP&I and is fairly well established there. Within the Maintenance and Engineering organisations it is less well established. Establishing the ARM system and the Integrated Risk Management Process (IRMP) firmly within Network Rail will be a challenging but essential next step.

The use of high-level Risk Maps to categorise and understand corporate risks at board level is also now a well established practice within Network Rail. However, these Risk Maps are not yet fully connected to the ARM system and this would be a sensible next step to ensure coverage and management of risks at all levels in the organisation, in particular for events or activities with high levels of risk or consequence.

The two assessment criteria with the highest scores were:

1) *Corporate risk definition* – Network Rail has been very successful since the introduction of its business risk management processes at defining and disseminating a very clear and best practice corporate definition of risk.
2) *Risk Quantification* – Network Rail has adopted the ARM system, and regularly utilises Risk Mapping at board level, to help identify, track, quantify and close out risks. This is all completed within a set of fit-for-purpose processes.

The two assessment criteria with the lowest scores were:

1) *Business Opportunity Analysis* – the culture within Network Rail is to view risk negatively, something that needs to be managed but cannot be harnessed for the corporate good. Although the various processes and guidelines encourage more positive behaviour, it was not strongly demonstrated during the assessment.
2) *Risk Mitigation Policy* – the ARM system and its attendant processes are in place but the adoption of these varies across the organisation as described above.

8.8 Asset Creation and Acquisition

Asset Creation & Acquisition examines how well an organisation's processes for acquiring and installing assets follow a systems engineering approach. This includes the consideration and apportioning of RAMS (Reliability, Availability, Maintainability, Safety) requirements, the consideration of interfaces with existing infrastructure, the functional and technical specifications, installation processes and acceptance processes including the comparison of delivered infrastructure with original RAMS requirements. This will also assess the overall project and programme management capabilities, including the consideration of systems engineering techniques and the arrangements for handback to operations.

The results from the full assessment of *Asset Creation & Acquisition* are shown in Diagram 11 below alongside the result from the high level review undertaken in March 2006.

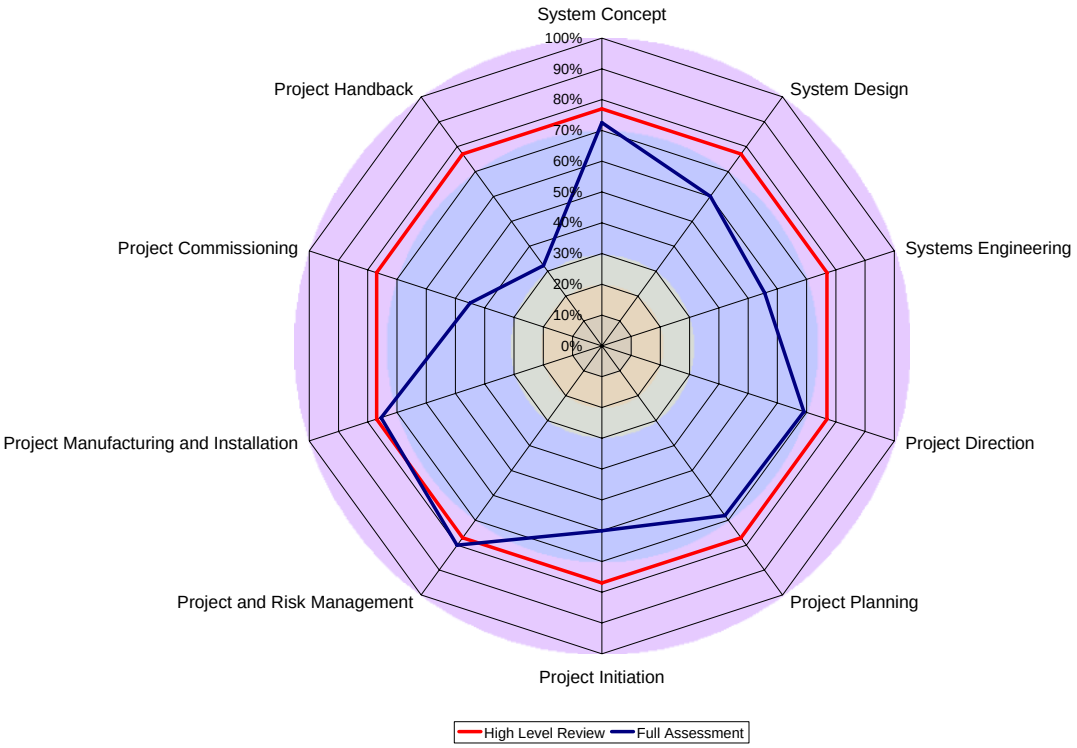

Diagram 11 Asset Creation & Acquisition

Table 13 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟢	🟡	System Concept
🟢	🟢	System Design
🟢	🔴	Systems Engineering
🟡	🟢	Project Direction
🟡	🟢	Project Planning
🔴	🔴	Project Initiation
🟢	🟢	Project and Risk Management
🟢	🟢	Project Manufacturing and Installation
🟢	🟡	Project Commissioning
🟢	🟢	Project Handback

Table 13 Variance confidence levels

Asset Creation and Acquisition is a relatively strong area for Network Rail due to the application and improvement of the Guide to Railway Investment Projects (GRIP) processes. In addition to the GRIP documentation, a significant amount of investment has been channelled into providing the organisation with world-class systems to help plan and manage large project portfolios (such as P3E and ARM). Both GRIP and the new systems are still in the process of being embedded within Network Rail, and despite the generally good scores in this area, it was felt that there is scope for improvement as the GRIP process and the new systems become fully utilised.

The GRIP guidelines have been in place for a number of years now, and have recently been streamlined and tailored for the individual disciplines within Network Rail to ensure that the most appropriate level of management of projects is applied according to the complexity and interdisciplinary nature of the project work. The new processes are being delivered to the organisation via a new web-based tool which is tailored for each discipline, known as the "knowledge hub".

These streamlined processes have not yet been fully implemented and the assessment was carried out on a mixture of current and future processes and practices. For all the disciplines, the list of GRIP products that are developed at each stage in the process have been rationalised to suit the discipline and complexity of the project, and have been more clearly defined and listed. In addition, the state of the three disciplines within MP&I assessed at the time of review were:

1) Track – the revised GRIP process for Track is currently being drafted and is due for implementation in January 2007. The main change is that it is an end-to-end revision of all stages of GRIP and not just those covered by the MP&I organisation. It is intended that the overall process will ensure a clearer division of the roles and responsibilities of the Maintenance, Engineering and MP&I functions, and that resources will be more sensibly apportioned between the stages.
2) Civils – the revised GRIP process for Civils has just been drafted and is due for implementation in January 2007. The main change within this is the ability to choose a predefined level of project management according to the complexity of the project. Low complexity projects are run with a GRIP 1-8 authority based on a standard method, medium complexity projects will be tracked using standard pro-formas for key deliverables, and high complexity projects will continue to be managed to the full GRIP process. This will mean low complexity projects will proceed through the stage gates more easily.
3) Signalling – the signalling discipline is continuing to work to the overall GRIP process. It is doing this because the projects it delivers are generally of a certain level of complexity that makes GRIP a sensible project management methodology to follow. However, one improvement is that signalling projects are categorised with complexity criteria inherent in this categorisation, which then influence the sophistication of GRIP application.

The recent revisions to GRIP will go a long way to ensuring the right level of governance is applied to the right projects. The GRIP tool will promote better compliance to GRIP as well as a greater ability to audit and visibility for continuous improvement.

Overall the findings for this area indicate two broad themes which can be summarised as:

1) Management of interfaces – the criteria related to interfaces, systems and stakeholders (*Systems Engineering, Project Initiation, Project Commissioning, Project Handback*) all score the lowest. This indicates that MP&I are not always communicating or supporting

other stakeholders sufficiently when they are delivering projects. This is particularly acute during the Project Handback stage, and also applies to the correct specification and validation of project benefits. This also applies to the *Project Direction* criteria, from the point of view that the Sponsor / Project relationship is not universally healthy. These are examples of how the excellent processes defined in GRIP are not always followed by the organisation.

2) Management of projects – the criteria related to the direct management and delivery of projects (*System Concept, System Design, Project Direction, Project Planning, Project and Risk Management, Project Manufacturing* and *Installation*) all score the highest. This is a direct result of the influence of GRIP over the last few years, and the organisational development of MP&I to efficiently deliver the appropriate level of GRIP compliance, culminating in the current discipline-specific revisions to the GRIP processes. Despite the good scores in this area, there is still scope for improvement as the new planning and risk management systems are fully embedded in the organisation, and ensuring compliance should now be a focus for Network Rail.

The two assessment criteria with the highest scores were:

1) *Project and Risk Management* – The GRIP process is based on a PRINCE2 style methodology for project and risk management. Network Rail project managers have available to them world-class project and risk management tools, and for the most part projects are executed in line with the plan. There is still scope for improvement however, as it is not felt that these systems are yet fully embedded into the organisation.
2) *Project Manufacturing and Installation* – There was clear evidence within the Signalling and Track disciplines that the control and interfaces with manufacturers during the implementation of projects was properly considered and carried out to high standards of quality and safety.

The two assessment criteria with the lowest scores were:

1) *Project close-out* – the project close-out stages within Network Rail are again governed by the GRIP process. Whereas the basic processes of commissioning and hand back of the system into service (see next criterion) are well established and essentially fit for purpose, the less immediately urgent areas of project review and ensuring the benefits of a project are captured have not traditionally been strong. This is reflected in the score; however the signalling area is beginning to remedy this with the production (so

far) of four full close-out reports, and the continuation of this practice in the future. The knowledge hub should help this area as it is effective at storing and mining data.

2) *Project hand back* – as with the project close-out criteria above, the basics of handing back the new system into service are relatively easy to achieve but are often neglected. Further opportunities exist to ensure elements such as training, spares and other support to the Maintenance and Operations organisations are fully provided to ensure that the full operational benefits of the new system are realised.

Network Rail MP&I has recently commissioned an internal "Project Management Maturity" review which published draft findings in September 2006 [7]. The methodology used for this review is based on a maturity model for project management capability, and is a far more detailed review of MP&I's activities than has been carried out within this assessment. The two reviews also cover different scopes, with this assessment concentrating more on ensuring the right asset is installed and validated as correct with respect to its RAMS requirements, and the Project Management Maturity model concentrating on the processes and disciplines within the project management activity. A comparison of the key findings from both reviews is:

1) Both assessments indicate that MP&I is performing relatively strongly in this assessment area.
2) The strongest areas under the MP&I review were:
   a. Process area – Work Management and Control. This is in agreement with the current assessment where the *Project Direction, Project & Risk Management* and the Project Manufacturing and Installation criteria all score in the "Excellent" band.
   b. Discipline area – Management of Scope and Procurement. There is no direct comparison within the current assessment but the *Project Direction* and *Project & Risk Management* criteria both describe how the project is managed and authorised by stages, and are in agreement with the MP&I review.
3) The weakest areas under the MP&I review were:
   a. Process area – Planning Stage. This is not fully reflected in this assessment, where Project Planning scores reasonably well. However, the evidence for this score was based on GRIP processes and the application of the P3E planning system, and

[7] Project Management Maturity for MP&I - Analysis and Recommendations for Improving the Company's Project Management Capability - Consolidated Report (Report 2), Martin Powell (Evidence item 337)

detailed analysis of the project plans was not undertaken, as it was within the Project Management Maturity review. This discrepancy is likely to be due to how well and consistently the planning process is actually applied in practice.

b. Discipline area – Project Quality and Integration. This is in agreement with this assessment, where the criteria relating to interfaces, systems and stakeholders (*Systems Engineering, Project Initiation, Project Commissioning, Project Handback*) score the lowest. There is also a specific recommendation in the report for improving project close-out activities.

8.9 Asset Rationalisation & Disposal

Asset Rationalisation & Disposal examines the processes an organisation uses to rationalise and dispose of assets. This examines opportunities for asset rationalisation due to changes in performance and capacity requirements, the consideration of costs and benefits of rationalisation using a whole life approach, the impact of asset rationalisation on other infrastructure and the processes for disposal of assets.

The results from the full assessment of *Asset Rationalisation & Disposal* are shown in Diagram 12 below alongside the results from the high level review undertaken in March 2006.

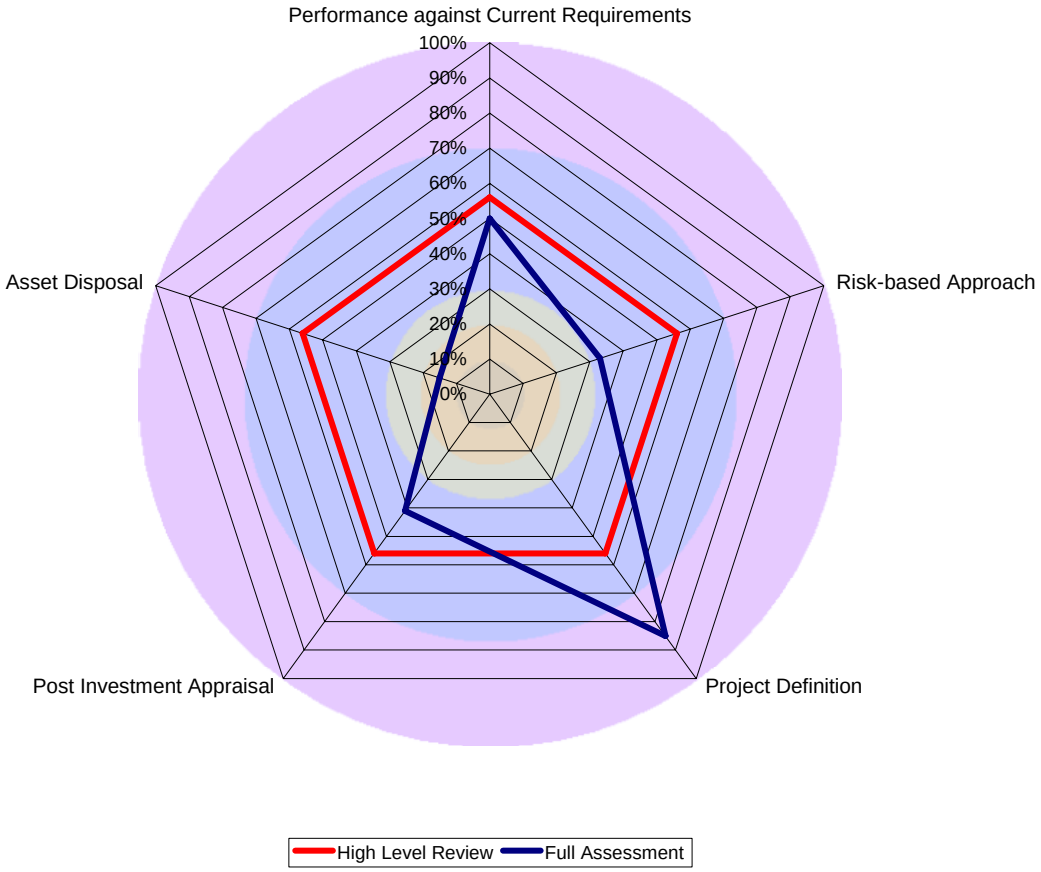

Diagram 12 Asset Rationalisation & Disposal

Table 14 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Performance against Current Requirements
●	●	Risk-based Approach
●	●	Project Definition
●	●	Post Investment Appraisal
●	●	Asset Disposal

Table 14 Variance confidence levels

Overall there is no dedicated asset rationalisation process, and the scores have been compiled with reference to the Network Change and GRIP processes as appropriate.

The two assessment criteria with the highest scores were:

1) *Project Definition* – this project definition criterion was scored against the GRIP process, which is Network Rail's project management and control process modelled on the PRINCE2 methodology. GRIP stages 2 and 3 require full project options development, including the consideration of asset rationalisation, and therefore this criteria scored well.
2) *Performance against current requirements* – The measurement of performance against current requirements was scored against the Network Change and other supporting processes (such as the RUS / Route Strategies and Route Plans processes). These are broadly external and internal consultation processes, and the only area of weakness was a formal review of RAMS requirements at this stage of asset rationalisation.

The two assessment criteria with the lowest scores were:

1) *Assets disposal* – No evidence was found within the Network Change or GRIP processes which specifically covered the cost-effective and ethical disposal of assets.

However these issues may well be dealt with within the procurement arm of Network Rail.

2) *Risk based approach* – The rationalisation processes, as discussed above, are mainly predicated on the understanding of demand and the needs of various internal and external stakeholders for rationalisation of the rail network, and the consequent options for achieving these aims. It is not evident that at any point an analysis based on the cost-risk trade-off of the removal, or indeed installation of new assets, is considered in depth. This strengthens the argument for the development of future "Infrastructure Requirements" as discussed within the Demand Analysis activity.

8.10 Incident Response

Incident Response examines the ability of an organisation to predict and respond to asset failures and non-infrastructure incidents in a systematic manner. A best practice incident response lifecycle is used to structure this assessment. This covers incident detection and identification, identification of appropriate response resources, information management and communications, competence of response teams, use of standard responses, temporary and permanent repair procedures, site access and handback, reporting, updating of asset information systems and response evaluation.

The results from the full assessment of *Incident Response* are shown in Diagram 13 below alongside the result from the high level review undertaken in March 2006.

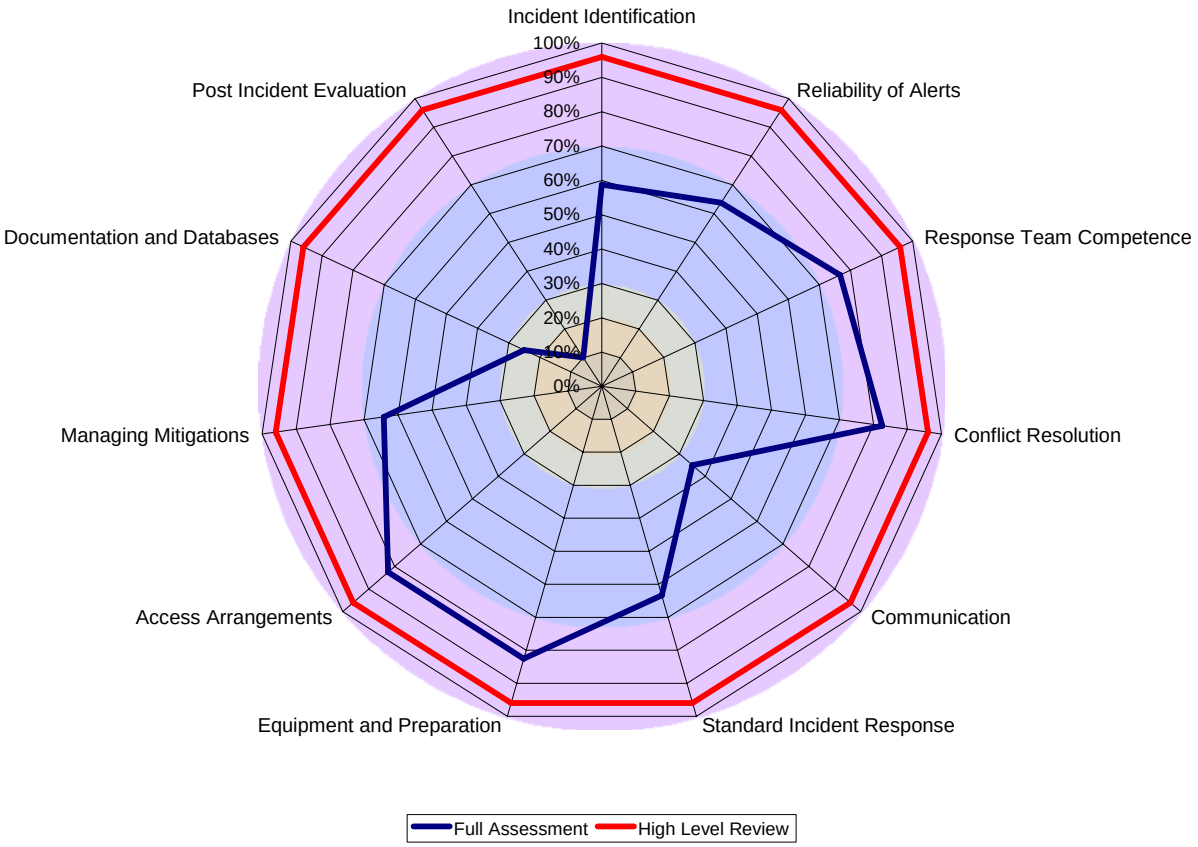

Diagram 13 Incident Response

Table 15 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Incident Identification
●	●	Reliability of Alerts
●	●	Response Team Competence
●	●	Conflict Resolution
●	●	Communication
●	●	Standard Incident Response
●	●	Equipment and Preparation
●	●	Access Arrangements
●	●	Managing Mitigations
●	●	Documentation and Databases
●	●	Post Incident Evaluation

Table 15 Variance confidence levels

It should be noted that the assessment of Incident Response was limited as only half the planned interviews were able to be completed due to difficulties identifying and securing time with the appropriate personnel, and only Signalling was explored at the Response Team Leader level. Based on this limited assessment, the full assessment scored significantly lower than the high level assessment.

The main themes identified are that the process of getting competent, well supplied and prepared response teams to site and effectively closing out faults and incidents are the key areas of strength, whereas the strategic preparation for managing a range of incidents and feeding back lessons learned could be improved. Much of the improvement in coordination and management of faults and incidents can be attributed to the adoption of joint fault and operations controls which effectively manage the incident lifecycle, and improvements in the supply of equipment and information to response teams. It was also interesting to note that condition monitoring infrastructure is now slowly starting to become widespread and reliable enough to improve the prediction and rectification of faults and incidents at several locations.

The three assessment criteria with the highest scores were:

1) *Conflict Resolution* – The Infrastructure Fault Controls (IFCs) play a crucial role in resolving prioritisation conflicts and managing response resources. The IFCs work to pre-agreed processes, procedures and local arrangements to ensure that the number, size or type of incidents they manage will for the vast majority of the time have the an appropriate level of technical or managerial resource allocated for its lifecycle.
2) *Equipment and Preparation* – The response teams seem generally to be well prepared both in terms of the physical equipment, spares and information they require for the incidents and faults they have to attend. This view was based on a limited sample and may vary more if further samples were taken.
3) *Access Arrangements* – Access to the line is governed by the Rule Book and local arrangements and is quite sensitive to local relationships between the Signallers and response teams. Within the areas assessed, there did not appear to be many problems with this relationship and as a result this criterion scored well.

The two assessment criteria with the lowest scores were:

1) *Documentation and Databases* – This criterion looks at the arrangements for recording the details of an incident and using this information to effectively close down the incident. FMS is the main tool for managing incidents and recording details and is not considered to be intuitive, easy to use, or reliable. These facts mean that IFC controllers are prone to taking short-cuts or missing information when their workload increases above a certain level. It is the responsibility of the IFC controllers to chase down post-incident actions before the incident can be closed off but this is done ad-hoc, and could be improved through the generation of regular “outstanding fault” logs which it is understood FMS cannot produce.
2) *Post Incident Evaluation* – The processes for evaluating incident response performance do exist, but are inconsistently applied, or only applied for incidents above a certain level of delay. The mechanism for methodically evaluating lessons learned and spreading these throughout the rest of the organisation, or improving the local organisation to ensure they are not repeated, was not strongly demonstrated during the assessment.

8.11 Asset Maintenance

Asset Maintenance examines both the processes used by an organisation to define appropriate maintenance requirements and the processes for ensuring these maintenance requirements are undertaken. The former include examining maintenance strategies and the extent to which these comply with Asset Management policies, criticality analysis to prioritise assets, the identification of risks and maintenance / inspection activities to mitigate the risks, the extent to which maintenance and inspection periodicities are based on an assessment of costs risks and the safety justification of the resulting maintenance requirements. The latter include examination of maintenance specifications and schedules, maintenance execution procedures, procedures for missed maintenance, resourcing requirements and the capture and utilisation of maintenance and inspection measurements and results.

The results from the full assessment of *Asset Maintenance* are shown in Diagram 14 below alongside the result from the high level review undertaken in March 2006.

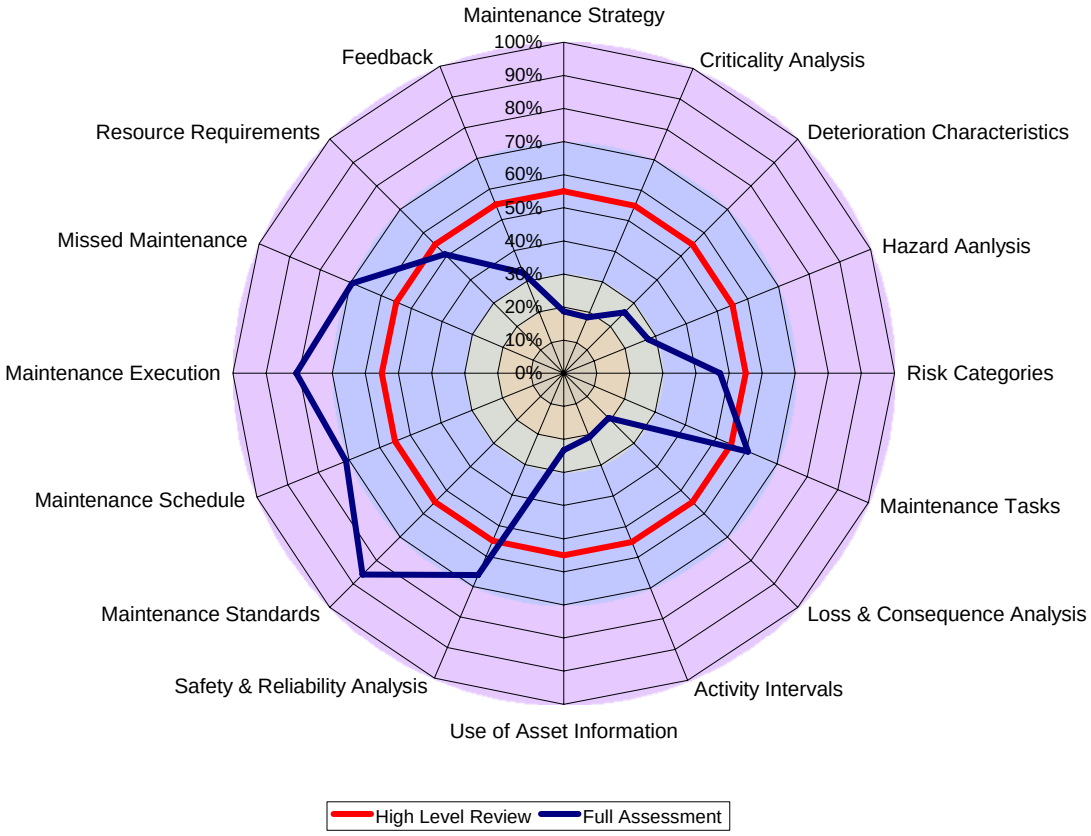

Diagram 14 Asset Maintenance

Table 16 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟢	🟢	Maintenance Strategy
🟢	🔴	Criticality Analysis
🟢	🟢	Deterioration Characteristics
🟢	🟢	Hazard Analysis
🔴	🟢	Risk Categories
🟡	🟡	Maintenance Tasks
🟢	🔴	Loss & Consequence Analysis
🟡	🟢	Activity Intervals
🟢	🔴	Use of Asset Information
🟢	🟢	Safety & Reliability Analysis
🟢	🟢	Maintenance Standards
🟢	🟢	Maintenance Schedule
🟢	🟢	Maintenance Execution
🟢	🟡	Missed Maintenance
🟢	🟢	Resource Requirements
🟢	🟡	Feedback

Table 16 Variance confidence levels

As Diagram 14 above shows, there are distinct strengths and weaknesses with Network Rail's maintenance processes. The processes are strong in the areas of documenting maintenance requirements and undertaking these maintenance requirements in accordance with the standards and periodicities defined. The processes are significantly weaker in the area of developing maintenance requirements using good practice Asset Management techniques.

There is no overall *Maintenance Strategy* for the three asset disciplines assessed, although some evidence was produced that could form part of a maintenance strategy in the form of Network Rail standards, the maintenance section of the Asset Policies and ROSE project documentation in the case of signalling. These do not cover the requirements of a maintenance strategy which should set the maintenance objectives and targets required by the business, the method of undertaking criticality analysis, the intended approach to

maintenance and inspection for each key asset type, the asset management techniques that will be used to determine the optimum tasks and periodicities to deliver the business objectives, and the overall timescales to deliver more robust maintenance regimes.

The strengths and weaknesses of the approaches used to determine the maintenance requirements are further examined for track, structures and signalling below.

Criticality Analysis is important to ensure resources responsible for improving maintenance regimes are focused on the most critical assets and activities. Within track, some criticality analysis exists in the form of the seven track categories, but this has not been further developed to assess the criticality of different asset types, components and activities by examining the planned maintenance, reactive maintenance and inspection costs together with the reliability and safety risks associated with defects and failures. Within structures, criticality analysis is used in the definition of different route types, but this does not appear to be used to prioritise the move towards risk-based inspection set out the in Civil Engineering Asset Policy. Within signalling, criticality analysis is not used to prioritise improvements to the maintenance regimes for signalling equipment, but some local criticality analysis is undertaken to identify critical assets within the Areas.

Deterioration Characteristics and *Hazard Analysis* both scored relatively low, although this masks a relatively high score for signalling. The ROSE project within signalling is addressing the maintenance requirements of a range of signalling equipment using a Reliability Centred Maintenance (RCM) approach. Failure Modes and Effects Analyses are being undertaken and maintenance tasks are being identified using the RCM decision diagram to ensure the tasks are appropriate for the deterioration characteristics of the different assets and failure modes. Within track and structures, maintenance requirements are not defined using a formal process like RCM, although some work has been undertaken within T-SPA and ICM in developing deterioration algorithms for track maintenance. These are still being developed but are used more for long term funding requirements than to set the day to day maintenance requirements.

Even though formal analysis processes have not always been followed, *Maintenance Tasks* are well documented for all three asset disciplines assessed and these have been proven to be practical and effective (although not necessarily optimised) over many years of application.

Loss and Consequence Analysis, Activity Intervals, Use of Asset Information and *Safety & Reliability Justification* are all associated with setting intervals for maintenance, inspection and work arising & minimum actions that are appropriate for the level of risk involved. All three disciplines scored weakly in these areas as very little formal analysis is undertaken by Network Rail. Many maintenance and inspection periodicities are mostly based on historical precedent and are often the same for assets with very different safety and operational risks. This is potentially the biggest opportunity within the maintenance function to deliver more efficient and effective maintenance by eliminating uneconomic maintenance and ensuring all safety risks associated with maintenance are managed ALARP. This opportunity is further explored in Section 10.2.2.

The activities and processes associated with documenting maintenance requirements within standards and specifications and the execution of maintenance within the Areas scored highly. Network Rail has introduced some robust processes to ensure the specified work is planned and scheduled correctly, and that the actual work undertaken is tracked to ensure any late or missed maintenance is identified. Well established processes have also been introduced to set out the risk assessment and mitigation processes necessary when maintenance is missed or late.

Finally, although the tracking of work undertaken is robust, *Feedback* from the maintenance organisation back to engineering about lessons learned from undertaking the maintenance is weak. This should include feedback on the validity of assumptions made when determining the maintenance requirements and an assessment of actual deterioration and failure rates compared to those assumed by engineering when designing the maintenance requirements.

8.12 Resource & Possession Management

Resource & Possession Management examines how well an organisation plans and allocates resources to asset management activities and manages rail possessions to enable work to be carried out efficiently and safely. It covers analysis of current resources (people, plant, tools and materials) against future work demands, evaluation of work priorities and risks, use of project management tools and techniques to ensure efficient use of resources, optimisation of spares and inventory management, work programming, resource continuity and investment appraisal.

The results from the full assessment of *Resource & Possession Management* are shown in Diagram 15 below alongside the result from the high level review undertaken in March 2006.

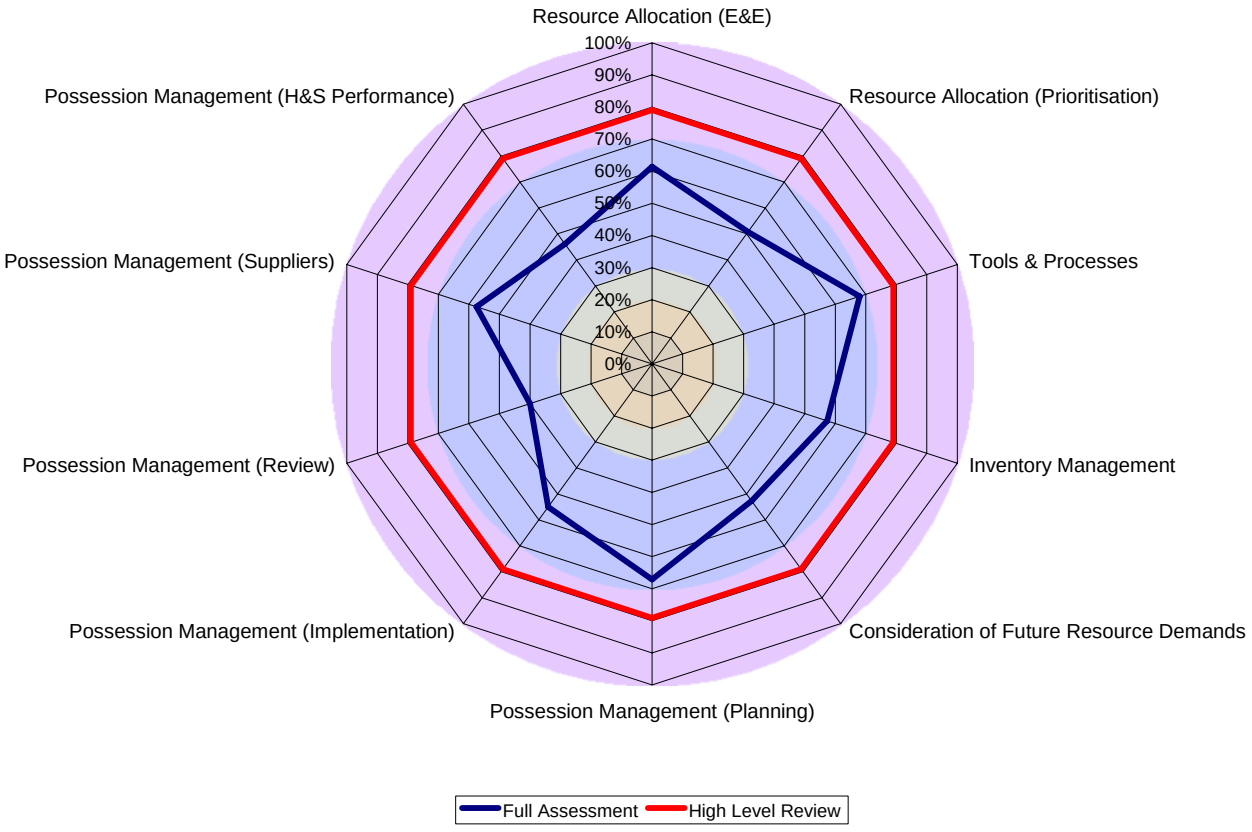

Diagram 15 Resource & Possession Management

Table 17 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟡	🟢	Resource Allocation (E&E)
🟡	🟢	Resource Allocation (Prioritisation)
🟡	🟢	Tools & Processes
🟢	🟢	Inventory Management
🔴	🟢	Consideration of Future Resource Demands
🟢	🟢	Possession Management (Planning)
🟢	🟢	Possession Management (Implementation)
🟡	🟢	Possession Management (Review)
🟢	🟢	Possession Management (Suppliers Performance)
🟢	🟢	Possession Management (H&S Performance)

Table 17 Variance confidence levels

There are a number of fairly well developed processes for work planning, such as the Enterprise system and P3E which are utilised within the framework of the “Work and possession planning for the railway infrastructure (Meetings management pack)” company standard NR/PRC/MTC/PL0056.

This work and possession planning standard is now mandatory and was being followed in the depots and Territories visited. The tools include processes for contingency planning and risk assessment (e.g. ARM – Active Risk Manager) and for judging the quality of project plans.

However, the methods and tools such as P3E have not yet been fully rolled out. In the Areas assessed, respondents suggested that 80% - 90% of major projects now use the tools but the figure is allegedly not as high in other Areas. Indeed, there is concern that P3E is too big, complex and unwieldy to be used with minor works and maintenance planning. There is a national team working on developing a stripped down version of P3E for use in minor works and maintenance but this is not in use yet. There are also a number of support tools under construction, such as POSMAN, but, again, these are not yet ready for use.

ECLIPSE / MIMS provide information on work banks but these are not planning tools. In the absence of a national planning tool, area and depot staff are using their own planning forms and tools. These are either designed locally for the purpose or derived from legacy systems, usually in an Excel spreadsheet (2 examples discovered). These tools seem to always have a number of features in common, e.g. the specification of the location of works, but also vary in their content, level of detail and quality of outputs (e.g. range and quality of management information). Few have everything the users stated they wanted, for example, none had a way of producing a report on costs of resources.

Partly as a result of the different planning systems but also because there are a number of other work and resource planning legacy systems in use, practice and performance on the ground is very variable. Amongst the teams assessed, the amount of planned maintenance work that was actually completed varied from 40% to 80% and much of the planned work completed was as a result of uncancellable deliveries, such as ballast and tamping.

Reasons for cancelling work included the need to undertake urgent fault repairs. How this is handled across the organisation is also variable. Some areas have dedicated fault teams while others draw fault team staff from existing maintenance teams. The former is generally thought to be a better arrangement than the latter.

A lack of local control over budgets means that it is difficult to deal with contingencies. For example, staff illness will often result in job cancellation because the arrangements lack flexibility. Spares was also stated as an issue by interviewees - it appears that spares are typically ordered, via purchasing, at 13 week out stage (though some, such as timbers are ordered annually). The depots assessed didn't have a local, minor stocking point so all spares had to be got from an area spares depot. The delivery of larger items, such as crossings, was described as "unpredictable" – so much so that work requiring such items was not planned until the items actually turned up.

Although it was clear that everyone was following the planning meeting procedures, record keeping from these and the quality of the meeting outputs was also found to be variable. In particular, in one depot assessed an attempt to trace particular works through all the planning meetings from 13 weeks out onwards but failed to find an example where the work was discussed at all the appropriate meetings.

Perhaps the most significant issues reported were those associated with long term Possession Planning in accordance with the "Principles of Work & Possession Planning" document (undated). This document requires the Territory Delivery Team to baseline the workbank at "TT-80" (i.e. 80 weeks prior to the start of the timetable year in which the work will take place) and begin the "constrain and optimise" process around the Annual Integrated Work Plan (AIWP).

The apparent lack of clarity amongst the Territory Engineers about what actual work they wish to undertake during the booked possessions means that frequently there are changes required (through the change management process PL0086) to the "Rules of the Route" as published at TT-56; this in consequence triggers payments to Train Operating Companies (TOCs) under the schedule 4 contract arrangements for the first 6 months of the timetable year.

The size of these schedule 4 payments is relatively large. The LNE Territory's Planning Team estimate that up to a 20% reduction in the estimated 2006/07 schedule 4 costs of £79M (2006/07 budget estimate of £103M) would be achievable if variations to the possession plans could be reduced to less than 10% from the point at which the "Rules of the Route" is first published (TT-56).

The Territory Planning Team also identified that the "apparent complexity of the Planning Business Model makes the impacts of decisions on the bottom line unclear". It appears that inconsistencies between management indicators used by different parts of the business can lead to some inconsistent behaviours and mean that, for planning purposes, it is not always possible to clearly identify the key business drivers that should apply. This is characterised, for example, by the trade-off between imposing speed restrictions and relaying track; i.e. following relaying work the track requires either application of the "Dynamic Track Stabiliser (DTS)" to allow it to be opened at line speed – with a consequent *loss* of relaying time, or opened with a TSR with the consequent *gain* in "yardage completed" during the possession. As an increase in TSRs is not considered desirable, planned work is therefore occasionally cancelled. Similarly, as Track Relaying success is measured in "yardage completed" rather than "yardage completed and opened at linespeed" this can also promote behaviours like that above.

The assessment did not gather sufficient “hard evidence” to fully verify instances like the above, but indications are that this in an area worthy of further investigation as part of work on analysing and considering such trade-offs when developing Asset Policy Justifications.

8.13 Review & Audit

Review & Audit examines an organisation's processes for reviewing and auditing the effectiveness of its asset management processes. It assesses the management processes for reviewing the performance of asset management activities including asset performance, asset condition, compliance with legislation and standards and the effective use of key performance indicators. It also examines internal assurance processes, audit policies and procedures, processes for internal audits, the use of third party audits, processes for reviewing audit findings and corrective actions and the use of external benchmarking.

The results from the full assessment of *Resource & Possession Management* are shown in Diagram 16 below alongside the result from the high level review undertaken in March 2006.

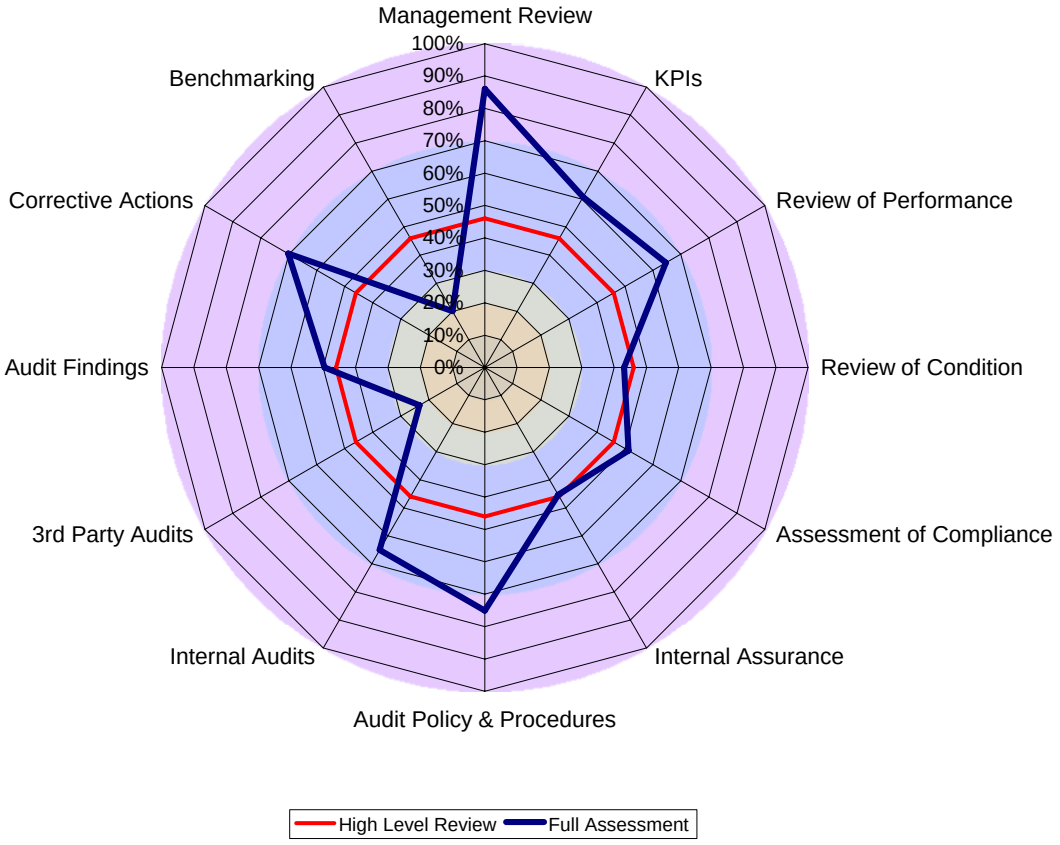

Diagram 16 Review and Audit

Table 18 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
🟢	🟢	Management Review
🟢	🔴	KPIs
🟡	🟡	Review of Performance
🟢	🟡	Review of Condition
🟢	🔴	Assessment of Compliance
🟢	🟢	Internal Assurance
🟢	🟢	Audit Policy & Procedures
🟢	🟢	Internal Audits
🟢	🟢	3rd Party Audits
🟢	🟢	Audit Findings
🟢	🟢	Corrective Actions
🟢	🟢	Benchmarking

Table 18 Variance confidence levels

As Diagram 16 shows, Network Rail's processes for the review and audit of its Asset Management activities are strong, and most of the assessment criteria score higher than the high level review.

The Monthly Business Review (MBR) is the process used by Network Rail to undertake periodic management reviews and to review asset performance and condition. Management review scores well as these monthly business reviews appear to be well embedded throughout the organisation and a consistent agenda and reporting format is used. These meetings also review a suite of KPIs that are defined consistently across the organisation. These are rolled up into a national report produced by the Engineering function every period, which also includes the overall asset stewardship index.

One observation on the process for producing KPIs is that the importance of each measure across different assets or routes is sometimes not reflected. For example removing a temporary speed restriction on a rural line would have the same affect as removing one on a key primary route, even though the business advantage of removing the one on the primary

route may be significantly greater. There is an opportunity to introduce a weighting factor for the appropriate KPIs to ensure the relative importance of the measures is reflected when these measure are rolled up. Assessment of compliance is also reviewed as part of the monthly review process and a number of compliance measures are defined and used consistently across the business.

Internal assurance is undertaken using the in-line checking process which is documented within Network Rail's Audit Manual and a number of Network Rail standards and procedures. The checklists for the in-line checks are developed centrally and have been developed for track but are still under development for signalling. For structures, the external contractors are required to undertake internal assurance and evidence of this is a requirement of the inspection and examination contracts.

Network Rail has a process of undertaking internal audits called NCAP (National Core Audit Programme) and the requirements for these audits are documented within Network Rail's Audit Manual. The audits are undertaken by Area Engineers on different areas within their Territory and sufficient evidence was provided to demonstrate that these audits are undertaken in accordance with the Audit Manual and that audit findings and corrective actions are raised and tracked until the actions have been closed out.

Although the practice of Areas Engineers auditing outside their Areas is a positive way to ensure independence and to help to identify and spread good practice, the audit processes do not require the different functions to audit each other. For example the Engineering function is not required to audit the Maintenance function to ensure maintenance standards and procedures are being undertaken in accordance with requirements. There is an opportunity to introduce cross functional auditing, in particular between engineering and maintenance, as part of the NCAP process, to provide additional assurance that activities are being undertaken in accordance with requirements and to provide a feedback process to continuously improve standards, specifications and processes.

Other than the regulatory reporters and occasional external safety audit, Network Rail does not regularly undergo third part audits. With some limited exceptions, Network Rail also does not participate in benchmarking against other rail administrations or regulated asset intensive industries. Both of these areas score relatively weakly as a result. Third party audits and benchmarking would provide Network Rail with opportunities to identify good

practice in external organisations that could be adopted and applied within Network Rail's Asset Management activities.

8.14 Asset Information Systems

Asset Information Systems examines the systems an organisation has in place to support the Asset Management activities and decision making processes. This includes the identification of asset information requirements, examining how an asset information strategy and plan will deliver these requirements, the selection of appropriate technology for each system, the role of user groups. All key systems are then assessed against a range of assessment criteria to examine the extent to which they will deliver the requirements of the asset information strategy.

The results from the full assessment of *Asset Information Systems* are shown in Diagram 17 below alongside the results from the high level review undertaken in March 2006.

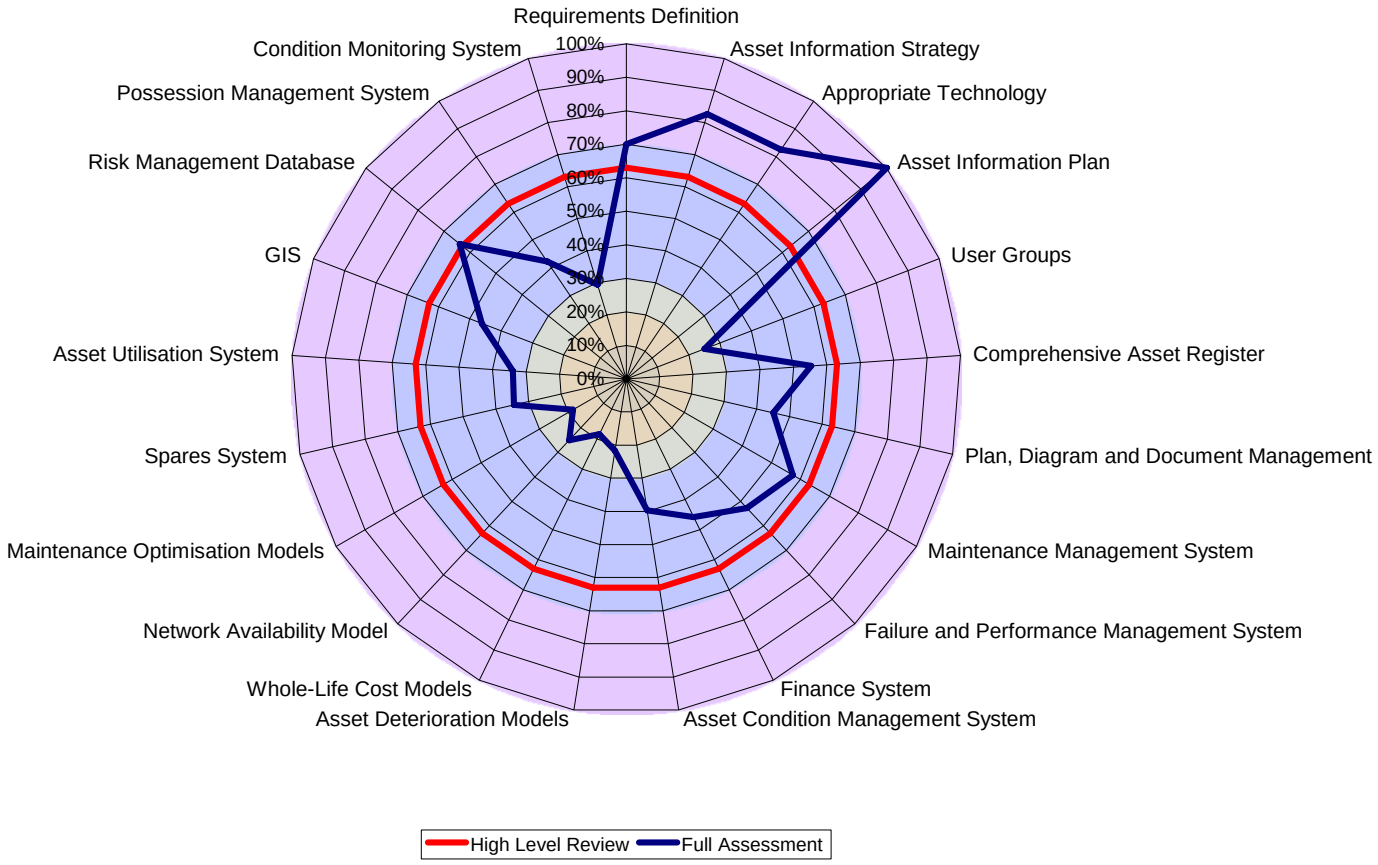

Diagram 17 Asset Information Systems

Table 20 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Requirements Definition
●	●	Asset Information Strategy
●	●	Appropriate Technology
●	●	Asset Information Plan
●	●	User Groups
●	●	Comprehensive Asset Register
●	●	Plan, Diagram and Document Management
●	●	Maintenance Management System
●	●	Failure and Performance Management System
●	●	Finance System
●	●	Asset Condition Management System
●	●	Asset Deterioration Models
●	●	Whole-Life Cost Models
●	●	Network Availability Model
●	●	Maintenance Optimisation Models
●	●	Spares System
●	●	Asset Utilisation System
●	●	GIS
●	●	Risk Management Database
●	●	Possession Management System
●	●	Condition Monitoring System

Table 19 Variance confidence levels

The overall score for *Asset Information Systems* reflects the current status of the asset information system assessment, backfilling, and rationalisation process which Network Rail is currently undertaking. The process is defined by a combination of two key action plans:

- Network Rail's six-task 'Asset Information Strategy', which is in direct response to Licence Condition 24 and assesses the asset information requirements against current data and defines gap filling projects and data management and assurance processes;
- Network Rail Information Management's '10 Year Vision' document, which provides a strategy for appropriate technology and system rationalisation.

The strength of Network Rail's activities in this area is reflected when the scores for the Assessment Criteria are considered in the following four groups:

- *Asset Information Strategy Requirements;*
- *Core Systems;*
- *Decision Support Tools;* and
- *Support Systems.*

The Assessment Criteria which can be grouped under *Asset Information Strategy Requirements* are:

- *Asset Information Requirements;*
- *Asset Information Strategy;*
- *Appropriate Technology;*
- *Asset Information Plan;* and
- *User Groups Exist.*

The lowest score here was for *User Groups*, as appropriate user groups are not utilised for all systems. All of the remaining Assessment Criteria score highly. The *Asset Information Strategy Requirements* group averages 72% on the maturity scale as a result of the clearly defined 'Asset Information Strategy' and the associated '10 Year Vision', which incorporate the definition of key business requirements for asset information, and the associated gap filling and technology plans.

The Assessment Criteria that can be grouped under *Core Systems* are listed below and also scored relatively well, with an average of 49% on the maturity scale.

- *Comprehensive Asset Register;*
- *Asset Plan and Diagram Management System;*
- *Maintenance Management System;*
- *Failure and Performance System;*
- *Asset Finance System;* and
- *Asset Condition Management System.*

This score reflects the fact that a range of diverse and non-integrated core systems are currently used within Network Rail. Although generally considered effective at the current time, Network Rail's core systems are currently being improved through the asset

information system assessment, backfilling and rationalisation process highlighted above. This should ensure the Core Systems develop towards best practice.

The following Assessment Criteria that can be grouped under *Support Systems* achieved a similar average score:

- *Spares Management System;*
- *Asset Utilisation System;*
- *Geospatial Information System;*
- *Risk Management Database;*
- *Possession Management System;* and
- *Condition Monitoring System.*

Again these systems are being addressed by the asset information system assessment, backfilling and rationalisation process highlighted above. There are also a number of the support systems which are currently at an early stage of development within Network Rail.

The following Assessment Criteria can be grouped under *Decision Support Tools*:

- *Asset Deterioration Models;*
- *Whole Life Cost Models*
- *Network Availability Models;* and
- *Maintenance Optimisation Models.*

The average score of 21% on the maturity scale for the *Decision Support Tools* reflects the relatively immature status of a number of these systems within Network Rail. As Decision Support Tools tend to rely on complete and accurate asset information data to function appropriately, their relative level of development is still low, as Network Rail complete the asset information system assessment, backfilling and rationalisation process.

A final, general observation, based around the multi-strategy approach to asset information systems is the lack of clear asset information champion. Currently, the Engineering, Maintenance and MP&I disciplines each generate and utilise asset information, often in different styles and for different purposes. The Asset Management Strategy Steering Group and Network Rail Information Management currently combine to undertake a system guidance and integration role, as illustrated in Diagram 18 , but with limited influence over the individual disciplines.

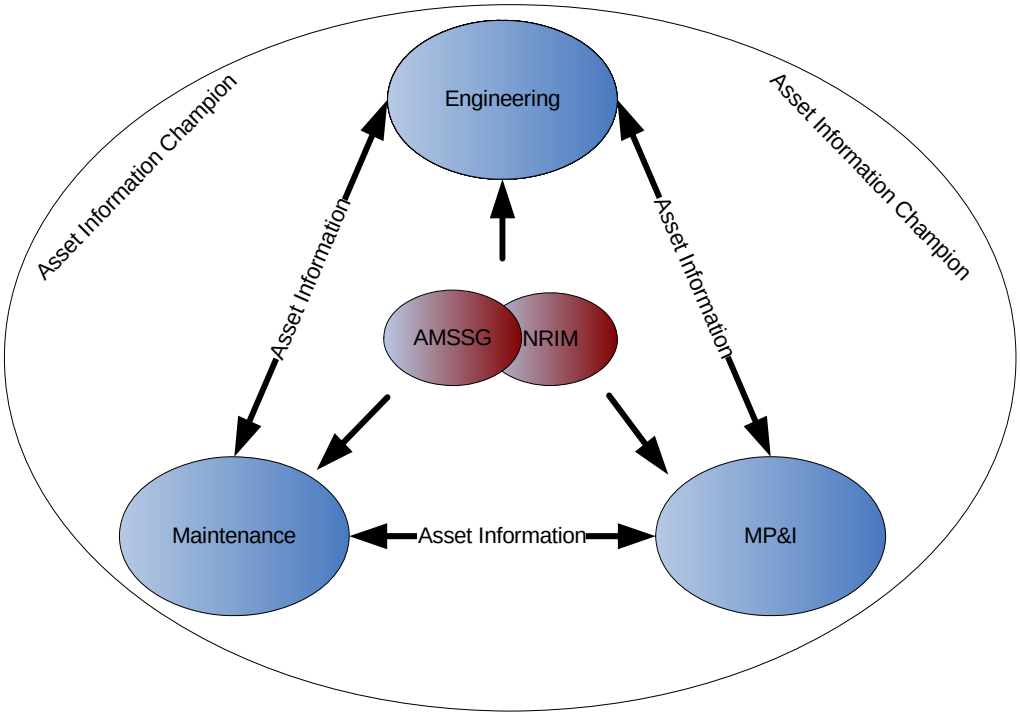

Diagram 18 Potential Role of Asset Information Champion

Consideration should be given to identification of an asset information champion, with the role of overseeing the development of asset information and systems across Network Rail's activities.

8.15 Asset Data & Knowledge

Asset Data and Knowledge examines the data and knowledge held within an organisation's asset information systems or in other media. This includes an assessment of data quality standards, the requirements for the population of different asset information systems in terms of population and level of quality defined within asset information plans and the assessment of asset data against these requirements.

The results from the full assessment of *Asset Data & Knowledge* are shown in Diagram 19 below alongside the results from the high level review undertaken in March 2006.

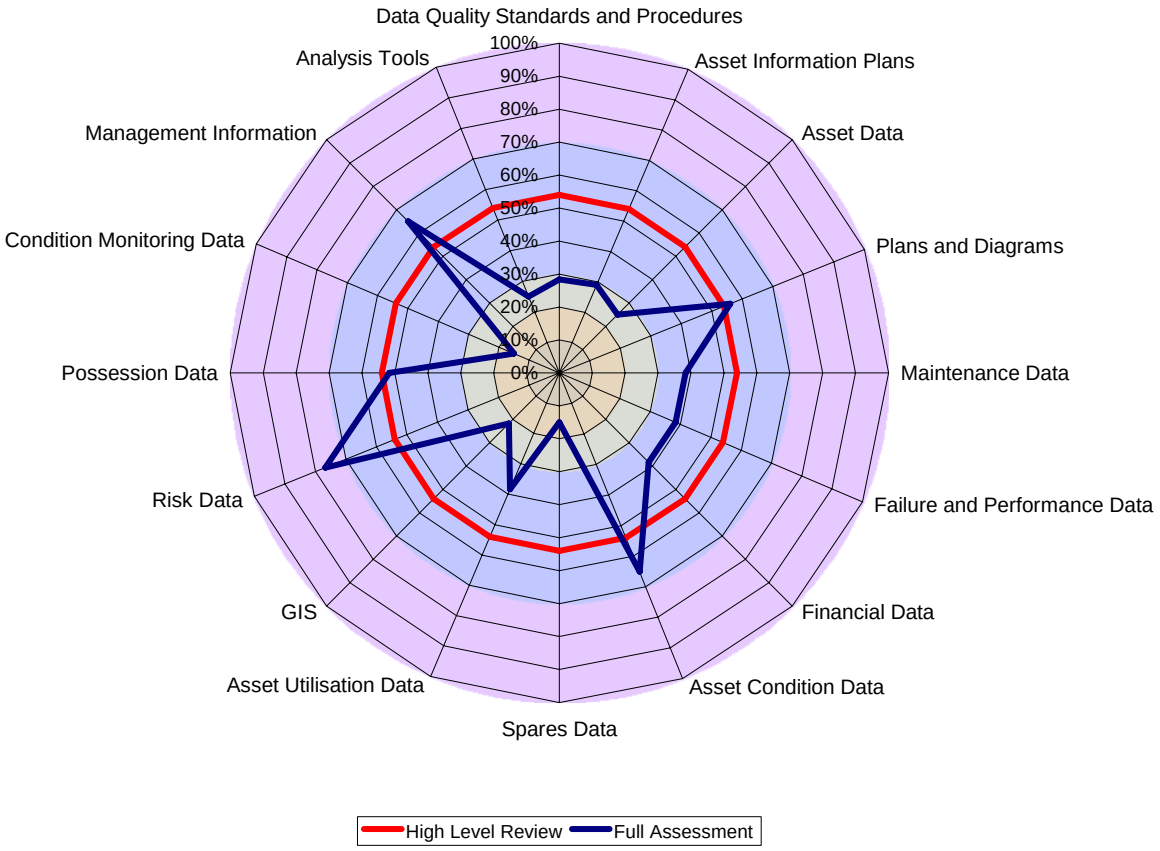

Diagram 19 Asset Data & Knowledge

Table 20 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot

modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Data Quality Standards and Procedures
●	●	Asset Information Plans
●	●	Asset Data
●	●	Plans and Diagrams
●	●	Maintenance Data
●	●	Failure and Performance Data
●	●	Financial Data
●	●	Asset Condition Data
●	●	Spares Data
●	●	Asset Utilisation Data
●	●	GIS
●	●	Risk Data
●	●	Possession Data
●	●	Condition Monitoring Data
●	●	Management Information
●	●	Analysis Tools

Table 20 Variance confidence levels

The overall score for *Asset Data and Knowledge* reflects the current status of Network Rail's six-task Asset Information Strategy, which is in direct response to Licence Condition 24. This project assesses the asset information requirements against current data and defines gap filling projects and data management and assurance processes. As a result of the Asset Information Strategy, Network Rail have recently completed a number of priority gap filling projects and are currently still working on a larger second group of projects, due for completion in September 2007.

It is anticipated that this ongoing work will move the scores for the *Asset Data & Knowledge* towards best practice. It is useful to consider the scores for Asset Data & Knowledge in the following four groups:

- *Data Management Standards and Procedures;*
- *Population and Quality of Data in Core Systems;*
- *Population and Quality of Data in Support Systems;* and
- *Management Information.*

The first of these groups, *Data Management Standards and Procedures*, scored an average of 29% on the maturity scale and includes the following Assessment Criteria:

- *Data quality standards & procedures are defined and utilised for all key asset information;* and
- *Asset information plans define the extent that asset information systems are to be populated.*

The key issues identified were the lack of generic data standards and plans to define the level of quality and population of asset information. It is recognised that Network Rail are actively working in this area at the current time.

The second group*, Population and Quality of Data in Core Systems,* scored relatively well, with an average of 43% on the maturity scale, and includes the following Assessment Criteria:

- *Asset data is available to a specified level of availability and quality;*
- *Asset plans and diagrams are available to a specified level of availability and quality;*
- *Maintenance related data is available to a specified level of availability and quality;*
- *Failure and performance data is available to a specified level of availability and quality;*
- *Financial data is available to a specified level of availability and quality;* and
- *Asset condition data is available to a specified level of availability and quality.*

This reflects Network Rail's belief that it already holds the vast majority of business critical asset information in some form. However, with respect to best practice, improvements are required to ensure asset information is populated to levels defined in asset information plans and data quality is in accordance with defined targets.

A very similar score, an average of 41% on the maturity scale, and equivalent issues with respect to achieving best practice were found for the *Population and Quality of Data in Support Systems* group*,* which is made up of the following Assessment Criteria:

- *Spares data is available to a specified level of availability and quality;*
- *Asset utilisation data is available to a specified level of availability and quality;*
- *The GIS is populated to a specified level of availability and quality;*
- *Risk data is available to a specified level of availability and quality;*
- *Possession data is available to a specified level of availability and quality;* and

- *Condition monitoring data is available to a specified level of availability and quality.*

The final group*, Management Information* includes the following Assessment Criteria:

- *Management information is produced in accordance with the asset information strategy and requirements;* and
- *Analysis tools are in place that allow stakeholders to review and analyse asset information.*

This group scored an average of 45% on the maturity scale based on strengths such as Network Rail's AS7 work and the pro-active use of Monthly Business Reports. Weaknesses identified included the early stage of development of the Corporate Network Model (CNM) with respect to providing stakeholder access to asset information. Again, it is recognised that this is an area Network Rail are actively working on in 2007.

Overall, Network Rail scored moderately for *Asset Data and Knowledge*. However, this review was undertaken at a time when the back filling of asset data and knowledge is being undertaken and the development of plans and targets for asset data quality and completeness is being initiated. It is therefore suggested that a second review of the *Asset Data and Knowledge* element of the AMEM model be undertaken following Network Rail's planned completion date for the ongoing Asset Information Strategy (Task 3), in September 2007.

8.16 Contract & Supplier Management

Maintenance organisations often depend on the capability of supplier organisations. *Contract & Supplier Management* addresses how well decisions are made on what should and should not be contracted out, requirements are defined, different forms of contract are used, suppliers are appraised and selected, supplier performance is assured, contractual and line management difficulties are resolved, supplier relationships are developed.

The results from the full assessment of *Contract & Supplier Management* are shown in Diagram 20 below alongside the results from the high level review undertaken in March 2006.

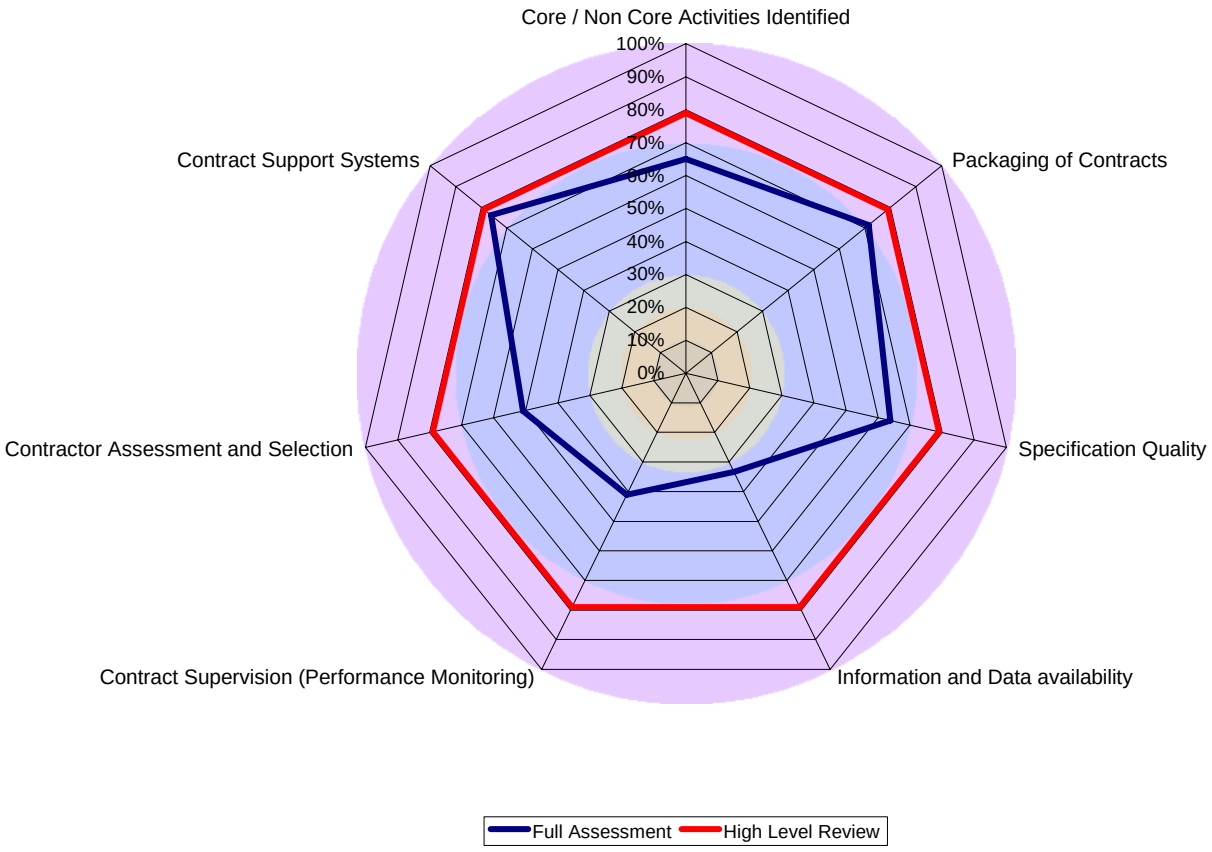

Diagram 20 Contract & Supplier Management

Table 21 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A

green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Core / Non Core Activities Identified
●	●	Packaging of Contracts
●	●	Specification Quality
●	●	Information and Data availability
●	●	Contract Supervision (Performance Monitoring)
●	●	Contractor Assessment and Selection
●	●	Contract Support Systems

Table 21 Variance confidence levels

There have been significant changes and improvements in contract and supplier management in the past few years as a result of the recognition of a trend towards increasing costs, although these changes seem more advanced in some functions (e.g. signalling schemes) than others.

Improvements in the work planning process (P3E, GRIP, etc.) are leading to better specified contracts and a clearer understanding of what should be counted as core and non-core activities, although there is still some debate in certain areas, such as whether signal testers should be in-house or contracted staff.

The weakest areas tend to be concerned with assessment and management of supplier performance. However, it is acknowledged that a management information system for recording and reporting on supplier performance (SAMS) is in development. Systems like P3E do allow for progress against milestones to be tracked but this does not include information on the quality of performance or, indeed on safety performance where information tends to be restricted to reportable incidents and what gets recorded in SMIS. It is worth noting that SMIS can be useful but is generally regarded as difficult to use and there are concerns over the reliability of some of the information. There is a tendency to fall back on locally collected qualitative information held in spreadsheets and derived from written reports.

Related to the supplier performance data problem is the quality of controls which are available for managing supplier performance. Controls tend to be very light touch or

draconian (sacking of contractor, suspension, removal from preferred supplier status, etc.) with little scope for other levels of action, though it is clear that Network Rail are concerned to work closely with suppliers to remove problems when they arise. Some parts of the process for contractor selection also seem unnecessarily inflexible and time-consuming, for example, requiring contractors repeatedly to pre-qualify when they tender for work.

8.17 Organisational Structure & Performance

Organisational Structure & Performance examines how well an organisation measures, develops and monitors its overall competence and performance across the range of technical, organisational and human capabilities needed to deliver world class asset management. The assessment focuses on the roles and responsibilities of key groups and individuals tasked with planning, implementing and evaluating asset management policy and strategy.

The results from the full assessment of *Organisation Structure and Performance* are shown in Diagram 21 below alongside the results from the high level review undertaken in March 2006.

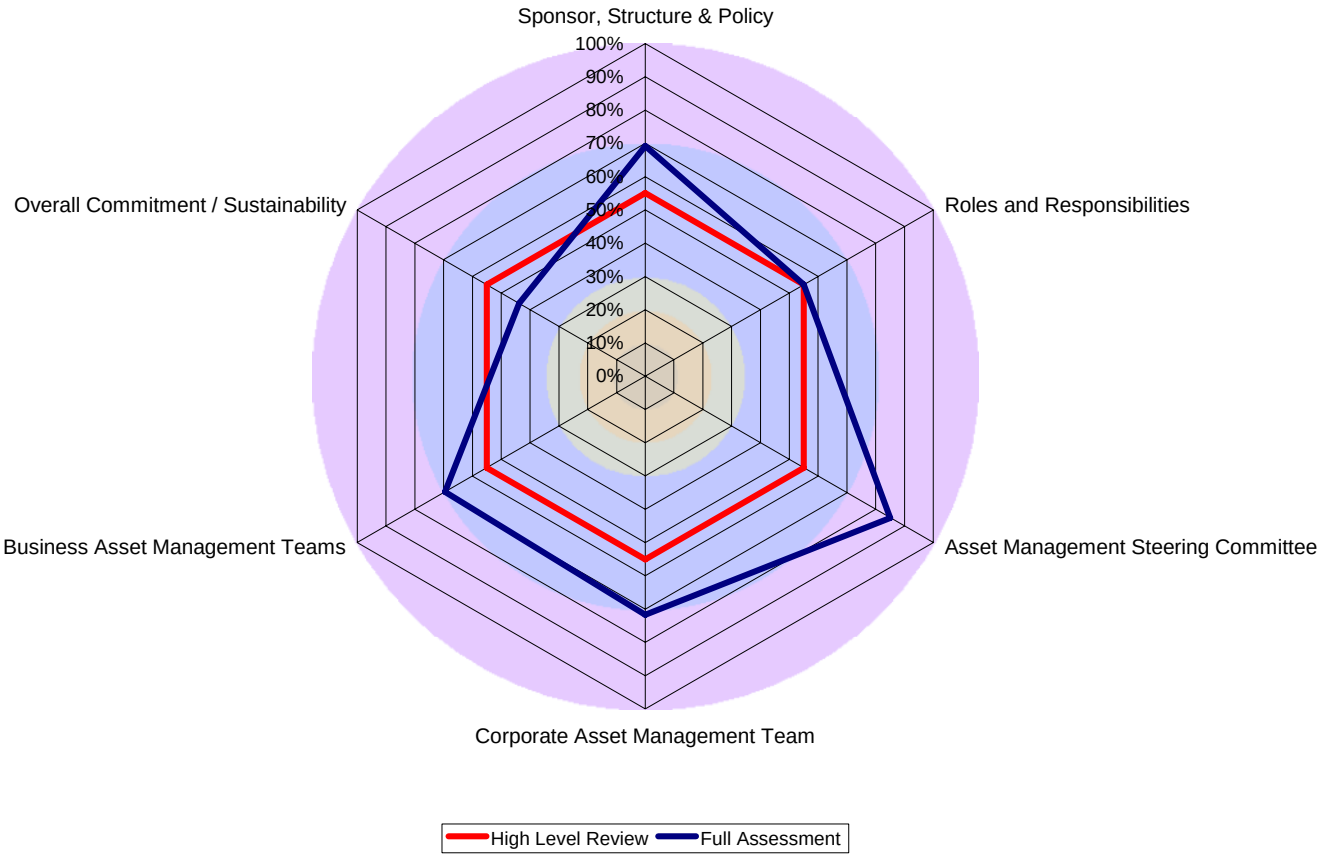

Diagram 21 Organisational Structure & Performance

Table 22 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence),

and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Sponsor, Structure & Policy
●	●	Roles and Responsibilities
●	●	Asset Management Steering Committee
●	●	Corporate Asset Management Team
●	●	Business Asset Management Teams
●	●	Overall Commitment / Sustainability

Table 22 Variance confidence levels

It is very clear that the top management team, whether in its Asset Management Strategy Steering Group guise or other guises, such as the Business Review Group, are highly visible to the company as the owners of asset management policy and the reviewers of asset performance. The routes and processes by which information gets to the top team appear to be well understood.

Below this level, there are well understood responsibilities for both the individual top team members and for other senior and middle managers. However, the arrangements for steering and controlling the implementation of asset policies are rather more informal and ad hoc. There are personal responsibilities for people like professional heads to liaise closely with others on issues of common importance. This means, for example, that asset management issues that affect closely related functions, like signalling and telecoms, will be the subject of joint discussions. It is less clear that wider issues affecting less closely related functions will receive a similar level of attention. Although this arrangement may provide a degree of welcome flexibility, it is probably not ideal. Asset strategies tend to get developed at an individual scheme level rather than on a company-wide basis. At lower levels in the organisation, more formal arrangements tend to re-assert themselves although a number of these, for example, quarterly assurance reports from the Tactical Safety Group, are relatively new approaches and still under development.

A more important issue concerns the quality of the information which is being provided to the various teams and individuals and which obviously must heavily influence the quality of the decisions made. Although many of the data reporting processes are well developed,

concerns have been expressed in a number of areas, such as asset reliability, manpower planning, contractor performance and IT issues.

Three main issues that arise here are:

1. The effectiveness of Network Rail's change management processes;
2. The assessment and understanding of company culture;
3. Knowledge management.

Certain aspects of all of these are well managed, but in every case there are noticeable weaknesses. Change control is generally well handled. There are well defined processes and procedures for approving and communicating changes, for example, through the Company Standards Group and TSG. However, change management tends to deal with process changes rather than cultural changes and the launch and implementation of change has not, traditionally, been well handled, according to the interviewees.

Company culture is addressed in a number of ways within the organisation. The company's view of what it would like its culture to be is expressed through its mission, values and behavioural statements. The employee engagement (Q12) survey, safety tours, and ad hoc culture assessments (e.g. the DuPont survey) contribute to the assessment of company culture. These are clearly useful for identifying such things as support and resourcing issues. However, the scope of the Q12 survey does not explicitly include safety culture, and the other methods are either not very systematic or are not applied on a consistent and integrated basis. Work is being done on developing other tools and approaches to assessing culture but this work has not progressed far yet.

Knowledge management is also addressed in a number of ways with different degrees of effectiveness. A number of IT systems exist for storing and sharing data, information and documents, including Connect and the CCMS. Knowledge of functionality is written into operational concepts and functional standards. The committee and team structures in place in most parts of the organisation also helps with both the sharing of information and reducing the likelihood that any one person is the sole holder of key information. However, there are some areas of the company where this is a concern, particularly in those business critical areas where it was felt that good succession planning arrangements are missing. Also there are concerns that the CCMS is not fully effective at document control and that there are

problems with document traceability and capturing feedback and comments during document review.

8.18 Individual Competence & Behaviour

Individual Competence & Behaviour examines the ability of an organisation to systematically develop and maintain an adequate supply of competent and motivated people to fulfil its asset management objectives. The assessment addresses organisational culture, workforce attitudes and competence management. It covers recruitment and selection, training and development, assessment and appraisal, accreditation and control of work performance.

The results from the full assessment of *Individual Competence & Behaviour* are shown in Diagram 22 below alongside the results from the high level review undertaken in March 2006.

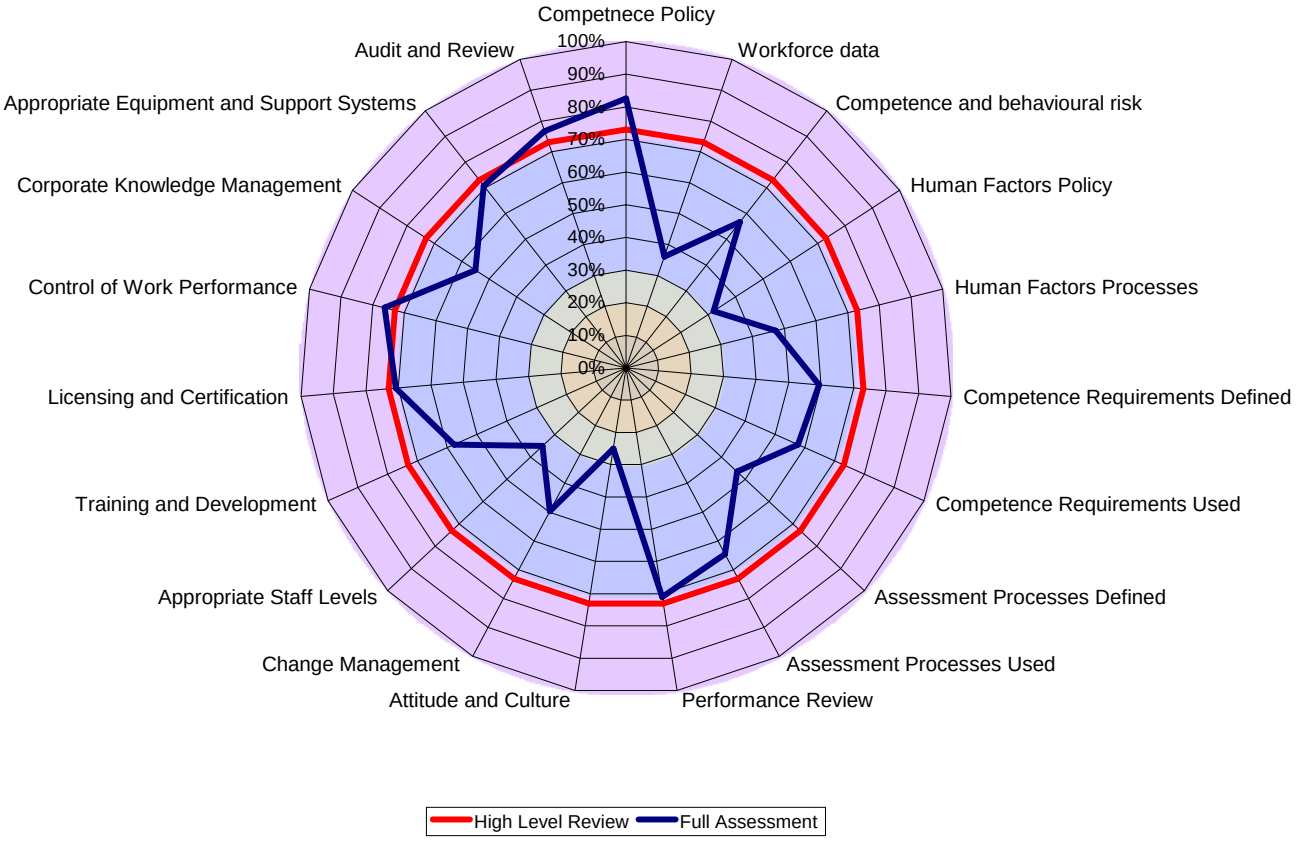

Diagram 22 Individual Competence & Behaviour

Table 23 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A

green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Competence Policy
●	●	Workforce data
●	●	Competence and behavioural risk
●	●	Human Factors Policy
●	●	Human Factors Processes
●	●	Competence Requirements Defined
●	●	Competence Requirements Used
●	●	Assessment Processes Defined
●	●	Assessment Processes Used
●	●	Performance Review
●	●	Attitude and Culture
●	●	Change Management
●	●	Appropriate Staff Levels
●	●	Training and Development
●	●	Licensing and Certification
●	●	Control of Work Performance
●	●	Corporate Knowledge Management
●	●	Appropriate Equipment and Support Systems
●	●	Audit and Review

Table 23 Variance confidence levels

The individual competence criteria can be grouped into three major areas:

1. Competence management
2. Human factors integration
3. Management of organisational and cultural change

In all three areas there have been significant developments in the past few years many of which are only coming to fruition now. This is most true of competence management. Although a number of tools have been in place for some time (e.g. Sentinel and PTS certificates). Only in the last few months have these tools been integrated into a proper competence management system.

A company standard (NR/CS/CTM/001) and a related business process document (NR/SP/CTM/001) on competence management have been released in December 2006 and supported by standards for management and technical competences (all functions) and quality assurance of competence assessment. This replaces the eight different competence management systems inherited by Network Rail when maintenance was brought in-house. Both the standard and the process document emphasise the importance of moving greater responsibility for competence management into the line. This step mirrors the general Network Rail policy of empowering line managers in areas such as safety management (e.g. Company Action Plan SAF 7).

The competence management standard incorporates the 15 principles set out in the HSE Guidance “Managing Competence for Safety-related Systems” as well as other aspects of good practice. There is every reason to believe that the competence system should work and an initial trial worked sufficiently well to gain approval from HMRI. However, the system has not been rolled out yet, nor has it been applied to all the roles it is intended to cover or to all aspects of competence. For example, track worker technical competence is well covered but not generic competences such as communication and supervisory skills. Signaller competences are being revisited. There is still work to be done to develop a competence database although the structure of the database has been designed. The system and database have yet to be fully integrated with other systems, such as HR. So, for example, it is not yet possible for managers or supervisors to check the competence of staff assigned to work although the system should support this when fully implemented.

Some concerns have already been expressed about the emphasis on line manager responsibility although much of this concern may be misplaced and based on a misunderstanding of the standard which could be addressed during the roll-out. Full compliance with the standard is not required until 2008. How well the system beds in will depend on the quality and effectiveness of the implementation and change management process. There is a 12 month rolling plan for delivery units which requires the implementation team to work closely with MDUMs.

A separate policy, published 12 months ago, and competence framework exists for MP&I. This framework conforms to the requirements of the company standard and, in some ways, is further advanced. For example, MP&I already have a competence database which is well, though not fully, populated and which can provide a wide range of management information. However, in several ways the approach adopted is different. For example, there is an

emphasis on self-assessment and the focus of assessment has been on generic competences. One of the areas for future development is the capture of technical competence and expertise. This contrasts with the track worker competences where the technical competences have been better defined than the generic ones. Because of this, the framework does not yet fully cover the risks associated with competence and its management. Furthermore, the assessment process is not as well worked out for the MP&I framework as for track workers.

More generally, there are a number of gaps in how the competence management systems are integrated into the business. Firstly, competence issues are not yet well handled in business cases. For example, costs associated with competence management issues arising from the introduction of new products, procedures, processes, etc are not well handled in business cases. Secondly, although development and succession planning is well handled in some parts of the business (e.g. the leadership development programme) neither these nor competence management arrangements are well developed for a range of business critical (but not safety critical) roles in the middle of the organisation, such as train planners and asset analysts, and technical roles. Furthermore, the existing systems do not provide comprehensive information for manpower planning. These are probably the biggest next challenges in the competence management area once the systems under development have been fully rolled out.

The situation regarding the integration of human factors into the organisation is very similar to that for competence management. A policy exists for how human factors should be addressed and this is expanded in the Company Procedure “Incorporating Ergonomics within Engineering Design Projects: Requirements” (NS/SP/ERG/24020) and the associated guidance note (NR/GN/ERG/00027). These identify where human factors and ergonomics expertise should be used and the level and type of competence required by those supplying the service. A range of tools have also been developed (e.g. Baseline) to aid managers across the business undertake preliminary and a number of standards have been developed incorporating ergonomic and human factors at a strategic level.

However, the policy is not necessarily known or understood by everyone in the company. Incorporation of human factors thinking is much more likely in large projects which are also likely to be more systematic in their use of appropriate techniques and methods and in their assessment of human factors risks. Human factors issues can also be raised through a number of different routes, such as specifications and project requirements or, for novel

technologies, through the acceptance process. Less progress has been made introducing human factors thinking to the maintenance area, possibly because the various teams are still bedding in to the company. Nonetheless, the use of methods such as the Request process provides the means for getting human factors considered more widely.

Perhaps the biggest issue concerning human factors at the moment is that the company has a large amount of potentially relevant data but it is not always readily available or in a useable form. Anyone trying to use such data is regularly faced with rewording and recoding problems which makes its use time consuming and expensive. Work is being done to improve this situation, for example, in changing the structure of 'cause' questions, but this work is just beginning. This, incidentally, is a problem for other areas of the business, such as fault cause analysis and any overhaul of the recording processes should try to cover all affected areas.

8.19 Asset Management Plans

Asset Management Plans examines how well Network Rail has implemented its various Asset Management processes to produce a robust plan of activities for the forthcoming year across all disciplines. This includes the extent to which the activities and cost / risk schedules have been defined, the resource requirements necessary to undertaken the activities, evidence of whole life cost analysis, evidence that external stakeholder requirements and performance / condition requirements will be delivered and an assessment of how the organisation uses Research & Development and other sources of good practice to improve the efficiency and effectiveness of its operations.

The results from the full assessment of *Asset Management Plans* are shown in Diagram 23 below alongside the result from the high level review undertaken in March 2006.

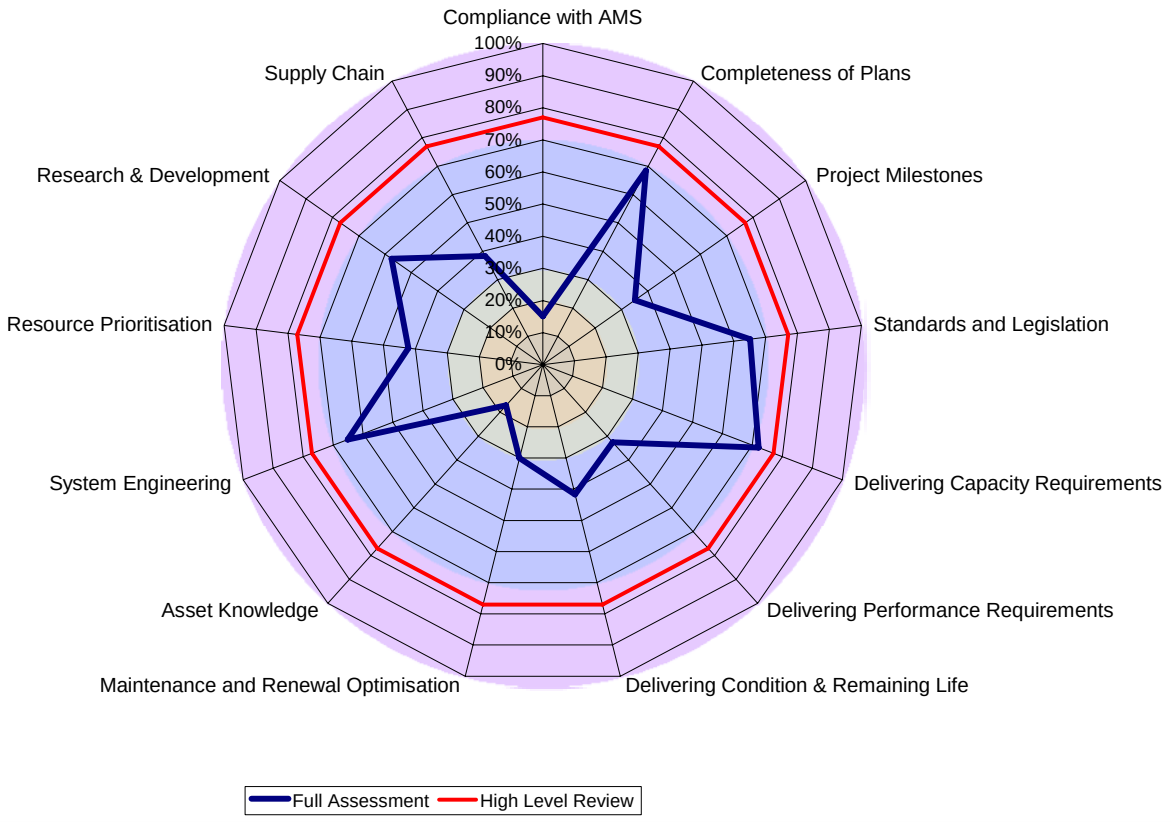

Diagram 23 Asset Management Plans

Table 24 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence), and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Compliance with AMS
●	●	Completeness of Plans
●	●	Project Milestones
●	●	Standards and Legislation
●	●	Delivering Capacity Requirements
●	●	Delivering Performance Requirements
●	●	Delivering Condition & Remaining Life
●	●	Maintenance and Renewal Optimisation
●	●	Asset Knowledge
●	●	System Engineering
●	●	Resource Prioritisation
●	●	Research & Development
●	●	Supply Chain

Table 24 Variance confidence levels

Network Rail do not have a single Asset Management Plan (AMP) that draws together all of the elements identified above. Instead these items are spread throughout a number of different documents and systems. It would be reasonable for Network Rail to argue that although a single coherent AMP is good practice, it is not essential. This factor was considered when making the assessment and evidence from disparate sources was gathered together and assessed as if it formed a 'virtual AMP'. The evidence used for this assessment was the following documents:

- Work banks for track and structures;
- Mid term funding review for signalling;
- 2006 Business Plan;
- 2006 Management Plan;
- 2006 Route Plans.

An overall finding in assessing the various plans is that although each of the documents reviewed contain some of the information and meet many of the assessment criteria for AMPs, the coordination and alignment of these documents is not always clear. Additionally, as no Asset Management Strategy has been developed, it is difficult to assess whether the various plans reviewed are aligned with the corporate Asset Management requirements, hence the low score for *Compliance with AMS.*

The plans scored well for the assessment criterion for the completeness of the plans and compliance with standards and legislation.

The assessment criterion where evidence is sought to demonstrate that the work plans will deliver the required capacity requirements scored relatively highly. The Route Plans provide detail on any key changes in demand and what infrastructure works are being planned to deliver any resulting increase in capacity.

The assessment criterion where evidence is sought to demonstrate that the work plans will deliver the required performance and condition requirements scored moderately well but lower than that for demonstrating capacity requirements will be delivered. The various plans contain an analysis of previous performance compared to targets including an explanation of how any improvements had been achieved, but there is little evidence in the plans that the planned renewal and maintenance activities included in the plan will deliver the future levels of performance and asset condition.

As discussed in previous sections, the assessment of whether activities in the plan are optimised and the appropriate technologies are being utilised are defined within the Asset Policies, lending further weight to the observation that improvement to the Asset Policy Justifications is a key priority for Network Rail.

The assessment criterion that examines whether the plans include the requirement to collect and maintain asset information has scored relatively low as none of the planning documents acknowledge that collecting and maintaining asset information is an equally important activity to renewal and maintenance of infrastructure. It is acknowledged that a separate plan exists as part of the Asset Information Strategy workstream within Network Rail, but there is an opportunity to integrate this plan into an overall AMP.

The four remaining criteria; *Systems Engineering, Resource Prioritisation, Systems Engineering* and *Supply Chain* all score moderately well and no specific observations have been identified.

8.20 Sustainable Development

Sustainable Development examines the processes an organisation has put in place to evaluate the social and environmental impact of its operations with a view to developing more sustainable methods of operation. This includes the evaluation of an organisation's strategy for sustainable development including the impact of future legislation on costs and incentives on energy and emissions, its use of triple bottom line accounting and an evaluation of its operations against the five capitals model.

The results from the full assessment of *Sustainable Development* are shown in Diagram 24 below alongside the result from the high level review undertaken in March 2006.

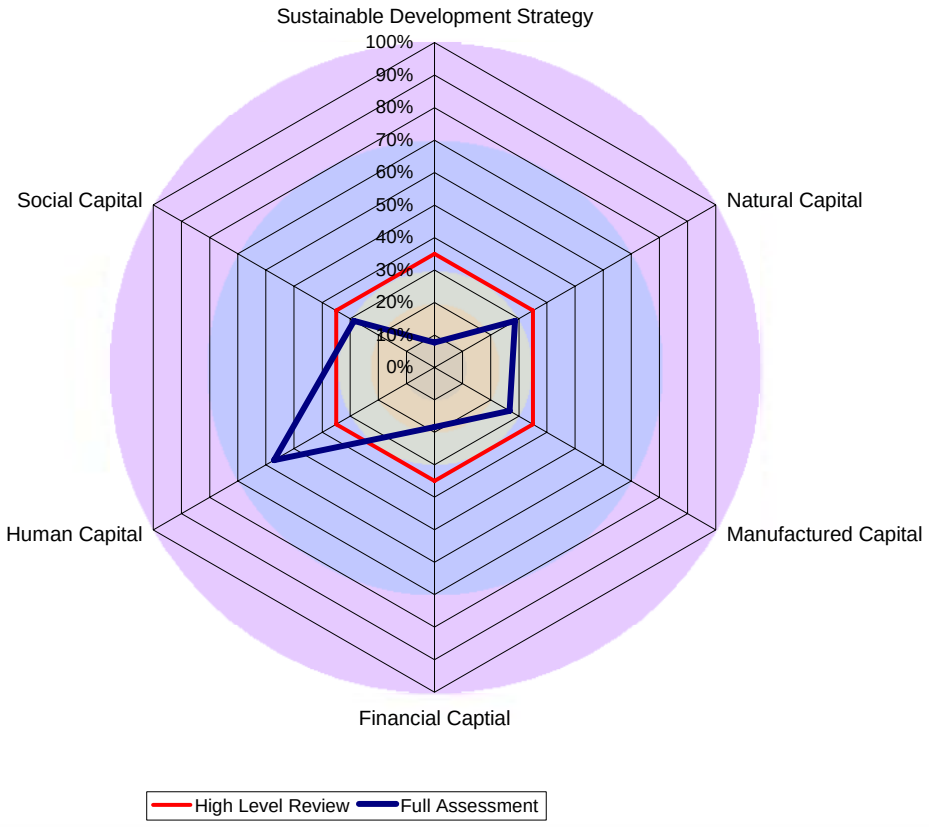

Diagram 24 Sustainable Development

Table 25 indicates the degree of variability in the assessment ratings. The first figure indicates the variability in scoring between sources (based on interviewees and evidence),

and the second the variability in scoring between different questions within the criteria. A green dot indicates a high degree of agreement between sources / questions, a yellow dot modest disagreement, and a red dot a high degree of disagreement. A full explanation is provided in Section 7.

Sources	Questions	Assessment Criterion
●	●	Sustainable Development Strategy
●	●	Natural Capital
●	●	Manufactured Capital
●	●	Financial Capital
●	●	Human Capital
●	●	Social Capital

Table 25 Variance confidence levels

Sustainable development is relatively new to most industries and has only become a mainstream concern to these industries over the last few years. Most organisations have only just begun to develop their approach to sustainable development and the scores shown above are typical of most industry sectors at this point in time.

The knowledge of sustainable development and its potential for change within Network Rail is well developed amongst the interviewees. There is an obvious professional and personal interest in gaining further understanding of the subject to add further value to everyday tasks, which is very encouraging. There is a risk that this potential does not actually deliver improvements in this area as the weakest scoring area of the assessment is strategy development and implementation. This is not necessarily surprising as the rail industry as a whole does not yet have a clear strategy for taking sustainable development forward.

RSSB has taken the lead in developing some common indicators for measuring sustainable development, but there is an opportunity for Network Rail to take a more active role in this work to help to set the agenda for the industry.

Some examples of best practice being delivered through the enterprise of its staff are:

1) The National Delivery Service (NDS) is providing a joined up approach to resource management for key commodities such as steel and aggregate which increasingly find their way back into the supply chain when removed from site.
2) Evaluation of the environmental credentials of designs before implementation is occurring in small pockets.

3) Support to staff is a key area of good performance. The biggest trade apprenticeship scheme in the country seeks to build a strong foundation for Network Rail and allows the participants to plan for the future.

Key areas of opportunity to develop sustainable development are as follows:

- *Sustainability Strategy* – The lack of clear strategy is the underlying reason why a cross-company focus on sustainability is absent. A strong internal vision needs to be translated into a well-communicated policy which can ultimately reap motivational as well as financial rewards. This strategy should also consider the benefits of Network Rail adopting Triple Bottom Line reporting.
- *Sustainability 'Demand' Strategy* – There is no evidence that Network Rail is considering the risks associated with sustainability and how these will impact on future operations. Reacting to environmental and social change (for example climate change and an ageing population) is as important as reducing the impact on the environment and society from its operations.
- *Supply Chain Incentives* – There is no evidence of engagement with framework suppliers to help them align with sustainability principles. This is a positive and easy initial step for Network Rail to undertake to engage the supply chain in adopting sustainable development principles.

9 Network Rail's Asset Management Framework

9.1 Asset Management Framework

Network Rail has developed an Asset Management framework and all management activities are developed in line with this framework. The framework was produced by Network Rail's Asset Management Strategy Steering Group (AMSSG) during 2005.

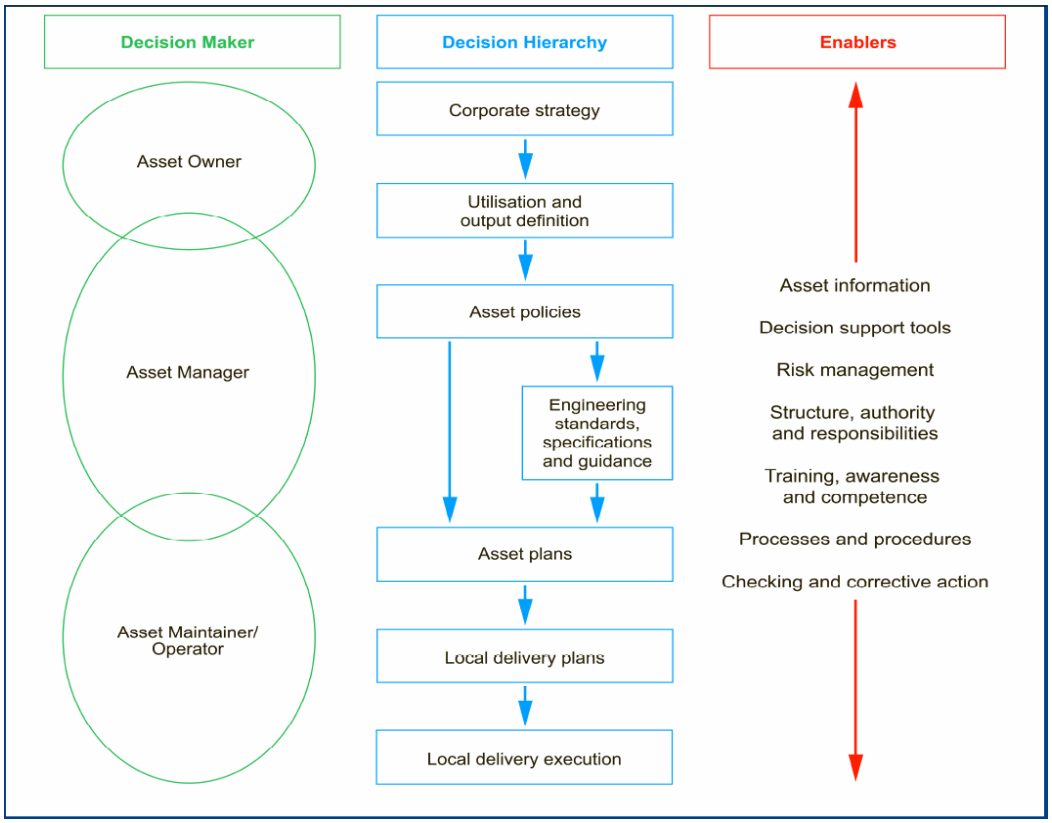

Diagram 25 Network Rail Asset Management Framework

In Diagram 25 the decision-maker column shows the three Asset Management roles. The role of the asset owner is fulfilled by Network Rail's Board in discussion with funding bodies. The Engineering function has the asset manager role, specifying maintenance and renewal requirements to the Operations and Customer Services, Major Projects and Investment, and Maintenance functions. The boxes in the decision hierarchy column represent the Asset Management decisions that Network Rail make in the different Asset Management roles. These decisions are supported by the seven enabling activities, which can support decisions made at any level in the hierarchy.

This structure is consistent with the twenty activities within the AMEM with the exception that consideration of 'Supply Chain' does not feature in the Network Rail framework.

9.2 Assessment Results by Asset Management Framework

The assessment results from this best practice review have been mapped to Network Rail's Asset Management Framework and are shown in Diagram 26 below, alongside the results from the high level review undertaken in March 2006.

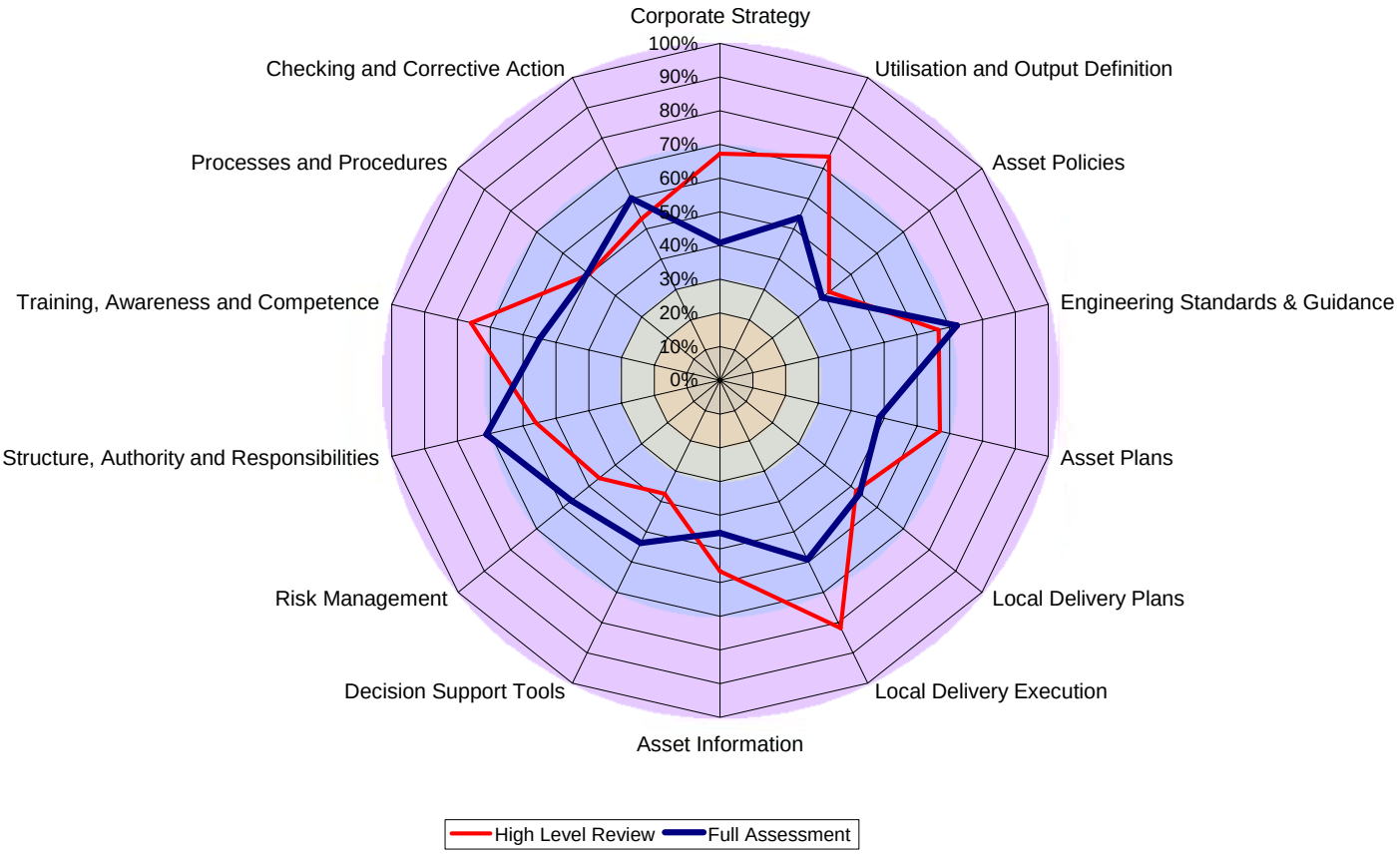

Diagram 26 Summary Results by Network Rail Asset Management Framework

10 Findings

This section summarises the assessment findings for the twenty activities detailed in section 8. The findings are structured into three parts:

- Overall Findings – general findings and observations that apply across Network Rail;
- Significant Opportunities - those that are felt to have a significant impact on the costs or deliverability of Network Rail's activities during CP4;
- Other opportunities – areas of opportunity for Network Rail identified through this best practice review.

10.1 Overall Findings

It is clear from this assessment that Network Rail has a high level of motivation and commitment to delivering improvements in its Asset Management objectives at both corporate and individual levels. This is evidenced by the quality of the strategic documentation that is now available. Significant progress has been made with Business Planning Criteria, ISBP, Route Strategies, and the Integrated Risk Framework, and it is expected that future developments will have less of a regulatory focus.

The Asset Policy documents (published in June 2006) have also been identified as pivotal in building on the initial successes and a series of specific findings in relation to these are documented in section 10.2

Although the existing Asset Policies recognise that Network Rail should move to a more Risk-Based approach for maintenance and inspection, the potential benefits are so significant that it is recommended that consideration should be given to accelerating this programme of work.

There are examples of the holistic approach being adopted across Network Rail, for instance the adoption of the Asset Management Framework and the Cost Analysis Framework. In some areas, however, opportunities exist for more effective cross business processes. For instance, it appears that opportunities to align processes between Engineering and Maintenance may be beneficial, for example, to ensure that the Maintenance organisation understands the outputs expected of their actions, rather than just the actions themselves.

This is particularly true for Structures where the use of a number of Decision Support Tools (DSTs) for the determination of both Structures workbank and budgets is felt worthy of further investigation. During the course of this assessment it was not possible to fully define the interaction between the various DSTs and the levels of intervention that they consequently prescribe.

Several other potential areas of opportunity for Network Rail have been identified through this assessment and these are detailed in the following sections.

10.2 Significant Opportunities

10.2.1 Asset Policies – Renewal and Enhancement

Asset Policies are pivotal to many aspects of Network Rail's business. The current Asset Policies have captured the engineering knowledge and existing policies into a set of Asset Management Policies that will deliver significant benefits to Network Rail in terms of increased consistency in the selection of technologies and solutions for inspection, maintenance, renewal and life extension schemes. This section explores the findings in relation to the impact of these policies on renewal and enhancements.

Network Rail's Investment Regulations IR01 and IR02 set out the requirements for analysing investment requirements and producing business cases for asset renewals and enhancements. These regulations state that condition-led renewals that are compliant with Asset Policies do not require any further justification. This means the Asset Policies are key to determining appropriate criteria for renewal and the optimum choice of technology. It is estimated that 80% to 90% of Network Rail's renewals fall into this category and do not require individual justifications and business cases.

Given the significance of these policies, the Policy Justification documents do not contain sufficiently rigorous lifecycle cost analysis to identify optimum whole life costs and risks whilst taking account of the resource and funding constraints. Improving these Policies through developing more rigorous Policy Justifications is potentially one of the biggest opportunities available to Network Rail. It is clear from work undertaken in other rail administrations that it is possible to reduce capital and operational expenditure significantly, with no increase in risk, through the application of rigorous whole life cost and risk analysis.

It is difficult to obtain explicit evidence of benefits from other businesses in capital expenditure efficiencies as this information is extremely sensitive, particularly in regulated industries. However, anecdotal evidence of significant efficiencies has been obtained from United Utilities and London Underground Limited.

The current Asset Policies and Policy Justifications have provided a strong foundation for this further development as the structure of the Policies and Policy Justifications and the supporting documents like the Business Planning Criteria are aligned with the principles of

good practice Asset Management. The need for developing more robust Asset Policies has been recognised by Network Rail and the 2006 Network Rail Management Plans states :

> '*Having reviewed our strengths in each of these activities, we are placing additional emphasis on the refinement of corporate strategy, utilisation and output definition, Asset Policies, asset information and decision support tools. The other activities are of equal importance, but generally have mature processes in place or improvement work already underway. In its role as asset manager, Engineering will be leading the future development of our Asset Policies and also the development of our asset information strategy*.'

It is acknowledged that work is already underway to further develop the Asset Policies and Policy Justifications, including the development of better guidelines for addressing many of the issues raised in this report. However, to develop these Policies to deliver the significant potential savings outlined above will require Network Rail to commit significant resources to undertake the necessary analysis.

A further benefit of undertaking this analysis is to provide greater clarity on the expected outputs from the adoption of policy, e.g. expected life and expected reliability of the infrastructure. This will allow the formulation of success criteria to evaluate the outcomes of policy implementation.

10.2.2 Asset Policies – Maintenance

In addition to the impact on renewals and enhancements described in section 10.2.1, there are additional opportunities in relation to the impact of Asset Policies on the maintenance of Network Rail's infrastructure.

As discussed earlier, many maintenance and inspection periodicities are based on historical precedent and are often the same for assets with very different safety and operational risks. There are well established Asset Management techniques available to review maintenance and inspection tasks and periodicities to ensure the specified maintenance is in proportion to the safety and financial risks being mitigated. Potentially the biggest opportunity within the maintenance function is to deliver more efficient and effective maintenance by eliminating uneconomic maintenance and ensuring all safety risks associated with maintenance are managed ALARP.

Diagram 27 shows the typical percentage benefit from adopting a risk-based approach in place of time-based or historically based maintenance and inspection regimes (based on analysis of such programmes in third party organisations)[8]. The benefit is calculated as the potential savings in labour and material costs whilst maintaining or improving asset reliability and risk.

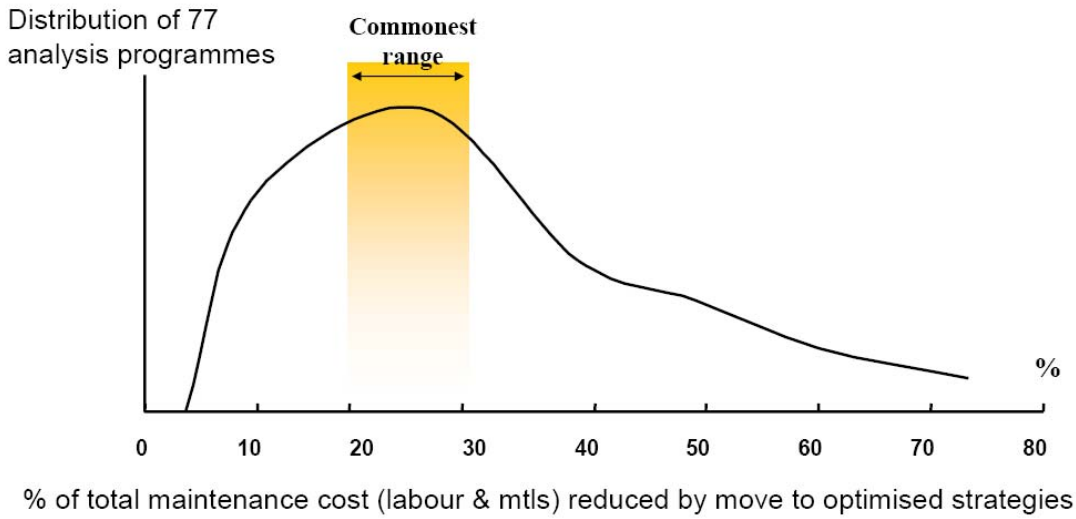

Diagram 27 Benefits of Optimised Maintenance and Reliability

[8] Based on all 77 studies undertaken by The Woodhouse Partnership across a range of industry sectors.

It should be noted that these are potential savings only and do not necessarily represent the savings actually delivered by the relevant organisations - these figures are typically difficult to obtain. In addition these savings do not take into account any mobilisation costs, such as training or analysis, but are included here to indicate the typical *potential* opportunity from implementing Risk Based Maintenance and Inspection.

Although the exact size of the opportunity available to Network Rail to make efficiencies in this area is not yet known, the characteristics of the current maintenance regimes within signalling maintenance, track inspection (which is already partly risk-based), track minimum actions and structures inspections would indicate, in our opinion, that there are significant potential savings.

This would appear to be verified by work recently undertaken by Tube Lines where benefits of up to 20% were identified from the application of Risk-Based Maintenance techniques. Some work undertaken by Network Rail in 2002-03 on the benefits of Risk-Based Maintenance for signalling identified similar levels of potential benefit.

Although the Asset Policies recognise that Network Rail should move to a more risk-based approach for maintenance and inspection, the potential benefits are so significant that feasibility studies should be undertaken to confirm the potential benefits available to Network Rail from adopting Risk-Based Maintenance and Inspection and consideration then given to accelerating a programme of work based on the results of these feasibility studies.

10.2.3 Decision Support Tools - Structures

STAMP is used to model the envisaged whole life cost profile of a structure at two points in the decision making process. In the first instance, Territories are able to apply individual structures to the tool in order to help them choose the most appropriate works proposal. In its second application, STAMP is applied by HQ to some 'template' structures as representatives of the national structures. It was not possible during the assessment to verify that either of these processes were rigorously undertaken on a consistent basis. The STAMP process is used at the discretion of the Territory Engineers when making design decisions on the future works schemes. It was also unclear whether the information generated helped by Territory STAMP exercises informed the HQ exercises.

Structures Annual Cost Profile (SACP) calculates cost profiles for the network's structures over the coming year(s) using unit costs and the volume of asset stock on the asset registers. This is currently being upgraded to CECSE, then onto C-CASE which is yet to be implemented, but which carries out essentially the same exercise.

We have not yet been able to assess these tools and as such cannot comment on their suitability within the decision support structure that has been described. It is would appear that their role within the decision making process within the Territories in not as fundamental as it could be as their application would appear to be discretionary.

The Civil Engineering Asset Policy sets out three approaches or 'policies' that may be taken by the asset managers, each of which allocate different spending regimes A to C defined as follows :

A. High Spend - Return and maintain the stock to steady state by the use of maintenance activities that will improve performance levels and the remaining life of existing assets;
B. Lowest Whole Life Cost - Allow structures to deteriorate until repairs or replacements are essential to maintain operational requirements. At the time of intervention, carry out works that achieve lowest long-term costs for the structure;
C. Low Spend - Allow structures to deteriorate until intervention is essential to maintain safety standards or raise performance levels to an acceptable level.

Whilst these policies are being used to inform the ISBP, it appears that they are not yet applied at Territory level and are subject to local political and engineering tensions.

There would therefore appear to be a gap between the formal budgeting and 'cost projection' tools used by the HQ team, and the approach undertaken by the Territory teams in prioritising where their annual budgets are spent.

It is recommended that further work is carried out to fully map the processes within the Civil Engineering function that are used to future work volumes and costs and how these processes interface with the day to day management of structures within the Territories.

10.3 Summary of Opportunities

Table 26 and Table 27 below contain a summary of the potential opportunities for further development of Network Rail's Asset Management capabilities. The significant opportunities discussed in Section 10.2 are included in this table for completeness. As many of the findings from this best practice review relate to the Asset Policies and Asset Policy Justifications that are being developed by Network Rail, the opportunities have been separated into those relating to Asset Policies and those relating to other issues.

10.3.1 Opportunities Relating to Asset Policies

Activity	ID	Opportunities
Policy & Strategy	1.	Improve the process of disseminating, evaluating, and improving policies by developing success criteria to evaluate the outcome of policy implementation
	2.	Develop timescales and targets for policy implementation
	3.	Develop an Asset Management Strategy, in accordance with the guidance provided in BSI PAS 55, that provides the road map to achieving Network Rail's engineering vision including the strategy to further develop the existing Asset Policies to support this future vision
Asset Costing and Accounting	4.	Improve the accuracy and variability of the maintenance unit cost data from MIMS for the 18 activities for which maintenance units are calculated and further develop unit costs for other key maintenance activities
Strategic Planning & Asset Maintenance	5.	Undertake a criticality analysis and develop a criticality based approach to ensure an appropriate level of analysis is undertaken to justify: • The Asset Policies for renewals; • The Asset Policies for maintenance; and • The activities and costs within the ISBP
	6.	Develop Asset Policy Justifications in order to demonstrate the work volumes and costs within the ISBP are required and that these activities will deliver the required level of capacity, performance and asset condition – see section 10.2.1
CAPEX Identification, Evaluation & Approval	7.	There is a significant opportunity to enhance the Asset Policy Justifications with whole-life cost analysis – see section 10.2.1
Asset Maintenance	8.	Develop a maintenance strategy for structures, track and signalling setting out the objectives and targets for maintenance and the intended approach for determining maintenance requirements to achieve these objectives and targets

Activity	ID	Opportunities
Asset Maintenance	9.	Develop better justification for the maintenance and inspection activities and periodicities using good practice asset management techniques to ensure the costs and risks are optimised – see section 10.2.2
	10.	Improve feedback from the Maintenance organisation to the Engineering organisation on the validity of assumptions and excepted outcomes of the maintenance specifications used to determine the Asset Policies

Table 26 Opportunities Relating to Asset Policies

10.3.2 Other Opportunities

Activity	ID	Opportunities
Demand Analysis	11.	Develop a process to link the demand analysis processes to the engineering processes, including defining how the HLOS, RUS, Route Strategies, Route Plans and Infrastructure Plans are linked
	12.	Develop route specifications that specify the requirements for current and future infrastructure and document how the proposed infrastructure solutions will meet these requirements
Asset Knowledge Standards	13.	Implement standards for capturing asset failures including failure modes and root causes of failure
	14.	Develop specifications for linking failure, defect and performance data
Asset Costing and Accounting	15.	Develop long-term funding requirements and asset valuations using annual annuities calculated from future costs of ownership over the expected lives of the assets
	16.	Quantify future asset liabilities and include in an 'Asset Management' balance sheet
Strategic Planning	17.	A number of specific opportunities relating to ICM can be found in AMCL's two audit report from the recent audit of ICM
	18.	Further examine the DSTs and processes used to develop the ISBP work volumes and costs for structures and to review how these processes are used by Territories to plan actual work – see section 10.2.3
CAPEX Identification & Evaluation	19.	Further develop the GRIP process as it has proved too onerous for some smaller projects
Risk	20.	Develop the identification of business opportunities within the risk register
	21.	Ensure consistent application of the ARM process across Network Rail to ensure it is the core method of identifying and managing risks
	22.	Develop cross-business processes to enable maintenance and engineering to use ARM as source of risk for business processes.

Activity	ID	Opportunities
Asset Creation & Acquisition	23.	Increase the understanding and use of existing internal 'maturity modelling' techniques to assess and identify opportunities for further development of GRIP
	24.	Enforce greater compliance in the application of GRIP processes, in particular in the areas of Project Close Out and Project Handback
	25.	Improve the 'handover' process between Project Sponsor through GRIP stages 1-4 and Project Deliverer (MP&I) through GRIP stages 5-8
Asset Rationalisation & Disposal	26.	Develop GRIP processes to specifically cover the cost-effective disposal of assets
	27.	Develop processes to ensure that the trade-offs between the drivers for the replacement or renewal of existing assets in modern equivalent form are understood and reviewed upon a change in utilisation
Incident Response	28.	Review FMS as it is the main tool for managing incidents and recording details but can not produce a regular "outstanding fault" log. The system is not considered intuitive, easy to use or reliable and information may be being missed
	29.	Ensure consistent application of the processes for evaluating, transferring and embedding 'lessons learned' from incident response reviews
Resource & Possession Management	30.	Review the use of P3E for management of small jobs as it felt to be too complex and is inconsistently applied across Territories
	31.	Define the mechanism for considering the impacts and trade-off between possession planning decisions and their impact on railway operations
Review & Audit	32.	Ensure KPIs measures take account of the relative importance of individual measures across different routes or assets
	33.	Consider the use of third party audits and external benchmarking to identify good practices from external organisations
	34.	Consider enhancing internal audit processes to require functions to audit each other, in particular engineering and maintenance
Asset Information Systems	35.	Consider the appointment of a clear asset information champion with the role of overseeing the development of asset information and systems in general, for Network Rail's optimal stewardship of the network.
Asset Data and Knowledge	36.	Re-evaluate Network Rail's position in September 2007 when the current Asset Information Strategy project is complete
Contract & Supply Management	37.	Develop an effective management information system for recording and reporting on supplier performance
Organisational Structure & Performance	38.	Develop and ensure transparency of succession planning arrangements
Individual Competence &	39.	Develop a methodology for identifying and assessing the impacts of competence deficiencies on business cases

Activity	ID	Opportunities
Behaviour	40.	Develop succession planning and competence management arrangements for business critical (but not safety critical) roles in the middle of the organisation, such as train planners, asset analysts, and technical roles
	41.	Develop a Human Factors Analysis & Classification System that allows all human factors data to be regularised and coded in a consistent manner such that it may be readily assessed, analysed and utilised
Asset Management Plans	42.	Consider drawing together the separate planning documents into an overall Asset Management Plan
	43.	Improve the integration and alignment of the separate planning documents
Sustainable Development	44.	Develop a sustainable development strategy setting out Network Rail's approach to sustainable development in the rail industry
	45.	Enhance company processes to ensure the risks associated with sustainability and how these will impact on future operations are considered

Table 27 Other Opportunities

11 Conclusions

AMCL would like to take the opportunity to thank all those in Network Rail who have participated in this assessment. Overall, it has been found that Network Rail has a high level of motivation and commitment to delivering improvements in its Asset Management objectives at both corporate and individual levels.

In general, Network Rail appears to have made good progress towards a coherent and holistic Asset Management regime. Many of the strategic documents and processes produced over the last 12 months are aligned with good practice Asset Management principles. Some of these processes are not yet fully integrated and aligned across the different departments of Network Rail and evidence of a lack of awareness of certain policies within the Territory organisations was noted.

This review of Network Rail has led us to conclude that Network Rail's maturity in Asset Management is at least comparable to that of other major infrastructure owners in the UK, in our opinion.

As could be expected at this stage of Network Rail's development, some of the documentation and outputs of the Asset Management regime tend to focus on those required for regulatory purposes rather than those that may benefit the day-to-day running of the business. For instance, a single integrated Asset Management Plan (AMP) if produced could readily fulfil both objectives, becoming both the 'working plan' and annual submission for stakeholder review.

Further development and implementation of Asset Policies and Asset Policy Justifications has been identified as an area for significant further consideration. The impact that these policies have on corporate expenditure is extensive and developing optimised Asset Policies could deliver significant savings in both capital and operational expenditure. The size of this opportunity is likely to justify a significant contribution of resources, time and effort to develop more rigorous Asset Policies and Justifications.

Although the existing Asset Policies recognise that Network Rail should move to a more Risk-Based approach for maintenance and inspection, the potential benefits are so

significant that it is recommended that consideration should be given to accelerating this programme of work.

The use of Decision Support Tools (DSTs) within the Civils function for the determination of both structures workbank and funding requirements is felt worthy of further investigation. During the course of this assessment it was not possible to fully define the interaction between the various DSTs and the levels of intervention that they consequently prescribe.

Finally, several other potential areas of opportunity for Network Rail have been identified through this assessment and these should also be given consideration.

12 Recommendations

The following recommendations are made:

1) It is recommended that the development of the Asset Policies and Justifications is accelerated by significantly increasing the contribution of resources, time and effort, in particular for high criticality assets, in order to bring forward the savings that could be achieved through more focused and optimised policies.
2) It is recommended that feasibility studies should be undertaken to confirm the benefits available to Network Rail from adopting the Risk-Based Maintenance and Inspection opportunities identified in Network Rail's Asset Policies and consideration then given to accelerating this programme of work based on the results of these feasibility studies.
3) It is recommended that further work is carried out to fully map the processes within the Civil Engineering function to develop a more transparent understanding of how the Asset Policies are used to develop the work volumes and costs for structures and how these processes interface with the day to day operations within the Territories.
4) Finally, it is recommended that consideration should be given to the other findings and opportunities identified in Section 10.3 of this report.

Appendix A People Interviewed

The following table includes all Network Rail personnel interviewed as of 9th October 2006.

Name	Role
Iain Coucher	Deputy Chief Executive
Paul Plummer	Director of Planning & Regulation
Richard Fenny	Director of Maintenance
Peter Henderson	Director of Engineering
Simon Kirby	Director of MP&I
Andrew McNaughton	Chief Engineer
Robin Gisby	Director, Operations & Customer Services
David Wilkes	Territory Maintenance Manager
Richard Eccles	HQ Head of Route Planning
James Angus	Planning Analysis Manager
Nigel Wunch	Principal Route Planner - Scotland
Paul Harwood	Principal Route Planner - South Eastern
Andy Kirwan	Engineering Information Development Manager
Mary Jordan	National Engineering Reporting Manager
Andrew Simmons	Head of Signal Engineering
Bob Cummings	Head of Track Engineering
Kim Teager	Director of Civil Engineering
Jerry Morling	Asset Strategy Engineer - Signals
Ian Griffiths	FMS Manager - Signals
Andy Jones	Asset Strategy Engineer - Track
Alan Dray	Asset Strategy Engineer - Structures
John Schofield	Group Financial Controller
Erwin Klumpers	Senior Financial Analyst
John Stretch	Head of Estimating
Paul Wiseman	Head of Investment Planning, MP&I
Charles Robarts	Head of Strategic Planning
Mark Greenfield	Business Planning Manager
Martin Arter	MP&I Project Director - Track
Neil Thompson	MP&I Project Director - Structures
Jim Crawford	MP&I Project Director - Signals
Caroline Donaldson	Head of Risk
Sam Brunker	National Business Risk Engineer
Mark Inwood	Head of Maintenance Compliance & Assurance

Name	Role
Jeremy Harrison	Head of Project Risk & Value Management (MP&I)
Paddy Dingwall	Possession Planning Initiative
Martin Tiller	Engineering Knowledge & Reporting Manager
James McGee	Programme Manager, NST Maintenance Systems & Data
Sam Turney	Head of Environment Policy
Graeme Cox	Head of HSQE - P&E

The following table includes all Network Rail personnel interviewed between 9th October 2006 and 15th December 2006.

Name	Role
Chris Rumfitt	Head of External Communication
Adam Bennett	Head of Network Performance
Sam Brunker	National Business Risk Engineer
Mark Inwood	Head of Maintenance Compliance & Assurance
Jane Austin	MP&I Programme Engineering Manager - Structures
Paul Clark	MP&I Programme Engineering Manager - Signals
Chris Binns	Network Change Policy Specialist
Holly Garner	Network Change Policy Specialist
David Painter	Territory Maintenance Manager No 1
Christopher O'Connell	Response Team Leader No 1
James Andrews	Fault Control Manager No 2
Paul Jenkins	Maintenance Delivery Unit Manager No 2
Nigel Wilson	Area Engineer - Track No 1
Paul Rutter	Area Engineer – Signals No 1
Steve Pearson	Area Engineer - Track No 2
Andrew Denholm	Area Engineer - Signals No 2
Brigitte Over	Head of MP&I Contracts & Procurement
Paddy Dingwall	Research Manager
Peter Hancock	Delivery Unit Resource & Planning Coordinator No 1

Name	Role
Alex Wright	Section Manager No 1
Ian Arnold	Delivery Unit Resource & Planning Coordinator No 2
Bob Doran	MP&I Programme Controller - Signals
Martin Cunningham	MP&I Delivery Planning
Alistair Robinson	MP&I Territory Delivery Manager - LNE
Mike Newby	Head of Human Resources Maintenance
Rod Reid	Head of Assurance
Tim Baldwin	Head of IMM Maintenance and Delivery Unit
Brian Ollier	Technical Development Manager (RCM & Seasons Management)
Steven Fink	HQ Manager responsible for Contractor Safety Assurance
Brian Neave	MP&I Head of Contract & Procurement - Signals
Nigel Salmon	Senior Performance Analyst
Michelle Nolan-McSweeney (Mike Carr)	Assurance Manager
Theresa Clark	Head of Ergonomics
David Carrier	Head of Competence & Training
Chris Knight	Competence Management System Manager
Martin Powell	Project Management Framework Manager (MP&I)
John Fissler	HQ Signalling - Maintenance
Deanne Haseltine	HQ Signalling - Maintenance
Nigel Wilson	Area Engineer - Track No 1
John Whitehurst	IMM West Coast South
Nigel Ricketts	Territory Civil Engineer for South East Territory
Ian Frostick	Territory Civil Engineer for West Territory
Nigel Loadman	Plans and Diagrams
Mike Howard	Enterprise Architect
Various	Renewal Investment Panel (15/12/06)

Appendix B Evidence Collated

The following table indicates all evidence collected:.

Ref	Description of Evidence
01	Buildings Stations and Depots: Engineering Policy
02	Climate change: An assessment of the potential impact of Flooding on railways in the South West
03	Coastal and Estuarine Defence and Management Strategies - Good Practice Guidance
04	Examination of Ancillary Structures
05	Examination of Buildings and Station Structures
06	Examination of Buildings and Station Structures
07	Examination of Coastal, Estuarine and River defences
08	Examination of Earthworks
09	Examination of Retaining Walls
10	Examination of Structures
11	Extreme Weather Mitigation Work in Network Rail : Improving Asset Resilience
12	Extreme Weather Mitigation Presentation
13	Infrastructure Cuttings: Condition Appraisal and Remedial Treatment
14	Infrastructure Embankments: Condition Appraisal and Remedial Treatment
15	LNE: Drainage Management Strategy
16	Management for Civil Engineering Portfolio
17	Management of Existing Bridges and Culverts
18	Managing Existing Structures
19	org chart for civil engineering
20	Organisation Chart for Civil Engineering: Business planning
21	Organisation Chart for Civil Engineering: Fire Safety NST
22	Organisation Chart for Civil Engineering: Major Structures NST
23	Organisation Chart for Civil Engineering: Mining NST
24	Organisation Chart for Civil Engineering: Policy
25	Organisation Chart for Civil Engineering: Station Design NST
26	Organisation Chart for Engineering Executive Team
27	Organisation Chart for Signal Engineering
28	Organisation Chart for Territory Civil Engineering
29	Organisation Chart for Territory Civil Engineering Earthworks and Drainage
30	Organisation Chart for Territory Civil Engineering: Building
31	Organisation Chart for Territory Civil Engineering: Environment NST
32	Organisation Chart for Territory Civil Engineering: Outside Party Engineering
33	Organisation Chart for Territory Civil Engineering: Renewals

Ref	Description of Evidence
34	Organisation Chart for Territory Civil Engineering: Structures
35	Organisation Chart for Track Engineering
36	Recruitment Engagement for Coastal Storm Forecasts Pilot Scheme
37	Revisiting Examination Frequencies for Bridges
38	Seasonal Preparedness Earthworks - Package 4:TRV and Climate Correlations
39	Seasonal Preparedness Earthworks - Package 4:TRV and Climate Correlations
40	STAMP Training
41	STAMP User Guidance Part 1: Using the Model
42	Structures Annual Cost Profile Policy for Earthwork by Route and Earthwork Type
43	Structures Condition Marking Index Handbook for Bridges
44	The Civil Engineering Cost and Strategy Evaluation (CESCE) Phase One
45	Total Railway Drainage Project: Initial Scoping Document
46	Update on Total Railway Drainage Project
47	Minutes from the Signalling change panel 16 June 2006 - Notes and Actions
48	Track Inspection Handbook
49	MP&I Programme Controls - Cost Analysis Framework Design CAF Application Policy
50	National Asset Systems Group - Revised Remit from September 2006
51	Visio Core Systems
52	Extract Function MBR Risk Management Report
53	Integrated Risk Framework
54	Risk Management Process for change Projects
55	SR6 Cause Effect
56	FRM 702
57	Maintenance Unit Costs
58	HQ Delay Minutes Forecast -Period 05
59	Assumptions used for pax demand spreadsheet
60	Demand Forecasts for the Network Rail 2006 Business Plan: An Explanatory Note
61	June submission passenger traffic forecasts
62	Passenger KMS spreadsheet
63	BP001 Definition of Signalling equivalent units (SEU) and volume reporting
64	BP002 Definition of level crossing equivalent units (LXEU) and volume reporting
65	BP003 Pre-efficiency minor works unit costs norms
66	BP004 Scenario 4 report
67	BP006 Signalling renewed in 2005_06 SEU count
68	BP007 Scenario 2 Report

Ref	Description of Evidence
69	BP008 Scenario 2 Report Appendices
70	BP009 Part renewal descriptions
71	BP010 Signalling scenarios update
72	BP011 Extrapolation of SEU concept to partial or incremental resignalling
73	ICM workbank values and formats only 060616.xls
74	Management Plan for the Signalling Infrastructure Condition Assessment SICA process
75	RDM03 - Signalling Renewals Issue 5
76	Signalling Power Supplies: Trackside distribution system selection
77	Signalling review
78	Signalling Review: Medium term funding submission FINAL 290405
79	Drivers Only Operations Report
80	Product Lists - asset specific Signalling
81	Product Lists Glossary PM16 for GRIP Support Group
82	Project Completion Report
83	RDM03 - Principal Changes from Version 5.0 to version 7.0
84	CAF Application Policy
85	CAF Design Notes
86	CAF Guidance Notes
87	CAF Standard Operating Procedures
88	CAF Template Design
89	Project Management: Principles of Estimating
90	Business Planning Manual March 2006
91	Engineering Infrastructure Condition Assessment 2006
92	Agenda for Wessex RSPG
93	Minutes from Route Planning South East Territory - Wessex RSPG
94	Route Strategy Planning Group Remit
95	Route Strategy Planning Group Remit minutes
96	SWML RUS Appraisal of RUS Options
97	SWML RUS Baseyear Report
98	SWML RUS final forecasting report
99	Wessex RIRG minutes
100	CAF Application Policy
101	List of RWI's
102	Daily Incident Log Mon July 24th 2006
103	HQ Delay Minutes Forecast -Period 02

Ref	Description of Evidence
104	Significant Performance Incident Review LNW
105	Integrated Risk Quick Guide to Closing a Risk
106	Integrated Risk Quick Guide to Preparing the periodic Board Report
107	Integrated Risk Quick Guide to the Integrated Risk Process
108	Integrated Risk Quick Guide to Transferring a Risk
109	Integrated Risk Management
110	Management Plan Commitments ARM User Guide
111	Cross London Draft for Consultation
112	Cross London RUS Scoping Document
113	East Coast Mainline RUS Search
114	Northwest RUS Scoping Document
115	Yorkshire and Humber RUS Scope
116	Interim Report on the Development of an Asset Register
117	Business Plan 2006
118	Delivering our customers: Business Plan 2006
119	Delivering our customers: Business Plan 2006
120	MP&I Track Risk and Value Management
121	Asset Data Maintenance Reference Data Change
122	Asset Data Management for Maintenance - Standard Maintenance Procedure
123	Business Process Document - Asset Data Management
124	Improving our Network: Route Plans 2006
125	ORR comments on Network Rails 2006 Business Plans
126	Corporate Social Responsibility 2006
127	Minutes from the Corporate Responsibility Committee
128	Network Rail Corporate Responsibility Report 2005
129	Scotland RUS Scoping Document
130	Minutes from the Asset Management Strategy Steering Group
131	Network Rail: Business Planning Criteria
132	Freight RUS Scope
133	South West Mainline RUS
134	Interim Progress Report on the Development of an Asset Register
135	July AIS progress report
136	Initial Strategic Business Plan: Control Period 4
137	Network Rail Asset Policies
138	Network Rail Asset Policies Civils

Ref	Description of Evidence
139	Network Rail Asset Policies Electrification and Plant
140	Network Rail Asset Policies Signalling
141	Network Rail Asset Policies Telecoms
142	Network Rail Asset Policies Track
143	The Guide to Railway Investment Projects: Policy manual
144	Network Rail Route Strategies: Control Period 4
145	Appendix C - Phases of CECSE
146	Appendix to SACP Phase 4
147	Control Panel Model
148	Development of the STAMP to meet the future needs of SACP
149	Overview of proposed functionality of CECSE Model
150	Property Operations within Railway Estates National Inspection Regime
151	SACP Appendix 3 - Policy Definitions
152	SACP Phase 3 Summary Report
153	SACP Phase 4 - Feasibility Studies Summary Report
154	SACP Policy Guidance
155	Network Rail Management Plan
156	Business Plan Guidelines
157	AS7 Close Out
158	Asset Accessibility Matrix
159	Asset Accountability Matrix 1
160	Business Process Document - FMS Entry Data
161	Business Process Document - The Provision of Track Category and Traffic Data - Specification
162	Business Process Document - The Provision of Track Category and Traffic Data - Work Instruction Document
163	Data Collection Spreadsheet
164	Greater Anglia Scoping Document
165	Guide to Railway Investment Projects - Policy Manual
166	Investment Regulations - IR02
167	Delivering a better railway: Management Plan 2006
168	Geospatial Information Portal
169	MP & I: Civils Programme Director Reporting Pack, MBR pack 2006/07 Period 6
170	Civils Programme Management Plan
171	MP&I Civils Safety Plan
172	Getting a Grip of GRIP: GRIP simplification plan
173	Unit Cost Benchmarking

Ref	Description of Evidence
174	Contractors Supplier Feedback Form For Civils Projects
175	Investment Regulation IR01
176	Delays and Failures Spreadsheet
177	Business Process Document: Signalling Maintenance Task Intervals
178	Signal Compliance Report
179	Compliance - Technical Maintenance Audit Wessex Area
180	NR Area Signal Engineers Maintenance Audit 2005 - Audit Checklist
181	NR Area Signal Engineers Maintenance Audit 2005 - Audit Checklist
182	Engineering Planning Guide Aberdeen - Birmingham (via East Coast)
183	Principles of work and possession planning
184	Work orders with Account Code
185	User Instructions for Referencing Maintainer Renewal Work on Work Orders within MIMS
186	MIMS Data Quality
187	LNE MIP Improvement Plan
188	Unverified Process updated
189	Unverified Asset Database Screenshots
190	Desktop
191	Laptop
192	SACP Presentation 2
193	SACP Presentation 3
194	Maintenance Assurance and Compliance
195	Track Compliance Report
196	Pre notification draft
197	GRIP Version 6 Release: Briefing Pack
198	Civils GRIP Application Manual
199	MP&I and Maintenance Work Instruction: S&C Track Renewals Asset Management Plan
200	Standards Briefing Note: Process for Introduction of new or revised Maintenance Regimes for Signalling Assets
201	Process for Introduction of new or revised Maintenance Regimes for Signalling Assets
202	Standards Briefing note: Signalling Maintenance Task Intervals
203	Business Process Document: Signalling Maintenance Task Intervals
204	Specification: Competence & Training in Civil Engineering
205	Significant Performance Incident Review LNE
206	Root Cause Analysis Meeting Minutes
207	Bristol MDU News
208	Bristol Depot Change Initiative
209	GW Local Instructions - Index Master - Control Centre General

Ref	Description of Evidence
210	SMS Procedure with FMS ETAPAS
211	Prioritisation of Incidents/ Faults
212	Procedure for Major /Serious Incident
213	Major Incidents and Escalation Process
214	Management of Infrastructure Fault Control Failures
215	Management of Rapid Response
216	MP&I Maintenance and Work Instruction: Plain Line Track Renewals
217	Process Step: P6900 Undertake Pre Work Survey
218	Process Step: P6940 Accept LWR Train Method Statement
219	Process Step: P7945 Quality Tamp
220	Track Renewals Programme: Design and Acceptance of particular specifications for Plain Line Track Renewals
221	Engineering Project Specification: S&C Renewals
222	Engineering Management of Projects Delivered by the MP&I Track Programme
223	Maintenance Key Performance Indicators for the ICC
224	Signaling Snapshot
225	RDM03
226	GRIP Lite Signalling Minor Works Generic Quality Management Plan
227	Signalling Renewals Programme LNE Signalling
228	Signalling RDM03 Grip Update v.7.0
229	RDM03 - Signalling Renewals Development Manual
230	Guide to GRIP Lite RDM03 GRIP Lite Signalling Minor Works
231	Sponsor's Remit - Project Oxley Signalling Renewal
232	Development Remit - Project Oxley Signalling Renewal
233	Efficiency scorecard for all type A or B work
234	Interlocking Data cards - user guide
235	Weekly Performance Statistics for West Coast
236	Project Manager's Remit GRIP Stage 2 Cardiff Area Signalling Renewal
237	National Signalling Programme, MP&I, Doran LED Shunt Signals, Phase 1 Closeout
238	Business Justification and Stakeholder Analysis for Network Change - guidance note
239	Part G - Network Change
240	Copy of the TPIP Process Activities List
241	webDocDisplay
242	10 Year Vision
243	Solution Design and Development Framework Overview
244	PossMan High Level Design
245	MS Project/PDF document showing plan/procedure for handover of ADM project to NASG.

Ref	Description of Evidence
246	Extract from Management Handbook
247	Management of Maintenance
248	Audit Manual
249	Infrastructure Maintenance Manager Chart
250	Territory Maintenance Director Chart
251	Territory Maintenance Manager Chart
252	Tactical Safety Group: Quarterly Assurance Report
253	Wales and Marches Area: Audit Report
254	Summary NCR Report
255	Extract from NIAD - NCR Actions
256	Extract NIAD Report
257	Bristol MDUM - Actuals and PFPI Targets by Period
258	Assessment in the Line - Line Manager Guide
259	Audits and Compliance Monitoring within Maintenance
260	Job description of the Head of Maintenance Compliance and Assurance
261	Inspection and Surveillance of Signalling Engineering Activities
262	Managing Non Conformance Reports Within Maintenance Organisations
263	Network Rail Audit Manual
264	SMIS Report for incidents trespass and vandalism
265	2006 -07 Track Summary
266	copy of the Western KPI Review 2006/2007
267	TV Track Cates
268	Feasibility Phase Definition Report
269	Project Management Framework
270	Competence Framework Presentation
271	PDR Slateford P-Way Depot
272	PDR Slateford P-Way Depot
273	Minutes of Work Planning Meetings
274	Principles of work and possession planning
275	Engineering Specification: Maintenance and Repair of Rail Vehicles - Competency and Training Requirements
276	Signalling Supplier Briefing
277	Tactical Safety Group: Quarterly Assurance Report - Rob Reid, Head of Assurance
278	Assurance and the Role of Engineering and Safety and Compliance
279	Network Rail Company Standard: Competence Management – NR/CS/CTM/001
280	Business Process Document: Competence Management – NR/SP/CTM/001
281	Business Specification: Quality Assurance in Training Delivery - NR/SP/CTM/005

Ref	Description of Evidence
282	Business Specification: Quality Assurance in Competence Assessment - NR/SP/CTM/006
283	Business Process Document: Competence & Training in Track Engineering - NR/SP/CTM/011
284	Business Process Document: Competence & Training in Signal Engineering - NR/SP/CTM/012
285	Business Process Document: Competence & Training in OHL Engineering - NR/SP/CTM/014
286	Business Process Document: Competence & Training in Conductor Rail Engineering - NR/SP/CTM/015
287	Business Process Document: Competence & Training in Fixed Plant Engineering - NR/SP/CTM/016
288	Business Process Document: Competence & Training in Civil Engineering - NR/SP/CTM/017
289	Business Process Document: Competence & Training in Distribution Engineering - NR/SP/CTM/018
290	Business Process Document: Competence & Training in Track Safety - NR/SP/CTM/021
291	Network Rail Company Standard: Incorporating Ergonomics within Engineering Design projects: Requirements – NR/SP/ERG/24020 (formerly RT/E/P/24020)
292	Network Rail Guidance Note: Incorporating Ergonomics within Engineering Design projects: Guidance Note – NR/GN/ERG/00027 (formerly RT/E/G/00027)
293	Network Rail Standard Delivery Planning Procedure: Manage Change – NR/PRC/MPI/PP09
294	Network Rail Standard Maintenance Procedure: Safety Tours – NR/PRC/MTC/SE0118
295	PossMan High Level Design, Version 0.2
296	MIMS Rescheduled Work Report – ECM81100
297	MIMS Rescheduled Work Report – ECM82100
298	Quarterly Report 0164 MIMS Reschedules Work Report, Scotland Territory 20061009(1)
299	Possession planning spreadsheet: Visual Plan 2006-2007 – Newport (version 1)
300	Resource Sheets for Possession linked workload: Doncaster Week 30 2006
301	Resource histogram: LNE Shifts Per Week spreadsheet
302	Methodology statement “The Scheduling of Day-to-Day Non-T3 Work Arising”: LNE local document
303	Scheduling Process Flow Chart – Mid-week work arising: LNE 09-06-04
304	Project Management Manual PM15 - Roles and Responsibilities
305	Plain Line Problem Statement
306	S C Renewals 2005 to 06
307	Proposal for Track Renewal: Header and Control Form - Sapperton
308	Track Renewals Generic Project Maintenance Strategy
309	MP&I Work Instruction: Commissioning of Track Renewals Works undertaken by the MP&I Track Programme
310	Track Renewals Process Document: Switch and Crossing Track Renewals
311	Track Renewals Process Document: Plain Line Trak Renewals
312	Standard Maintenance Procedure: Procedure for the requisitioning of railway spares

Ref	Description of Evidence
313	London North West Stock Shortage Report
314	Refresher Training Presentation
315	Document Management Policy
316	Business Process Document: Document Control - Process and Accountabilities
317	Company Standard: Document Control - Issue and Reciept
318	Project Manager's Asset Data Management Checklist
319	Strategy - Intelligent Infrastructure
320	Towards Intelligent Infrastructure
321	OJEU Responses for IMM
322	MIMS Improvement Programme: National Overview
323	Example ARM Output
324	Example Investment panel papers for projects GGRK60 and EEPH06
325	PM05 - The Management Plan
326	PM09 - Reporting
327	PM10 - Risk Management
328	PM14 - Project Close Out
329	PM15 - Roles and Responsibilities
330	Project A635 - Project Close Out Report
331	RT/E/S/11221 Signalling Works Testing
332	Track Inspection Handbook
333	Example completed dispensation form for non compliance of minimum actions
334	Example of Track Compliance Indicator Report
335	Example Agenda and Minutes from the TME weekly meeting with Supervisors
336	List of 2009/10 renewals / problem statements
337	Project Management Maturity for MP&I - Analysis and Recommendations for Improving the Company's Project Management Capability - Consolidated Report (Report 2), Martin Powell