

Signalling Review

Network Rail's long term funding
submission

June 2006

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Introduction

Structure of document

This document contains the individual supporting elements that have been compiled in support of the signalling element of the Periodic Review 2008.

It is structured in to five main sections:

Policy and strategy

The policy and strategy section explores which policies and strategies are applied in respect of technology choices, maintenance, and supply chain issues when identifying renewals.

Planning

This section explains how the workbanks are developed; the application of the signalling infrastructure condition assessment tool; how deliverability is assessed and integrated within the planning process. It also highlights the need for support contracts and development funding; and how unit costs are developed and used.

Delivery

This section explains the delivery processes and organisation required to deliver the renewals workbank. It also explains the analysis of the supply sector and how the procurement strategy and renewals workbank have been aligned to improve delivery efficiencies.

Output from scenario work streams

This section summarises the main finding from the scenario work streams.

The conclusion and detailed appendices complete this submission.

Interaction between the 2008 Periodic Review and the Signalling Review

The Rail Regulator published his Final Determination of ACR 2003 in December 2003. The determination recognised that uncertainty existed in the forward projections of volumes, costs, and technologies that were available and associated with signal renewals. It stated:

"In the next two years, Network Rail will need to increase the amount of renewals to approximately the levels that had previously been established. Thereafter, there is uncertainty about the volume of work Network Rail will need to carry out and the strategy that it should have in place for its signalling equipment. The Regulator is aware that Network Rail is addressing these issues and will be producing a national signalling strategy by next year. He has therefore decided that it is necessary to conduct a further review of signalling before April 2006 in order to determine Network Rail's finding requirements for the last three years of the Control Period"

Access Charges Review 2003: Final Conclusions, paragraph 5.6(c)

In the anticipation that the signalling review would be completed by December 2005, CP3 funding for signalling was constrained by the Regulator to 2005/06 levels. During ACR 2003 we acknowledged that the signalling renewals strategy and associated volumes may be subject to change due to improvements in our planning processes, developments and confirmation of our technology and procurement strategies, and any interactions with, or provision of enabling works to, the ERTMS programme.

It was proposed that a further more in-depth study of the signalling renewals requirements be carried out and that a regulatory review of future signalling volumes, technologies and costs should be completed within two years. This would confirm the expenditure levels required to the end of CP3. Because of the lead-time and long term nature of signalling renewals, a settlement for only three years was thought to give an insufficient level of certainty to the supply industry and would not allow us to plan effectively the achievement of our efficiencies. Therefore, it was agreed that a two-part submission, taking into account first the medium term expenditure to the end of CP3 (March 2009), and then the long term expenditure needed to the end of CP4 (March 2014) would be a more appropriate format. During the evolution of the signalling review, the structure and processes associated with the regulatory management of Network Rail was changed by the Railways Act 2005. As a consequence of these changes, the Office of Rail Regulation in conjunction with Network Rail considered that it would be appropriate to incorporate the Long-Term Funding submission originally proposed as part of the Signalling Review into the Periodic Review 2008.

Process adopted for the long-term review

ACR 2003 highlighted issues to be addressed in developing our future signalling strategies; the long term funding submission has been developed to facilitate a clearer understanding of these issues.

In terms of process adopted for the long-term review it was agreed that a similar process to that used in the medium term review would be implemented. In particular stakeholder engagement was considered essential by Network Rail and the Office of Rail Regulation. To facilitate this cross industry engagement the two management meetings adopted for the medium term submission were continued.

- Signalling Review Steering Group
- Signalling Development Group

The terms of reference for these groups were modified to cover the long-term submission and the membership of the Signalling Development Group was also expanded to include representatives from the Association of Train Operators (ATOC) and Railway Industries Association (RIA).

In considering the long-term signalling review, it was agreed by Network Rail and the ORR that four scenarios would be adopted as follows:

- Scenario 1: Condition led, delivery optimised, optimised whole life asset costs.
- Scenario 2: Condition led, delivery optimised, optimised whole life system costs.
- Scenario 3: Condition Led, ERTMS Optimised.
- Scenario 4: Capped expenditure

Consultation and discussions with stakeholders were also held where it was considered appropriate by the members of Signalling Development Group.

The long term review is now integrated into the process for the periodic review 2008. This document therefore supports the information contained in Network Rail's June 2006 initial strategic business plan that forms an early input to that review.

Evolution and convergence of the scenarios

Simultaneous with the development of the scenarios for the long-term submission, the National ERTMS Programme Team (NEPT) were developing the National Business Case for ERTMS. It was recognised that in order to produce the National Business Case for ERTMS there had to be a common understanding of the signalling renewals workbank. It is this factor that has had the most significant impact on how the development of the scenarios has been implemented and is explained in more detail below and in 'Signalling scenarios Update.'

Development of the Scenario 1 and Scenario 3 workbank

In developing the Scenario 1 workbank, it became clear that based upon raw SICA information, the unconstrained engineering workbank would exceed industry capability and was unlikely to be affordable. In addition a significant tail-off in demand also occurred following the short period of peak demand. Network Rail recognised that such a renewals profile was not appropriate and that some form of smoothing was essential to produce a sustainable workbank.

It was possible to identify a number of factors that could be utilised in determining the relative priorities of individual workbank items in situations where the overall unconstrained engineering workbank exceeded a sustainable delivery level. In conjunction with NEPT it was decided that an appropriate consideration was alignment with Rolling Stock replacement wherever feasible, this would have benefits in optimising the costs of the ERTMS roll-out plan. Even if the roll-out plan was not affordable, as the case presently exists, it was recognised that such an alignment would still facilitate optimum alignment should the business case improve over time. It would also allow conventional signalling to be optimised to rolling stock replacement even where ERTMS is considered inappropriate either due to costs or other factors.

Given the above factors the Scenario 1 and Scenario 3 workbanks have converged into a single workbank in terms of when major renewals occur. The difference between the Scenario 1 and 3 workbank is the type of technology to be used when the renewal activity is required. In Scenario 1 the renewal activity is likely to be implemented using line side signals whereas in Scenario 3, the renewal activity is likely to be implemented using ERTMS either with or preferably without line side signalling.

It is recognised that alignment with ERTMS is one of a number of strategies that could have been adopted to produce a deliverable and sustainable workbank. Whilst other strategies could have been adopted, the main issue from an efficiency viewpoint is that a forward plan has been produced. This will enable long-term planning to be implemented addressing industry capability and competence and will also facilitate obsolescence strategies for key systems. It must be recognised that the scenario 1/3 workbank also provides the baseline for any changes to programme due to changes in industry priorities. In addition to the efficiencies benefits, the alignment with Rolling Stock replacement also facilitates a line of route approach rather than piecemeal interlocking renewals – this will allow route enhancements to be more readily realised. Formal change control procedures will be implemented to ensure that any proposed changes are acceptable in terms of asset condition and performance as well as deliverability.

Development of Scenario 2

Scenario 2 has involved investigating the benefits of a number of functions and systems that could produce whole life benefits to the railway, not just Network Rail. It was originally envisaged that changes to the Scenario 1 workbank may have been required if the business benefits of some of the items required changes to the priorities of the renewals workbank.

An analysis of the outcome of the Scenario 2 investigations reveals that no priority changes to the workbank can be justified at this stage and therefore Scenario 2 has no impact on the Scenario 1/3 workbank.

Our business planning criteria and the Signal Engineering Asset Management Policy clearly highlight the importance of considering these options at the time of renewal. Clearly, however, it is not possible to model this in a mechanistic way since it depends on the specific circumstances.

Development of Scenario 4

Scenario 4 is considered to highlight the implications on the functionality, condition and sustainability of the network should a financial cap be imposed on the renewals plan.

It is considered that such an analysis can be implemented from a theoretical position and that the production of a workbank is not necessary. Scenario 4 therefore considers from a theoretical perspective the implications of capped funding. Initial considerations for Scenario 4 were based upon an analysis showing the impact at the average CP3 level and at levels of 10% and 20% below this figure. During the development of the scenarios it was recognised that during CP3 there is a significant growth element and that the expenditure in 2008/09 is predicted to be far higher than the average yearly expenditure. Therefore it can be determined that if the average CP3 expenditure is considered in Scenario 4, then a year on year reduction in expenditure from 2008/09 will be experienced even prior to further reductions of 10% and 20% being imposed.

Scenario 4 therefore models the following theoretical situations:

- Annual expenditure at average CP3 values plus further reductions of 10% and 20%
- Annual expenditure at average CP4 values plus further reductions of 10% and 20%
- Annual expenditure showing the implications of the average CP3 values on the scenario 1/3 workbank plus further reductions of 10% and 20%

Interaction with the Signal Engineering Asset Management Policy

The Signal Engineering Asset Management Policy has been updated in line with the emerging issues from the Signalling Review. In particular it incorporates the finding from scenario 2 highlighting those items to be included in the base case for renewals and those items that need to be considered on a project by project basis.

The Signal Engineering Asset Management Policy can therefore be considered as defining scenario 1 and 2, whilst scenario 3 is presently informed from the National Business Case for ERTMS published in December 2005 but will be further updated following the Red Diamond Review due in December 2006.

Policy and strategy

The Signal Engineering Asset Management Policy considers the overall signalling system throughout its entire lifecycle. The objective of the asset policy is summarised as follows:

The Signalling Asset Policy sets out the maintenance and renewal policy statements that are intended to deliver the required network and route outputs for the funds that are available.

Network Rail's signalling policy has two main aims. Firstly it aims to set out a development path that will deliver signalling and control systems fit for the long-term needs of the business. Secondly it aims to improve asset management of the signalling infrastructure.

Signal Engineering Asset Management Policy

The purpose of the Signal Engineering Asset Management Policy is to define the functionality and systems required to deliver the requirements of the various stakeholders whilst considering whole life costs. Within the Long Term Signalling Review a number of technical/functional issues were considered within Scenario 2. These have been incorporated within the Signal Engineering Asset Management Policy where appropriate. The Infrastructure Cost Model is based upon the technology policy described within the Signal Engineering Asset Management Policy, supported by the Signal Engineering Asset Management Justification document, the work from Scenario 2(BP007/BP008) and Trackside Distribution System Justification (BP005).

Renewals identification

The signal engineering asset management policy for renewals is to minimise the whole-life cost of the signalling system, while as a minimum maintaining both safety and performance requirements, within the available funding and deliverability constraints. To achieve this requirement, we use a combination of life-extension and total renewals activities. Life-extension activities involve partial renewal or replacement of selected components in order to extend the expected asset life.

We have adopted a national renewals planning process that prioritises workbanks against national requirements and constraints, and helps facilitate the use of the most cost-effective renewals strategies. The national renewals workbank allows greater flexibility to accommodate variations brought about by changes in asset condition, business requirements such as enhancement opportunities or project delivery constraints, leading to greater overall stability in the workbank.

As detailed within the Business Planning Criteria document, we are aligning signalling renewal activities with other activities on the network such that whole life efficiencies or benefits to our stakeholders can be achieved. The workbanks are also developed within delivery constraints; both internal and external to Network Rail.

The resultant modified workbank incorporating these additional constraints generates the business plan for signalling and is reflected in the Infrastructure Cost Model to support the long-term planning of the network. Through interaction with stakeholders in Route Investment Review Groups and Route Strategy Planning Groups, modifications to scope and timings of renewal are considered. Where business opportunities are considered appropriate, modifications to the renewals plans are incorporated.

Project development

Our approach to project development is designed to minimise risk to the company through the life-cycle of the project and also during operations and maintenance of the system. This is achieved by using in-house resources to develop renewal schemes, and control the management of minor works and life-extensions. We are also investigating the feasibility of setting up minor works teams within the maintenance organisation. These teams will be able to implement minor renewals activities as well as maintenance works that require small design changes.

The introduction of the Guide to Railway Investment Projects (GRIP) has also introduced greater rigour into the project authorisation process. GRIP requires stage gate reviews at the completion of appropriate development phases within the project. The investment authorisation process, whereby all projects are required to be authorised by the Renewals Investment Panel (RIP) and, where appropriate, the Network Rail Investment Panel, further enhances the effectiveness of the GRIP process.

Whilst the base case for a renewal project is to provide existing network outputs, stakeholder involvement through Route Investment Review Groups and Route Strategy Planning Groups play a key role in defining any enhancements and or rationalisation options to be considered within the

development phase of a renewals project. The process for this interaction is detailed within the Business Planning Criteria document.

Project delivery

The Major Projects & Investment team (MP&I) is the delivery organisation for all signalling renewals projects, except for a number of remaining renewal and enhancement schemes on the West Coast Main Line. The delivery of signalling projects is now managed on a national basis. This facilitates the standardisation of processes and enables consideration of the wider interactions with the supply market. The clearer understanding of delivery constraints that arises from single point accountability allows us to determine with greater confidence our ability to deliver the workbank, and make appropriate adjustments to the workbank. This reduces the likelihood of a particular market sector becoming critical in terms of delivery capability and hence driving up costs in that sector, while introducing spare capacity in other dependent market sectors.

Maintenance

The key focus of the strategy for maintenance is to consolidate best practice maintenance into a single set of national maintenance standards for use by the in-house maintenance teams. The introduction of national Signalling Maintenance Standards (SMS) has facilitated the production of national competence standards for technicians, which are presently being further developed. This will enable the introduction of standard training modules which are currently under development. These initiatives are intended to improve further the competence of our maintenance staff in a cost-effective manner, and increase the overall effectiveness of maintenance to increase the performance of the signalling system.

National SMS have been introduced in conjunction with the MIMS workbank management system. Better visibility of maintenance activities will ultimately allow us to determine the effectiveness of the maintenance regime, and give a greater understanding of the impact of the SMS.

We are also developing of a Defects Management System (DMS), which will operate in conjunction with the MIMS workbank management system, to standardise the action taken on discovering defects and allow appropriate prioritisation. The use of the MIMS workbank management system will facilitate processes to monitor the action taken to address defects and will allow any backlogs developing to be addressed appropriately. It will also provide a consistent measure to assist in renewals decisions.

We are also introducing reliability centred maintenance for our signalling assets. Reliability centred maintenance allows standard tasks to be implemented at different intervals dependent upon the overall risk to the operation of the railway. The development of reliability centred maintenance is being implemented under the Reliability Centred Maintenance of Signalling Equipment (ROSE) initiative; this is building upon the lessons learnt from an earlier implementation of risk based maintenance.

Examples of assets to which risk-based maintenance has been applied and successful results have been obtained include:

- clamplock and HW-type point machines; and
- Train protection and warning system (TPWS).

The main influences on the frequency of risk-based maintenance are safety and performance driven, and vary depending on the equipment type. Benefits have been observed where new maintenance regimes using risk-based maintenance have been introduced, however, with only partial coverage of equipment types the full benefits have yet to be realised. We therefore intend for ROSE to extend reliability centred maintenance to cover other equipment types. It is likely that the extension will

involve the modification of existing SMSs rather than the introduction of duplicate maintenance standards for identical types of equipment.

Resources

Our primary aim in this area is to ensure we have sufficient competent resources to safely and reliably sustain the network. A number of factors are associated with the achievement of this objective. These include long term planning in order that future skills requirements are understood, and common methods on implementing activities across the company such that common competence standards can be developed. These common competence standards will be supported by common training modules.

In conjunction with London Underground Ltd, we now stipulate that all staff implementing critical signal engineering activities must have an Institution of Railway Signal Engineers (IRSE) licence. We have also produced common equipment-specific competence requirements for maintenance activities. Common training modules are now being developed. We believe that such actions will not only further increase the competence of our staff, but in conjunction with MIMS will also improve the reliability of the railway by ensuring quality maintenance is undertaken at the appropriate time.

We have been actively addressing key resource shortages; in particular we have launched a signal engineering conversion programme. Through this programme experienced engineers from other disciplines attend a fast-track training programme, devised in conjunction with external training providers. We are now beginning to obtain the benefits of this programme as a number of the conversion engineers bring their previous external experience into the industry. We have also been successfully recruiting project managers to the signalling delivery organisation. Any temporary shortfall in the available project management resource will be mitigated by prioritising schemes, based on their importance and complexity. We will focus our internal resources to address these priority schemes, and we will use short term agency staff for less complex projects.

As part of overall national initiatives covering all disciplines, signal engineering will benefit from the intake of additional graduate trainees and the formulation of the Network Rail advanced apprenticeship scheme.

Supply chain

We recognise that in order to sustain the network in a cost-effective way, it is essential to consider the impact of policy decisions and workbank formulation on the supply chain. In recognition of these issues we have completed a number of initiatives; these include reviewing the types of work required and identifying appropriate supply chain sectors, and analysing the make up of these sectors to determine if more efficient contracting mechanisms can be introduced.

Within the individual sectors we have also considered the supply capacity in relation to the volumes within the workbank. Modifications to the proposed volumes have been incorporated such that we can have greater confidence in delivering the volumes in a cost-efficient way.

As highlighted in a later section, the result of this analysis is a procurement strategy that recognises the key sectors of the supply chain and the development of framework contracts to provide long-term commitments to suppliers to allow efficiency and training initiatives to be realised.

Efficiencies

In order to drive out waste from the development and delivery of signalling renewals we are pursuing a number of opportunities, introduced here and considered in greater detail in subsequent sections. They mainly fall into the categories of scope, engineering optimisation, supply chain and unit costs.

- Scope. During the project development phases, the required capabilities of resignalling schemes are examined to determine if the proposed engineering solution is appropriate. Opportunities are considered to optimise the engineering solution to deliver whole life benefits to the railway.
- Engineering optimisation. A number of existing designs and processes have been developed as a result of incremental requirements over a number of years. We are reviewing these designs and processes to determine whether they consistently deliver the desired outputs in the most efficient way.
- Supply chain. We are working closely with our main suppliers to determine methods by which projects can be delivered more efficiently by the removal of waste. Such initiatives include improvements to the procurement process and the long term stability of workbanks. We believe that this approach will deliver efficiencies by providing the supply chain with an improved and stable view of the workbank, improved processes and improved contract documentation. This approach is also recognised by the Railway Industry Association (RIA) as an appropriate way to cater for growth in the industry.
- Unit costs. In order to measure and control the efficiencies programme, relevant metrics are required. We have an established metric for renewals; the Signal Equivalent Unit (SEU), Level Crossing Equivalent Unit (LXEU) and minor works metrics. It is therefore expected that we will be able to monitor our performance against the required efficiency targets more robustly as a result of these metrics.

It is our consideration that the above activities contribute to the efficiencies profile modelled within the Infrastructure Cost Model. This will also be subject to further work as part of the programme outlined in the efficiencies chapter of our initial strategic business plan.

Planning

The business plan as defined within the Infrastructure Cost Model comprises the engineering workbank necessary to sustain the network, taking due cognisance of delivery constraints, and opportunities for incorporating other discipline renewals and enhancements where they are cost-effective.

The overall planning process adopted by Network Rail is described in the Business Planning Criteria document. The remainder of this section details how this has been implemented from a signalling perspective.

Engineering workbank

The workbank is generated from a number of sources, including:

- Signalling Infrastructure Condition Assessment (SICA);
- asset failure data;
- maintenance reports and requests; and
- compliance issues and corrective actions.

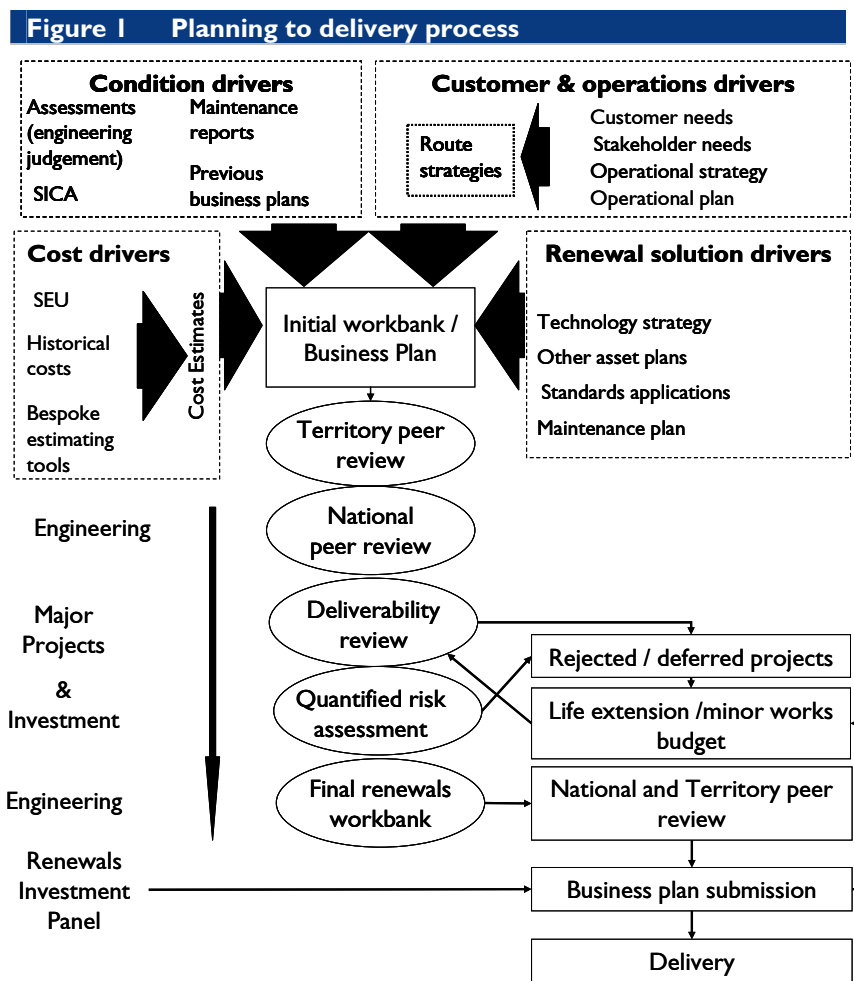
All interlockings have a SICA record that gives details of their installation and their theoretical renewal date. They are inspected to assess, and adjust if necessary, whether the renewal data contained in the SICA database is correct, given the condition of the asset.

Every interlocking on the network has an associated Interlocking Data Card (IDC) that records the proposed renewals plan for that interlocking. The work items detailed on the IDCs are then combined at territory and national level to produce an overall engineering workbank. The primary data for the IDC is the SICA survey although renewal proposals are subjected to a peer review process where a panel of Network Rail engineers determines if the renewal proposal is valid for the observed condition of the asset. The peer review process involves a detailed inspection of the installation to confirm the

main drivers for renewal. The peer review activities cover over 60% of the renewals workbank. It is not necessary to achieve 100% coverage as the process also provides a mechanism by which the territory signal engineering team can benchmark their assessment of condition.

Minor works renewals assessments, including wire degradation and silver migration checks, are identified by the Maintenance function. These activities are generally more immediate in nature and detail the work necessary within the next two years. The initial workbank is unconstrained and therefore it does not include any life-extension opportunities that will be required in order to sustain the network should any renewals be deferred or delayed. The IDC also records life-extension proposals as an alternative method to addressing the main drivers of renewal. A life-extension activity, for example cable replacement, can delay the SICA date therefore extending the useful asset life of the installation, and may provide a more cost-effective solution for a given time period. IDCs also records minor works that are required to maintain the existing operation and functionality of the equipment.

The following diagram illustrates the process used in generating the final deliverable workbank.



Operational and stakeholder interface

The operational and stakeholder input to the engineering workbank is driven by the RUS and Route Strategy processes informed by Route Investment Review Groups (RIRG) and the Route Strategy Planning Groups (RSPG). The role of the RIRG is to interface with customers; the RSPG interfaces internally. Both groups will examine the renewals plan and specific renewals proposals to enable the relevant parties to identify programme, scope or specification changes, or potential enhancements. Where combined renewal/enhancement schemes can be demonstrated to have overall benefits to the railway, it is possible to modify the business plan to accommodate priority changes

The operational and stakeholder requirements are input throughout the early stages of the GRIP process. At GRIP stage 2 external stakeholder consultations with TOCs, FOCs, SRA and other third parties, ORR, Highways Authority and local government takes place.

Concurrently, internal consultation relating to operational route strategy and control centre strategy also occurs. Internal cross-functional sign-off to ensure the suitability of the scheme to address the needs of all stakeholders is required when the business case is presented to the Renewal Investment Panel or the Network Rail Investment Board.

Signalling Infrastructure Condition Assessment

Background and history

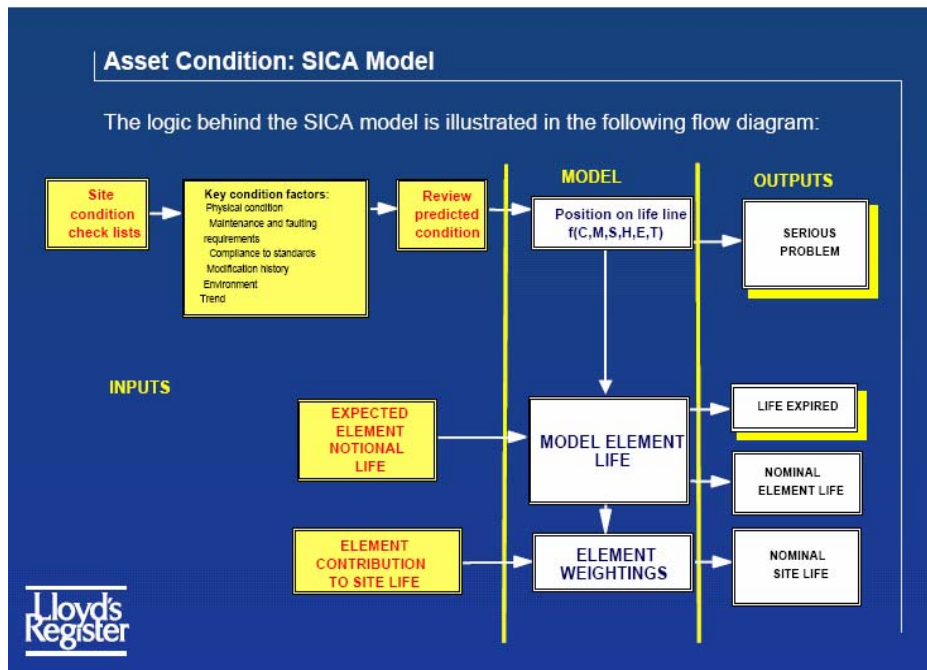
In 1994 Railtrack commissioned development of a methodology and tool to estimate the remaining useful life of signalling systems - Signalling Infrastructure Condition Assessment (SICA). The tool would be used to support planning of renewal at the optimum time to prevent degradation of asset condition and performance. It was also considered that the tool could support achievement of any condition-based targets set by the ORR. Imperial College, London, RTSC led the project, supported by Railtrack engineers and independent rail consultants MHA Ltd (now Lloyd's Register Rail Ltd). The project was to be a continuation of previous development work undertaken under BR.

Through continued application of the tool refinements have been identified and various upgrades to the model and methodology introduced. In June 2004, SICA3 was released. It includes a module which will be used to assess level crossings, following initial validation in the field.

SICA process and outputs

The SICA model combines qualitative reporting from site inspections with quantitative modelling, and generates an assessment of the condition of individual elements present at the site with a weighted summary for the site as a whole. Assets within the site are broken down into groups, known as elements, each of which is expected to have a notional life, based on expert opinion of the typical life-span of these elements. The model combines a number of factors, known as the key condition factors, for each of these elements to predict when they will require replacing. This is the nominal life or remaining life. The model then combines these lives through a weighted average to give an indication of the life of the site as a whole.

Figure 2 SICA process



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Often condition assessment is subjective in nature and subsequently it is difficult to prioritise and compare across national assets. By supporting professional judgement with SICA a significant level of objectivity can be introduced, providing consistent and transparent outputs allowing comparison of results between sites. SICA achieves this through the use of standardised methods and definitions, so that consistent results can be produced, even if undertaken by different individuals and organisations. It is generally recognised that condition should have a quantitative dimension. SICA does this by providing outputs that allow measurement of interlocking life and its constituents.

Primary SICA assessments focus on the factors driving interlocking life and provide a means to rank condition between sites. This focuses on condition-driven priorities. Secondary SICA assessments provide a more comprehensive evaluation of condition, increasing confidence in results and providing a means to evaluate and compare renewal and maintenance options, allowing direct comparison of results with other sites and priorities.

The remaining life output from SICA provides an indication of the relative condition of the site as a whole and, although not a definitive life indicator, it can be used as a comparative figure providing a key input to the investment planning process at both local and national levels. Calibration of methods and results is ongoing and relies on feedback from the users, peer review and decision makers as experience is gained.

As SICA is the primary input to the IDC and therefore the engineering workbank, the detailed level of life extension/minor works is greater for those areas where a secondary SICA has been implemented. Typically this restricts the accuracy of the IDC derived workbank to 4 years, extrapolation techniques have been used in the Infrastructure Cost Model for life extension/minor works for future years.

Level crossings

Level crossings have not until recently had a specific SICA module to determine the long term renewal requirements. The assessment for the long-term submission has used a combination of professional judgement, interlocking SICA, maintenance reports and knowledge of the steady state renewals rate. Whilst we recognise that this does not benefit from the structure that will be provided by the level crossing module of SICA, we consider that for the long-term term workbank it is sufficiently rigorous when coupled with the peer review process.

Similar to interlocking activities, synergies between safety enhancements and renewals activities are considered. However, a clear distinction is made between minor works and complete renewals, and safety enhancements. Upgrading to current standards, where appropriate, is only considered when a full renewal of the control circuitry is proposed.

Risk assessments are carried out to ensure the risk level is as low as reasonably practicable (ALARP) on level crossings where the perceived risk has changed, or where a renewal may not be designed to provide a like-for-like replacement. It should be noted that the technology currently being considered for future renewals may not ultimately derive the same individual risk integrity as that presently achieved by existing level crossing technologies. However, it will be better optimised to the risk level that is being mitigated. Such developments will, therefore, reduce the overall risk to the railway, although on an individual crossing by crossing basis the level of risk may change. Such a process of risk management is considered to satisfy ALARP criteria when considered as addressing level crossing risk across the whole network.

The completion of the SICA assessments of all level crossings requiring signalling equipment will be completed by autumn 2006. It is proposed that a long-term level crossing plan will be produced following the completion of this exercise. This will facilitate pre-GRIP activities to support level crossing closures which can require extended periods of consultation with relevant stakeholders.

Potential delivery constraints

The first part of this process has been a study to determine the maximum capability of the delivery organisations both internal and external to Network Rail. This capability lies in a number of differing market sectors; these were examined as part of the medium term review and are re-validated on an ongoing basis.

This delivery capability is then matched against the initial workbank, and adjustments made to the IDCs and the overall workbank where necessary. It is at this stage that additional life-extension opportunities are considered and entered on the IDCs. In some cases the life-extension opportunities may be sub-optimal in their own right, but are appropriate in the context of delivering the overall programme within a delivery or financial constraint.

The process reviews critical elements of the renewals delivery programme. In circumstances where the programme risk is considered unacceptable, further workbank iterations are required. It should be noted that where projects are delayed due to delivery risks, the risk associated with the deferment have to be considered and, where appropriate, life-extension activities implemented. These additional life-extension activities are likely to be sub-optimal and also increase the minor works requirement – itself then requiring a further examination of delivery capability.

Interaction with other assets

In developing our asset workbanks, significant importance has been placed on understanding and aligning as far as possible with the renewal requirements of other asset types, and any relevant enhancement proposals. By aligning these activities and the renewals programme it is possible that overall efficiencies can be achieved whilst optimising the network outputs - this applies particularly to

switches and crossing renewals. For schemes presently under development centralised processes are being implemented to ensure that cross functional benefits are recognised at the business planning stage. This involves the workbanks being shared between engineering disciplines to determine if alignment is possible. The opportunity is also taken to agree the most appropriate specification at common interfaces, for example, points machines.

Should such alignment opportunities exist, they are flagged on the IDC to ensure that any subsequent changes to the asset workbanks make due reference to this fact. Similar activities occur with route planning to ensure enhancements are considered. Where alignment possibilities exist further studies determine the full scope of the potential benefits, such as efficiencies or improved outputs that can be achieved. This may involve moving renewals, or deferring them in favour of life-extension works.

Support contracts

The purpose of support contracts is to facilitate the recognition and options associated with the ongoing use of critical systems, in particular, the management of obsolescence, and technical queries connected to cost-effective installation, and ongoing maintenance support. As highlighted in the medium term submission increased coverage of support contracts is required so as to provide appropriate timely cover for recently introduced systems, such as CBIs, axle counters and point machines, where the future effective management of obsolescence will become critical in sustaining the network in a safe and cost-effective manner. The support contracts themselves only identify and recommend actions to be taken by Network Rail. Each individual package of work requires incorporation into the business plan and authorisation through the approved company investment processes. We regularly review the range and scope of support contracts to ensure that the coverage is appropriate for the long-term sustainability of the system.

Development funding

In a number of cases opportunities associated with efficiencies or capacity enhancements and obsolescence issues require development activities prior to acceptance in to service or the update of processes – including the implementation of network trials. In order to deliver these improvements development funding has been incorporated into the business plan. Due to the nature of development activities where it is difficult to predict the future scope, funding allowances have been used in the business plan based upon historical spend profiles.

Unit costs

Interlocking renewals - SEUs

Costs of renewals schemes vary widely due to a range of cost drivers. However, empirical work with available data from completed schemes has demonstrated that scheme size and complexity can be adequately represented when illustrated by the number of output units i.e. signals and point ends. This provided the basis for the use of signalling equivalent units (SEU). The number of SEUs associated with each interlocking is a primary input to the IDC and business planning process (see Definition of Signalling Equivalent Units (SEU) and Volume Reporting – BP001). The use of SEU applies to all large renewals schemes, but different unit costs are applied to different technologies and scope of projects. For example, resignalling, (see Definition of Signalling Equivalent Units (SEU) and Volume Reporting – BP001) full renewal, partial renewal (see Part Renewal Descriptions - BP009 and Extrapolation of SEU concept to Partial or Incremental Resignalling – BP011) and relocking. The SEU unit rate presently uses data gathered from eleven schemes with a combined cost of £933 million for 3,804 SEUs. With the exclusion of non-signalling-specific costs this equates to a mean unit cost of £240k per SEU (2005/06 prices). This rate is monitored on an ongoing basis.

Variance around this unit cost can be caused by the:

- outputs required;
- geographic location of the worksite and any associated accessibility problems;
- density of signalling, for example a long signalling section will require more lineside cabling than a terminal station area;
- size of the contract let; and
- type of technology being installed.

The use of the SEU metric enables the effective measurement and analysis of efficiencies. These efficiencies will be achieved by:

- taking greater control of the development of signalling projects;
- taking in-house GRIP stages 1-4 development;
- development of the contract strategy to utilise the volume opportunities and remove waste within the supply chain; and
- standardisation of all aspects of the contract including terms and conditions, pricing structures, and technical specifications.

The use of SEUs is consistent with our previous submissions. While recognising that on an individual project level outturn project costs may have significant variance, when compared with the SEU rate their accuracy when used on the basis of a network-wide business submission is robust (within 10 per cent across a range of schemes). The SEU rate of £240k (2005/06 prices) will be modified as required in line with the efficiency profile. The efficiency profile used within the Infrastructure Cost Model assumes that the SEU rate will fall to £164k (2005/06 prices) by 2014.

Minor works

For minor works, we have defined volume metrics based upon the SICA categories and these are a primary input to the IDC and business planning process. Through a combination of historic data and recent tender returns we have now derived unit rates for these activities (see Pre-Efficiency Minor Works Unit Costs Norms – BP003). The Infrastructure Cost Model incorporates minor works volumes derived from the Interlocking Data Cards and uses the recently derived unit rates to determine the overall costs associated with life extension/minor works.

Level crossings

For Level crossings, we have defined new metrics known as Level Crossing Equivalent Units (LXEU) (see Definition of Level Crossing Equivalent Units LXEU and volume reporting – BP002). LXEU are divided into the following types: Miniature Stop Lights (MSL), Automatic Barrier Crossing Locally Monitored (ABCL), Automatic Half Barriers (AHB), Manually Controlled Barriers (MCB) and Manually Controlled Barriers with CCTV transmission. We have also derived unit rates for these activities from historical data. It is intended that following the completion of the level crossing SICA analysis and production of the level crossing long-term plan, the use of LXEU will be incorporated into the business planning process with separate IDCs for level crossings. For the purposes of the Infrastructure Cost Model we have considered Level Crossings within the existing signalling IDCs and used an appropriate number of SEUs depending upon the complexity of the crossing

Delivery

While the business planning process defines the workbank and an initial assessment of the likely activities to be implemented in order to sustain the network according to agreed outputs, the project

development and authorisation processes provide further opportunities to ensure that the delivered scheme is appropriate and cost-effective in its implementation.

Having defined within the business planning process that an activity is required to sustain the network, an engineering remit is prepared and passed to MP&I to develop the requirements further. All projects are implemented using the GRIP process. In general, projects are progressed through the various GRIP “development” stages (GRIP stages 1-3) where the options specified in the engineering remit are considered. It should be noted that in a number of cases the options available are fairly limited. In these situations it is possible for the GRIP-lite process to be implemented where the engineering remit itself details the single option to pursue.

In parallel with project development activities, the project authorisation process requires all projects to be authorised at defined points. For large signalling projects using the full GRIP process, the standardised process will be to submit project approvals at the following GRIP stages:

- GRIP stages 1-3 – authorised to proceed, complete and ratify single option selection;
- GRIP stage 4 – authorised to proceed, complete and ratify single option development; and
- GRIP stages 5-8 – authorised to proceed to project completion.

Projects are authorised by the Renewals Investment Panel or Network Rail Investment Panel, as defined within the company's procedures. These authorisation panels provide a robust challenge to the scope and delivery mechanisms for projects, and ensure that issues that may introduce risks to the project, the renewals programme, Network Rail or the rail industry, are understood, and where appropriate, will have the necessary support.

Efficiencies within the project development process

Background

In 2002 the Head of Signal Engineering undertook a review of the issues associated with the delivery of signalling projects. This review highlighted that changes to, or lack of, scope definition at appropriate stages was a key factor associated with project overrun in both time and cost. Therefore control of scope definition was an important factor in assuring the efficient delivery of projects. The main outcome of this review was the formulation of the Signalling New Works Programme Team (SNWPT) in 2003 – this has now evolved into the Signalling and Telecoms Project Engineering (STPE) team.

Function of the SNWPT/STPE

The purpose of this team is to manage the development of signalling schemes in such a way that minimal changes will be required during the detailed design and implementation phases of the project, and to allow a national focus on the whole renewals portfolio to be delivered. The fundamental requirements of this team are to work to common processes and national standards and introduce tools and techniques to achieve efficiencies in the development phases of the project lifecycle. The overall benefit of these changes will be a more efficient project development phase that delivers, from a whole asset life perspective, the requirements of the relevant stakeholders.

In addition to the management of the development process, the review also recognised the benefits associated with moving the design of schemes in-house. The remit for SNWPT was therefore to both manage the development, and implement the scheme plan design, for all resignalling schemes.

Since the inception of SNWPT, the company reorganisation has further clarified roles and responsibilities within the company, with SNWPT migrating into the MP&I renewals delivery team headed up by the Programme Director (S&T). This allows a single point of focus for the efficient delivery of the renewals programme, of which a stable and appropriate project scope is a fundamental requirement. In the May 2003 reorganisation the SNWPT was renamed the Signalling & Telecom

Programme Engineering team (STPE). Whilst these various initiatives are delivering efficiencies within CP3, they are fundamental in delivering further efficiencies within CP4. Further development work is scheduled to be implemented within CP3 to allow the efficiency profiles in CP4 to be achieved. In particular the Signalling Tools and Methods Programme (STAMP) is developing scheme development tools and data transfer protocols – future activities will concentrate on assurance processes.

Scope definition

We have tightened up the processes of scope definition to help ensure that the appropriate level of scope is defined at relevant stages in the project lifecycle, as defined in GRIP/GRIP-lite. Once a project reaches GRIP stage 3 the scope is generally frozen. The outline design, or scheme plan, being frozen at GRIP stage 4.

These actions facilitate improved efficiencies by minimising or eliminating changes during the detailed design and implementation phases of projects, where costs of these changes are significantly higher and more difficult. We therefore believe we are in a more robust position to deliver the renewals plan on time and on budget, as a result of these initiatives. As noted above we intend to work closely with train operators and other stakeholders to establish the appropriate scope of projects at an early stage in their design.

Efficiencies through engineering optimisation

Over time a number of existing designs and processes have been developed and modified as a result of incremental requirements changes. This has resulted in a non-standard and sub-optimal set of engineering solutions. We are challenging these engineering practices and processes to identify the optimal standard set of solutions, and prevent the application or further development of over-engineered or non-standard solutions. In reviewing the rationale behind these designs and processes we will determine if they deliver the desired outputs in the most efficient way. Wherever possible, we are defining requirements more prescriptively within company standards, and the asset policy will reflect and further endorse the use of the most cost-effective option. A further benefit of this approach is that individual projects require only to demonstrate their compliance with the national specifications, rather than justify every design requirement on an individual basis.

Project delivery

The delivery of projects is implemented on a national basis facilitating standardisation of processes and the ability to consider the interactions with the wider supply market.

With a clearer understanding of delivery constraints, it is possible to determine with greater confidence the ability to deliver the workbank and make appropriate adjustments. This reduces the likelihood of a particular market sector becoming critical in terms of delivery capability and hence driving up costs in that sector, whilst introducing spare capacity in other dependent market sectors.

An analysis of the supply base and the workbanks has identified that efficiencies can be made in the procurement and delivery of signalling projects.

Procurement strategy

We have reviewed the market sectors of the signal engineering supply chain to identify an appropriate capability and delivery model that can deliver our workbank in the most cost-effective way over the next five to ten years.

The workbank segmentation that we have introduced to deliver signalling projects is shown in the table below:

Figure 3 Segmentation		
Type A Major Resignalling Schemes >150/200 SEUs	<i>Multi-discipline projects with significant cross-functional work, particularly permanent way</i>	Hub model System integration & construction management by Network Rail Typically 4/ 5 functional contracts direct with Network Rail
Type B Spot Renewal Interlocking Replacements <150/200 SEUs	<i>Mainly Signalling Work but supplier capable of managing ancillary permanent way, E&M work etc.</i>	Prime contract Resignalling contractor in the lead for all work Fixed price lump sum contract
Type C Minor Works	<i>Almost entirely signalling work and related civil construction</i>	X - year term contracts (Lower value schemes via Maintenance delivery) Implementation only
Type D Level Crossings All Level Crossing Schemes (Stage 1 – 5 design in-house in York)	<i>All works associated with level crossings (excluding where part of a type A or B scheme)</i>	Detailed design completed in-house by Network Rail
Type E Signalling control systems	<i>Control systems and man-machine interfaces</i>	Development and initial deployment contracts

Type A, C and E contracts are presently being negotiated. Type B contracts are considered a subset of either type A or type C arrangements, depending upon the scheme scope. These new contracts will benefit from standard terms and conditions, national specifications and application of common information exchange. Further analysis is ongoing on the most effective method of contracting for Type D contracts

We have also reviewed our organisational structure to afford greater opportunity for overall efficiencies based upon the market segmentation and contracting strategy. All signalling renewal schemes will be under the overall control of the Programme Director (S&T) and will be delivered either through project specific stand-alone teams (type A and E schemes) or dedicated teams within the Territories (type B, C and D schemes).

Specific procurement and delivery strategies have been identified for each market segment. Project definition and all outline design to GRIP stage 3 will be done using the STPE project development team. The senior project manager will develop a fully scoped and validated scheme, including a plan and outline project specification in GRIP stage 4. This will be sufficiently detailed in the vast majority of projects to let a fixed price contract in GRIP stages 5-8 under design and build contracts. Only those projects where time does not permit the proper separation of design from implementation or those where the uncertainties associated with innovative technology will be considered for alternative procurement approaches.

Type A and E schemes will, in the main, be multi-discipline projects that will be delivered using discrete specialisation contracts with system coordination and integration being assured by a suitably sized Network Rail contract management team. Each work package will be a separate contract with Network Rail. The signalling contractor is likely to be a large integration contractor or a manufacturer. The most appropriate contractual arrangement to assure cost-effective and timely delivery of schemes using the “Hub” model is being developed. A key issue is the integration between the various work specialisations – suitable arrangements have to be devised to provide the “glue” between the individual contracts and contractors, and to ensure that all levels of the workforce are incentivised to work in support of each other to deliver the common aim.

Type B schemes are more likely to be single discipline signalling schemes where other specialisations are in support of the signalling renewal, for example Coventry and Knottingley/Ferrybridge. In this instance Network Rail will have a single contract with a prime contractor who will award and manage appropriate work package subcontracts. The type of supplier will depend on the size of each individual scheme and will vary from the minor works suppliers, through integration contractors, to manufacturers.

Type C schemes are typically smaller individual renewals and life-extension projects that will be procured using territorial call-off term contracts with signalling suppliers.

As highlighted above, the detailed procurement strategy for type D schemes (level crossings) is under development, although it has already been determined that the optimum delivery will be assured if Network Rail fully design each scheme using its in-house resource and pass that to an installation contractor at GRIP stage 5. The most likely suppliers for level crossing schemes will be those who would be considered for type C schemes.

Type E contracts are being developed for our major signalling control centres. They will be considered as part of the trade package in the hub model for the first signalling schemes that will utilise the signalling control centre. However it is possible that the type E contract will be required to facilitate further expansion of the signalling control centre facilities under follow-on projects.

Efficiency through deliverability

With a stable and affordable workbank it is possible to implement on a national basis contracting strategies that optimise the number of suppliers, and use forward volumes as a lever to develop contracting efficiencies. By considering larger volumes and timescales for projects, it is possible to eliminate waste from repetitive tendering exercises. In conjunction with our suppliers it will be possible to develop and introduce Value Improvement Programmes within framework contracts and deliver the benefits on an ongoing basis.

Outputs from Scenario Work Streams

Scenarios 1 and 3

As stated earlier, simultaneously with the implementation of the long term review, the National ERTMS Project were producing the ERTMS report for the DfT on the national implementation of ERTMS. An analysis of requirements of both the long term review and the DfT report identified that both required the use of a common workbank for consistency. In addition to the above it was recognised that the unconstrained engineering workbanks implementing the requirements of the Signal Engineering Asset Management Policy were not sustainable from a delivery viewpoint and that a smoothed profile at sustainable levels was required.

In situations where the unconstrained engineering workbank exceeded the sustainable delivery profile it was necessary to provide a mechanism for the prioritisation of the engineering workbank. In conjunction with the National ERTMS Project, it was decided to use likely Rolling Stock replacement dates. This prioritisation was considered to provide the optimum roll-out arrangements for ERTMS, and even if the business case for ERTMS was initially unaffordable, it would allow later migration if the business case improved without significant disruption to renewals plan. Even in the event that ERTMS is not considered appropriate for national roll-out, integrating signalling and rolling stock renewals would appear to offer whole life system benefits. Interlocking Data Cards were used to record changes in the renewals dates and to record both existing minor works and life extension activities.

The resultant workbank was further analysed to ensure that the life extension activities required to support the delivery optimisation could also be delivered within the constraints of the market sector. On completion of this analysis the Interlocking Data Cards were updated and formed the basis of the engineering workbank that has been incorporated into the Infrastructure Cost Model.

The output from the Infrastructure Cost Model is therefore considered as satisfying the requirements of the scenario 1 and is contained within the overall submission in support of the ACR 2008.

The scenario 3 workbank is similar to that produced for scenario 1, however the renewal technology for certain schemes within CP4 also introduces ERTMS technology. However the major impact of ERTMS on the renewals plan does not really occur until CP5. The output from the DfT report is considered as satisfying the requirements of scenario 3.

Scenario 2

The Scenario 2 analyses investigated various functional items that could be integrated within the scope of signalling renewals to determine if their inclusion within the Signal Engineering Asset Management Policy could be justified from an overall business perspective.

Initial workshops were held with key stakeholders within Network Rail and a short list of items was produced for further analysis. The list of functions to be investigated was agreed between Network Rail and the ORR.

Following the completion of the detailed analyses an initial report (see Signalling Interim Review Scenario 2 Signalling Systems Benefits Investigation - BP007, Signalling Interim Review Scenario 2 Appendices to Signalling Systems Benefits Investigation – BP008) was produced highlighting the industry benefits and making recommendations as to whether these functions should be incorporated within the technical policy. Further workshops were then arranged with external stakeholders (ATOC, TOCs, FOCs and RIA) to determine if cross industry benefits had been captured appropriately. Whilst in a number of instances it was recognised that not all the cross industry benefits had been captured, it was concluded that further changes to technical policy were not required.

The table below summarises the output from the scenario 2 analyses.

Item Description	Status	Further Action
Axle Counters	Incorporated in Signal Engineering Asset Management Policy	Reliability growth on installed installations
Event Logging	Incorporated in Signal Engineering Asset Management Policy	
Condition Monitoring	Incorporated in Signal Engineering Asset Management Policy	
Level Crossing Predictors / electronic treadles	Incorporated in Signal Engineering Asset Management Policy	
Level Crossing Obstacle Detection	Not incorporated in Signal Engineering Asset Management Policy	Research activities are being carried out by RSSB. Will be considered as either an enhancement to AHB or an efficiency to a MCB CCTV
Proceed on Sight Aspects	Incorporated in Signal Engineering Asset Management Policy	Requires individual business case assessment

Signal control rationalisation	Incorporated in Signal Engineering Asset Management Policy	Migration strategy being implemented in conjunction with Operations and Customer Services
Signal control diversity	Not incorporated in Signal Engineering Asset Management Policy	Further analysis of engineering solutions and systems architecture required to improve business case
Mechanical signal box rationalisation	Not incorporated in Signal Engineering Asset Management Policy	Further activities include further unit cost efficiencies and application simplification
Auxiliary signalling system for possession management	Not incorporated in Signal Engineering Asset Management Policy	Further analysis of available systems required
Automatic Track Warning Systems	Not incorporated in Signal Engineering Asset Management Policy	Considered as a safety enhancement should Look Out Operated Warning System be adopted by maintenance and individual site business case exists.
Bi-directional signalling	Incorporated in Signal Engineering Asset Management Policy	Requires route specific business case
Automatic Route Setting	Incorporated in Signal Engineering Asset Management Policy	Standard fitment for large control centres
Merging signalling and operational control	Incorporated in Signal Engineering Asset Management Policy	Will be considered where area logistics have a positive business case
Floodlighting of junctions	Not incorporated in Signal Engineering Asset Management Policy	No significant benefit
Level Crossing median strips	Not incorporated in Signal Engineering Asset Management Policy	Individual Level Crossing safety enhancement
Level Crossing Red Light Enforcement Cameras	Not incorporated in Signal Engineering Asset Management Policy	Individual Level Crossing safety enhancement

SPAD Alarms	Incorporated in Technical Policy	Fitment mandated for new/r Will be considered where area logistics have a positive business case refurbished panels and VDU. Not required for retrofit activities
Line side SPAD mitigations	Not incorporated in Signal Engineering Asset Management Policy	Individual requirements covered by SPAD safety enhancements
Degraded mode aspects	Not incorporated in Signal Engineering Asset Management Policy	Not required with LED signals
Closing up signals	Not incorporated in Signal Engineering Asset Management Policy	Application will be implemented if required to delivery required outputs
Remote isolation of traction systems	Not incorporated in Signal Engineering Asset Management Policy	
Signalling power supplies	Incorporated in Technical Policy	

Where a number of Scenario 2 items have been declared as being appropriate to include in the Signal Engineering Asset Management Policy without constraints, their inclusion is considered to have a marginal impact on unit rates or are actually considered to provide an efficiency opportunity. The benefits are therefore realised in other areas of spend. Therefore these items have not required changes to the renewal SEU rates.

Where a number of Scenario 2 items have been declared as being appropriate for inclusion in the Signal Engineering Asset Management Policy but where a specific project business case is also required to justify inclusion in a project scope, it is considered that such functionality will be treated as an enhancement and therefore funding will be required from sources other than the signalling business plan. This would then allow transparency between the signalling renewals contained in the baseline and the enhancement elements contained in the basecase. To enable this type of enhancement element to be developed, a funding provision specifically to facilitate Scenario 2 projects is included in the enhancement elements of the Initial Strategic Business Plan. Such an arrangement also negates the need to make changes to the SEU rates allowing tracking of efficiencies over time.

In some cases, the Scenario 2 elements are specifically identified in schemes. More generally, however, their incorporation into schemes is covered by the proposed continuation of the Network Rail Discretionary Fund. As we develop our plans, the balance between these two processes should evolve.

Our business planning criteria and the Signal Engineering Asset Management Policy clearly highlight the importance of considering these options at the time of renewal. Clearly, however, it is not possible to model this in a mechanistic way since it depends on the specific circumstances.

The precise costs associated with the Scenario 2 enhancements will depend on the needs of the stakeholders and the scope of individual renewal with which the enhancement will be developed. Each Scenario 2 enhancement element will be assessed on its merits. Its costs may be offset by quantifiable and realisable benefits, and potentially, external funding.

The treatment of scenario 2 as highlighted above provides benefits with respect to the business planning process and the derivation of unit rates. With respect to the business planning process the treatment of scenario 2 items as stated above means that it is necessary only to produce and maintain the Scenario 1/3 workbook. This workbook defines the priority and timing of renewal activity, the difference between Scenario 1, 2 and 3 being the scope of the renewal activity depending upon the scenario being considered.

Scenario 4

The output from this scenario (see Scenario 4 Model Report – BP004) confirms that an imposed capped expenditure below the Scenario 1 expenditure levels submitted in the ACR 2008 requires additional life extension activities. The rate of increase in life extension activities is related to extent of the cap imposed. The final output of this scenario demonstrates that imposing a capped expenditure to the same level as CP3 would result in an increase in life extension activities, however this does not take full effect immediately. Should a further reduction in funding of 20% occur then the financial model shows that no full renewals would be implemented after CP6. All work would therefore consist of life extension activities resulting in the long-term the capped expenditure being exceeded.

It should be recognised that Scenario 4 represents a financial model. It does not attempt to measure the impact on supplier confidence (which will impact efficiencies due to lack of investment), the impact on safety as the system will increase in average age and incremental safety improvements due to modern standards will not be realised, the impact on performance and operational functionality as a result of equipment failing more often as it reaches the end of its serviceable life or where proactive action is taken to ensure wherever possible that safety is not compromised. It is envisaged that when these factors are considered the impact on the whole life benefits to the network would be just as significant as the impact on the signalling supply industry.

Conclusion

The long term signalling submission builds upon the activities being implemented as part of the overall asset management plan for Network Rail. During the period of the long term signalling review we have:

- introduced improved condition assessment processes that has allowed a sustainable workbook to be identified
- consulted with stakeholders and derived benefits associated with additional signalling functionality and where appropriate incorporated within the signal engineering asset management policy
- incorporated the work on our signalling policy into the framework for Asset Management Policies used across all areas of the business
- introduced organisational and process changes that introduce consistency and efficiency within the delivery teams,

- introduced volume and cost metrics to facilitate monitoring our delivery activities including volumes delivered and efficiencies
- introduced and implemented a procurement strategy that builds upon the renewals workbank to facilitate long term contracts with associated efficiency benefits
- produced a report for the DfT on the business case for the national roll-out of ERTMS
- Continued with the development of revised maintenance procedures and standards to facilitate further improvements to quality and efficiency following the decision to undertake in-house maintenance activities.

The process for adopted for the long term review also built upon that implemented for the medium term review. This involved key stakeholders through a combination of the Signalling Review Steering Group and the Signalling Development Group – the latter being expanded to include representation from ATOC and RIA.

The Network Rail Initial Strategic Business Plan provides the culmination of the signalling review activities in terms of the asset management policy, the asset renewals plan and the associated cost from the Infrastructure Cost Model. In addition the DfT report submitted in December 2005 provides the latest position with respect to the national implementation of ERTMS – it is anticipated that this will be further updated in December 2006 by the 'Red Diamond' that will investigate the benefits of ERTMS on key routes and the impact of future technologies on the migration plan .