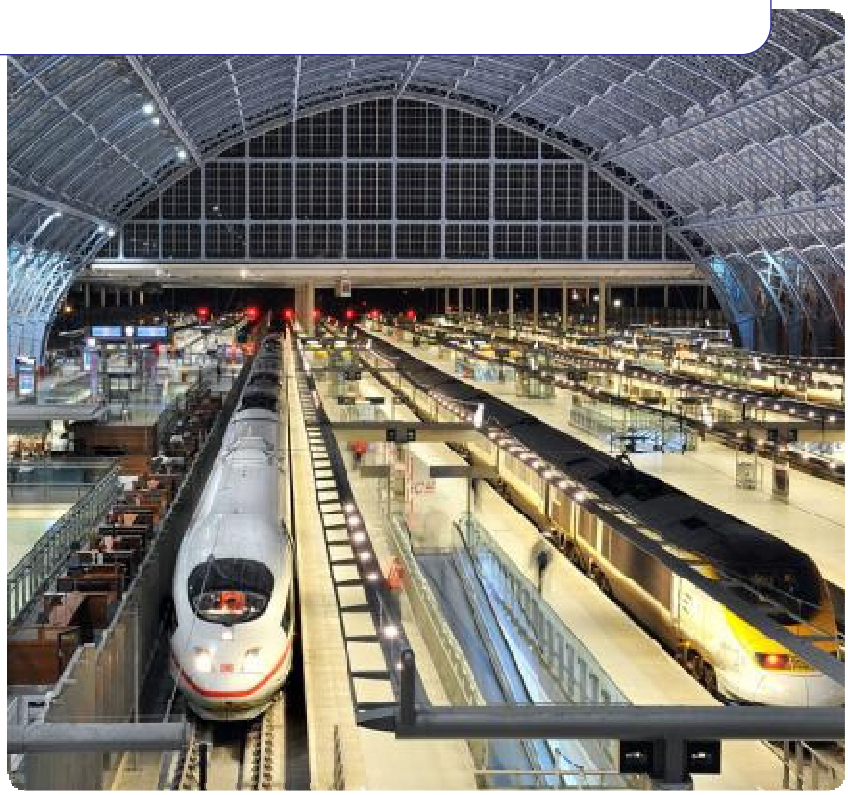
Review of HS1 Asset Specific Policies

On behalf of HS1 Limited and the Office of Rail Regulation

for HS1 Limited

26/10/2012



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1	31/05/2012	Draft for HS1 and ORR review.
2	26/10/2012	Formal issue following HS1 and ORR review. Includes further consideration of the Escrow account.

Compiled by: Martin Westerman

Signed:  E-sig mpw-166030/5 ... Date: 26th October 2012.....

Verified by: Colin Porter

Signed:  Eschp121026 ..... Date: 26th October 2012.....

Approved by: Colin Porter

Signed:  Eschp121026a..... Date: 26th October 2012.....

Distribution List

Name	Organisation	From (Issue)	To (Issue)
David White	High Speed 1	1	Current
Marius Sultan	Office of Rail Regulation	1	Current
Colin Porter	Lloyd's Register Rail	1	Current
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Summary

Lloyd's Register Rail has been engaged to undertake an independent review of the High Speed 1 (HS1) 2011 Asset Specific Policy (ASP) and 'Road Map' documents. This review has been undertaken on behalf of HS1 Limited and the Office of Rail Regulation (ORR).

The broad aim of the review has been to ensure that the 2011 ASP documents:

- Are robust in terms of existing standards and specifications in developing a risk based approach to the new suite of ASPs.
- Will not lead to an unsustainable level of deterioration of the assets, in both safety and economic terms, before Control Period 2.

The ASPs for the following assets have been reviewed: Track, Signalling, Communications – Data Transmission Network, Control systems, Structures and bored tunnels, Electrification – Overhead Catenary System (OCS), Ventilation Equipment, and Buildings and depots. In addition, the Asset Management Policy and the Asset Management Strategy have been considered, along with the 'route map' covering development of the AM strategy and leading to a more comprehensive set of ASPs in 2013.

The majority of assets are at a relatively young age within their expected asset life, and consequently the current asset management activities are aimed at achieving a 'steady state' with the focus being upon minimising delay minutes associates with failures.

The overall view is that the existing 2011 ASPs are considered to be sufficiently comprehensive and robust to support the current ongoing maintenance and support of the critical infrastructure HS1 assets. Considering the set of ASPs as a whole, the following overall comments and conclusions are drawn:

1 The ASPs follow a common logical structure, and consistent with the objectives of the first drafts of the ASPs described in the Initial Asset Management Statement [6].

2 The current 2011 ASPs only cover specific assets which have been deemed 'critical' on the basis of an impact assessment. The 2013 ASPs will cover a broader scope of assets.

3 The focus is currently upon a 'steady state' of maintaining the assets, aimed primarily at minimising delay minutes.

4 The ASPs present a summary of the asset scopes, their condition and performance, current expectations of asset life and interventions for renewals, and improvement initiatives. The maintenance arrangements and current performance are generally considered to be effective and appropriate.

5 The ASPs have highlighted the areas where assets will require renewal through equipment obsolescence (generally electronic systems), however there is little visibility of the obsolescence management process.

6 The 2011 ASPs do not contain any Whole Life Cost modelling, and it is stated that simple WLC modelling will be included within the 2013 ASP to support justification of the policies. It is recommended that if changes to maintenance arrangements are identified as a means of minimising whole life costs, then the impact of safety case constraints are recognised.

Current ASPs and the supporting evidence of asset performance appear sufficient to ensure that a backlog of maintenance activities and/or renewals is not currently building up. There is, however,

limited visibility of costs and efficiency in the documentation made available, but despite that, the current asset management arrangements demonstrated through the ASPs appear appropriate.

Detailed comments and recommendations to take into account during development of the 2013 ASPs are detailed within the relevant subsections of Sections 5.4 through 5.11. A number of common topics have been summarised below:

7 Determination of Asset Criticality. The ASPs focus upon the more critical assets from performance and safety points of view, however the visibility of this 'filtering' is not too clear.

8 Visibility of Maintenance Procedures. The only visibility of the way in which the assets are being maintained is through the ASPs; we (and HS1) have not had visibility of the supporting maintenance procedures due to the nature of the concession agreement between HS1 and NR(CTRL). Similarly, competence and resources requirements are not addressed within the ASPs.

9 Failure History Performance Indicators. Although ASPs give an indication of the number of faults in 2010/11 and associated delay minutes, the ASPs do not give a good indication of the fault and maintenance history, as an indication that the assets are in a stable or improving condition. By comparison, the remedial actions for each asset area in the Initial AM Statement provides graphs of the monthly number of corrective work orders by asset group.

The above are suggested as areas for improvement within the next draft of the ASPs.

With regards to the 'road map' for development of the asset management regime to become compliant with PAS 55, detailed comments are included in sections 5.2 and 5.3. The main thrust is to ensure HS1 properly defines the scope of the Asset Management system clearly defining the split of responsibilities between themselves and NR (CTRL) and then manage the relationship so that all aspects of the AM system are in place and robust.

From consideration of the rail and ballast renewals and associated costs, our conservative engineering estimate is that the costs for the first set of renewals are up to 50% higher than the HS1 assumptions underpinning the contributions into the Escrow account. This estimate is, however, sensitive to assumptions on unit renewals costs which may not apply to other asset groups. The estimate and underlying assumptions have been discussed with HS1, and it was concluded that using a less conservative set of assumptions the cost of renewals are some 25% higher than the original HS1 assumptions, with the expected shortfall being between the 25% and 50% figures. We therefore recommend that the contributions to the Escrow account should be further considered once the 2013 ASPs are issued, since these are expected to present a more robust and comprehensive view of renewal interventions.

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1 Introduction

Lloyd's Register Rail (LRR) has been engaged to undertake a review of the High Speed 1 (HS1) 2011 Asset Specific Policy (ASP) and 'Road Map' documents. This review has been undertaken on behalf of HS1 Limited and the Office of Rail Regulation (ORR).

This report presents a summary of the scope, the approach adopted, and the observations and conclusions emerging from the review.

2 Acronyms and Abbreviations

Acronyms and abbreviations used within this report are defined below.

Acronym / Abbreviation	Definition
AM	Asset Management
AMAS	Asset Management Annual Statement [Ref 9]
AMCL	Asset Management Consulting Limited
AMIP	PASS 55 Asset Management Improvement Plan [Ref 11]
ASP	Asset Specific Policy
ATG	Absolute Track Geometry
ATP	Automatic Train Protection
LB&DAP	Lineside Buildings and Depots Asset Policy [Ref 21]
CAP	Communications Asset Policy [Ref 16]
CP	Control Period
CSAP	Control System Asset Policy [Ref 15]
CTRL	Channel Tunnel Rail Link
CWO	Corrective Work Order
DfT	Department for Transport
DTN	Data Transmission Network
EGMTPA	Equivalent Gross Million Tonnes Per Annum
ESCROW	Independent and trusted third-party who receives and disburses finance
EMMIS	Electrical, Mechanical Management and Information System
ERTMS	European Rail Traffic Management System
FWI	Fatalities and Weighted Injuries
GSM-R	Global System for Mobile Communications – Railways
HS1	High Speed 1
ITCS	Integrated Train Control System
KPI	Key Performance Indicator
LED	Light Emitting Diode (signal)

Acronym / Abbreviation	Definition
LRR	Lloyd's Register Rail
NR(CTRL)	Network Rail (Channel Tunnel Rail Link)
OCS	Overhead Catenary System
OCSAP	Overhead Catenary System Asset Policy [Ref 17]
ORR	Office of Rail Regulation
PAS 55	BSI Publicly Available Specification 55 – Specification and Guidelines for the Optimised Management of Physical Assets [Refs 4, 5]
PC	Personal Computer
PLC	Programmable Logic Controller
RCCS	Route Control Centre System
ROGS	The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended)
RSSB	Rail Safety and Standards Board
S&BTAP	Structures and Bored Tunnels Asset Policy [Ref 19]
S&C	Switches and Crossings
SDH	Synchronous Digital Hierarchy, a communications technology
SRP	Systems Review Panel
SRS	Strategic Route Sections
SSAP	Signalling System Asset Policy [Ref 14]
TAP	Track Asset Policy [Ref 18]
TVM	Transmission Voie-Machine, French in-cab signalling system
VCC	Verrou Carter Coussinet, type of clamp lock
VCS	Ventilation Control System
VEAP	Ventilation Equipment Asset Policy [Ref 20]
VT	Voltage Transformer
WLC	Whole Life Cost

3 Background

HS1 Limited holds the concession from government to operate, manage and maintain the Channel Tunnel Rail Link high-speed railway infrastructure until December 2040.

The Channel Tunnel Rail Link extends from the Channel Tunnel to Fawkham Junction in North Kent (opened 2003), and through to London St. Pancras (opened 2007). The assets are hence approximately 9 or 5 years' old respectively.

HS1 has responsibility for overall asset management, with responsibility for the infrastructure sub-contracted to Network Rail (CTRL) Ltd acting as the controller and infrastructure manager.

Network Rail (CTRL) maintains and operates three stations, St Pancras International, Stratford International and Ebbsfleet International. Eurostar International Ltd maintains and operates Ashford International Station. Stations assets are separately reported to the DfT.

HS1's railway infrastructure has physical connections with Eurotunnel, the DBS freight depot at Dollands Moor and the Network Rail classic railway at Ashford, Ebbsfleet, Ripple Lane and domestic lines north of London.

As the Infrastructure Manager for HS1, it is NR(CTRL)'s responsibility to develop Asset Specific Policies (ASPs) for the HS1 Route infrastructure. The purpose of the ASPs is to optimise asset lifetime performance through the adoption of a structured whole-life approach to operations, maintenance, renewal and upgrades.

The ASPs are being developed in two stages.

- The first stage which presents the current policy reflecting existing standards and specifications. This first stage identifies additional requirements to achieve optimum whole life costing. These documents were delivered in late 2011
- The second stage will include a full whole-life cost justification for all activities, and will include developed funding scenarios to support discussions for Control Period 2. This second stage will be delivered by October 2013.

In addition, an ASP route map, which will be delivered in early 2013, will detail a plan for developing the current 2011 ASP to the 2013 ASPs.

Although the ASPs are not a regulatory deliverable, they make a significant contribution to the CP2 funding requirements. Whilst it is recognised that first stage ASPs do not include full whole-life cost justification for all activities, both HS1 and ORR require an independent review of these documents to ensure that they:

- Are robust in terms of existing standards and specifications in developing a risk based approach to the new suite of ASPs.
- Will not lead to an unsustainable level of deterioration of the assets, in both safety and economic terms, before Control Period 2.

4 Scope and Methodology

4.1 Asset Specific Policies (ASPs)

The ASPs for the following assets have been reviewed:

- Track
- Signalling
- Communications – Data Transmission Network
- Control systems
- Structures and bored tunnels
- Electrification – Overhead Catenary System (OCS)
- Ventilation Equipment
- Buildings and depots.

In addition, the Road Map, the Asset Management Policy and the Asset Management Strategy have been reviewed.

The approach is based on a proven 'T- slice' methodology, combining structured reviews of each Asset Specific Policy (ASP) and the assumptions underlying them, with a broader review of the asset management strategy (business process) and how closely it aligns with PAS 55 principles.

The focus of the review of the ASPs is to ensure that they:

- are consistent and will not lead to an unsustainable level of deterioration of the assets both in economic and safety terms;
- provide present life, duty achieved and evidence of asset condition and duty information;
- provide an understanding of the effect of intervention options and their implications for extended useful remaining life;
- are considering long term sustainability such that the rate of degradation is managed to avoid an uneconomic backlog of renewals in future control periods;
- give due consideration to the use of new technology in achieving scope, good performance and pro-active safety culture;
- have suitable and sustainable renewal assumptions relating to the asset base;
- employ what is considered to be best practice in asset management practice for the specific asset base.

In undertaking the review, we have given due consideration to the policies' deliverability given current and future operating constraints and whether robust long-term plans are being developed to meet the business objectives. We have sought evidence of whether that has been a need to renew any assets at this early stage considering teething and initial reliability issues where applicable.

We have reviewed whether suitable decision support tools and processes are being developed to determine the long-term delivery of network outputs, the economics, future costs and safety risks.

Where applicable, we have identified improvements for incorporation within the second draft ASPs.

4.2 Business Process and 'Road Map' Review

We have reviewed the broad business process (asset management policy and approach) and the corresponding 'Road Map'. The review seeks to establish if the 'Road Map' which we understand is at an early stage of development, is likely to provide the required level of detail as set out in the Infrastructure Asset Management Strategy and Initial Asset Management Statement to deliver performance and mitigate risk, using a risk based management and systems approach.

We have provided feedback on whether the 'Road Map', combined with the asset management policy and approach, has alignment with PAS 55 principles.

4.3 Review Team

The personnel who carried out the review are indicated below.

Personnel	Role
Colin Porter	LR Project Director Signalling and Control Systems
Martin Westerman	LR Project Manager Telecommunications and Ventilation Equipment
Chris Knowles	Asset Management Practice
Nigel Moore	Electrification (OCS)
Hugh Fenwick	Buildings and Depots
Richard Spoors	Track
Kevin McLernon	Tunnels and Structures Decision Support Tools

5 Commentary and Findings

5.1 Asset Management Policy and Strategy

In support of the ASP review, the Infrastructure Asset Management Strategy [3] and Initial Asset Management Strategy [6] have been provided, along with the Asset Criticality Analysis [7] and Infrastructure Asset Information Strategy [8].

These documents, along with the ASPs, have been used to understand the way that asset management is currently being undertaken. Supporting the ASPs are a suite of more detailed maintenance documents. These are listed within the ASPs, however they are not available to HS1 and have not formed part of this review.

5.2 Road Map

The Road Map has been taken to be a combination of the High Speed 1 PAS 55 Asset Management Improvement Plan (AMIP) draft A, dated 10th April 2012 [9] and the Asset Specific Policy Development Plan for HS1 Route, Draft v7 [8]).

To understand the context of the Road Map it was necessary to review the Gap Analysis Assessment Report prepared by AMCL for High Speed 1 (Gap Analysis Assessment Report PAS 55:2008, Version 1.0, 10 April 2012[7]).

The Gap report [7] addresses the Asset Management arrangements of HS1 having performed a series of interviews with members of the HS1 team and a member of NR (CTRL). Several documents are also referenced as having formed part of the review. It is not in the scope of this study to readdress the gap analysis itself; it is helpful to reflect on some of the key findings in setting the context for the Road Map review as the treatment to be applied is dependent on the condition diagnosed.

The report identifies 18 areas "where compliance is at risk". These are used as the section headings for the review of the Road Map to consider if it has effectively addressed the concerns raised. Where it is felt helpful, guidance on PAS 55 interpretation is provided.

From a compliance perspective, all aspects of the relevant clause of PAS 55 must be met for the system to be considered compliant. This would mean not just a robustly defined approach covering the full scope of PAS 55 but also tangible consistent evidence that the approach was being used in practice and subject to a process of continuous improvement.

5.2.1 General Requirements (PAS 55 4.1)

The asset management organisation is required to define the scope of the asset management system, put in place an asset management system to address the full PAS 55 requirement and importantly to ensure that when any of these elements are outsourced that it "…shall ensure control over such aspects…".

The gap analysis suggests that the asset management system is not clearly defined, nor is the outsourcing of AM activities effectively specified – this will be explored again in section 5.2.2 which addresses PAS 55 clause 4.4.2.

It should be noted that PAS 55 does not require all of these activities to be "in –house". The intent of the requirement is to make sure that when others are tasked with performing the asset management activities, they know what is expected of them and that the asset-owning organisation has arrangements in place to assure itself that these things are being carried out.

The AMIP includes actions to address the scope and the split of responsibilities for the AM system. It will be important here to make sure that the scope adequately specifies what is included and excluded, and the interface between in house and outsourced activities is clear.

5.2.2 Asset Management Policy (PAS 55 4.2)

The alignment of Asset Management Policy (not asset specific policies) with the HS1 business objectives is highlighted as a gap by AMCL. This is a fundamental principle in PAS 55 that "Line of sight" exists between the corporate objectives and all activities in the asset management system. A certification assessment would explicitly look for evidence that this is the case.

The AMIP includes actions to address this. It is recommended that the process used to develop this includes engagement with the SMT before the "submission for authorisation". It is essential that this is a policy which is clearly owned by HS1 top management and is seen to be a commitment to the implementation of effective asset management for HS1.

Whilst it is good practice to have a version of the policy for communication (and indeed for display), PAS 55 does not require that the policy itself is "stand alone". It would be acceptable for it to be embodied within a strategy document or in more detailed form for internal use. It is a decision for the organisation.

The communication aspect should also address how this policy will be briefed throughout the NR (CTRL) organisation.

5.2.3 Asset Management Strategy (PAS 55 4.3.1)

PAS 55 does not require a single document called Asset Management Strategy. It does require a (single) strategy – which may be formed of a number of documents. It is essential that these, taken together form a holistic strategy for the assets, and that the requirements of sub clauses a) to l) of PAS 55 clause 4.3.1 are satisfied.

As part of this review, reference was made to the HS1 Infrastructure Asset Management Strategy (HS1 Infrastructure Asset Management Strategy, version 1.4, 25 June 2010 (headed R-HS-HS-00017-02-INT version 02) [3]). Many aspects of the requirements of 4.3.1 are present, and HS1 will need to build upon this, ensuring other strategy documents link with it. Good practice elsewhere has included the use of a linking document to explain how the various components come together to form the holistic asset management strategy. HS1 may wish to consider if a similar approach would be helpful here.

It was noted that this document suggested removing reporting on some types of failure (such as weather related incidents) as HS1 cannot influence these events (Reference [3] page 54). It is recommended that this is reviewed from a customer (end user) perspective as the response to such events and the asset system preparedness can be controlled by HS1, although it is accepted the initiating events fall outside HS1 control.

The AMIP addresses the need to review the strategies for alignment with Business Plan – it is important also to ensure they *align with each other* to ensure the impact on the railway as a whole asset system is addressed in a coordinated way.

It should be noted that many of the aspects required of the asset management strategy in PAS 55 are elements HS1 seeks to include in the Asset Specific Policies. An example would be the narrative on asset related risk or the criteria for optimisation (Whole Life Costs (WLC) forming a key part of this). This in itself is not an issue in PAS 55 compliance terms – but it is important to realise that these

policies also contribute to the overall asset strategy. The alignment mentioned earlier is therefore critical in respect of these documents as well.

5.2.4 Asset Management Plans (PAS 55 4.3.3)

Whilst a lot of work has taken place this is a clear gap against the requirements of PAS 55 4.3.3 at present.

The requirement drives not just the preparation of a suite of optimised and prioritised plans for the management of the assets, but also ensuring the resources and facilities are put in place to carry them out and that the plans are specifically reviewed for continued appropriateness.

The improvement actions currently in place address the creation of a suite of Asset Management Plans by October 2013 and the development of WLC models to help with this definition. It is important to make sure the plans are optimised not just within their respective asset groups (such as signalling) but also across the whole railway system (considering the optimal approach to track, power, signalling, communications etc) reflecting an optimised approached to managing the performance of the railway system as a whole in any given section.

It is further recommended that the programme specified in the AMIP is further broken down to enable effective management and monitoring of progress in this area.

5.2.5 Structure Authority and Responsibilities (PAS 55 4.4.1)

The gap analysis identifies gaps in the definition of responsibilities within HS1, the way in which these are allocated between HS1 and NR (CTRL) and the stated view that NR (CTRL) does not necessarily view itself as part of the asset management arrangements of HS1.

The AMIP identifies a number of actions to address this. The requirement to clearly specify the responsibilities of top management are essential and should be tied in with the development of the Asset Management Policy. The individual concerned should be engaged in the preparation of the policy to foster ownership and the timescales for policy and top management accountability definition should therefore be aligned.

The timeframes for resolving these areas are quoted as "within annual review cycle". The urgency for resolving many of the other issues highlighted in the Gap Report may be hindered unless accountability and responsibility for asset management is clearly understood throughout the organisation and its contractors. HS1 may wish to consider this as a priority.

5.2.6 Outsourcing of Asset Management Activities (PAS 55 4.4.2)

This section of PAS 55 relates to *any* aspect of the asset management arrangements that the organisation chooses to outsource to others. It is not restricted to asset management plans. By inference, therefore, there is no restriction on what can be outsourced provided that the arrangements are adequately specified and the relevant controls are in place to provide assurance that all the requirements of section 4 of PAS 55 continue to be met.

The dependence placed on NR (CTRL) by HS1 for business performance and safety makes this area a significant component of the overall system.

The AMIP in this area recommends developing areas for continuous improvement in the relationship and improvements in the sharing of information. HS1 should also consider the extent to which the interface with NR (CTRL) is adequately defined and then operated. This is mentioned earlier regarding issues surrounding PAS 55 4.4.1 (Structure, Roles and Responsibilities). The actions regarding

information flows should be supplemented with actions to make sure the relevant areas of the AM system to be delivered by NR (CTRL) are defined and understood, including responsibilities and specifically how activities are controlled and integrated into the overall AM system.

"Controlled" does not mean direct management of the activities of NR (CTRL) by HS1 – but it does mean ensuring that the requirements are clear, the responsibilities are understood and accepted and the delivery can be demonstrated, with supporting information flows to allow both parties to perform their elements of the AM system.

This will also contribute to improvements in respect of clause 4.1 of PAS 55.

5.2.7 Training Awareness and Competence (PAS 55 4.4.3)

The Gap Report highlights the difference between the competence and training arrangements in HS1 compared to the hands on competence requirements of NR (CTRL). This is not an uncommon finding – many organisations focus on the technical skills as a priority rather than the wider AM skill set.

The actions within the AMIP should address this.

A wider issue applies in respect of the outsourcing carried out by NR (CTRL). It is not clear from the papers sampled in this exercise that a review of competence (processes or sample of personnel) is carried out beyond the commercial review at contract award. HS1 should ensure that competence arrangements are effective at every level of the supply chain in the asset management system.

5.2.8 Communication, Participation and Consultation (PAS 55 4.4.4)

The Gap Report states that the internal communications within HS1 and NR (CTRL) are "fit for purpose". The focus on external stakeholder communications therefore appears appropriate and the AMIP provides actions consistent with this.

This clause of PAS 55 also covers communications with contracted service providers and HS1 should assure themselves that communication is effective across the contractual boundary with NR (CTRL) and between NR(CTRL) and their sub contractors.

5.2.9 Asset Management System Documentation (PAS 55 4.4.5)

The need for Asset Management documentation, in a few cases, is a specific requirement (such as Asset Management Strategy and Asset Management Plans). It is, however largely left to the organisation to decide what to document; the decision to be based on the risks arising should lack of documentation lead to departures from acceptable practice. The focus of this clause is the asset management system itself. The gap analysis shows a gap against PAS 55 4.4.5 relating to the AM system documentation. (Asset information is covered in PAS 55 4.4.6)

The AMIP actions appear to address the concerns raised.

5.2.10 Information Management (PAS 55 4.4.6)

The Gap Analysis suggests a fragmented picture of asset information ranging from original as-built drawings to electronic work management systems covering some areas of the asset base. An asset information approach should be defined to understand what is required to manage the asset base meeting HS1 business objectives, where that information is to be stored and controlled and how it will be made available to those who need it. Capture, storage and management of information is not without cost and it is essential that this alignment to need is clearly considered.

Good practice indicates a single source for information and the AMIP recognises this. It is for HS1 to decide where and how this information is managed; the current arrangements of the information being managed by NR(CTRL) would not necessarily block PAS 55 compliance provided that

- access to relevant information was provided to HS1 in a timely manner and
- NR (CTRL) was able to demonstrate that the required asset information was maintained and available to allow them to perform their part of the AM system, and
- NR (CTRL) could demonstrate their ability to store and pass asset information back to HS1 at the end of the contract term.

The AMIP suggests the approach of "align(ing) asset information strategy to current NR (CTRL) systems". This is pragmatic but HS1 should assure itself that this will meet the strategic aims of HS1.

5.2.11 Risk Management (PAS 55 4.4.7)

The risk management arrangements within HS1 are reported as being "fragmented" and "not currently effective". The arrangements in NR (CTRL) are reported to be more robust given the safety case requirements, but still display some weakness in critical asset management areas such as asset maintenance. These issues present clear gaps against the requirements of PAS 55.

Risk sits at the centre of an asset management system and it is essential to have a consistent language across the organisation such that risks can be identified, analysed, evaluated and resulting controls prioritised on a common basis. It is a fundamental part of governance and the asset management optimisation process and feeds into the WLC developments required in the ASPs. It is central to decision making at the strategic and tactical level.

Whilst the AMIP shows some high level steps to address this, HS1 should ensure that the improvements address issues such as:

- Ensuring a common scoring mechanism is in place for all areas of the business to ensure consistent analysis
- Defining the risk appetite of HS1 – to allow effective evaluation of risks
- Developing the optimisation criteria and responsibilities for risk ownership and mitigating controls
- Inclusion of the criteria and means of escalation of risks between NR (CTRL) and HS1.

5.2.12 Management of Change (PAS 55 4.4.9)

The change management processes are noted as being absent save for those relating to changes relating to access (under the OA) and changes to assets and standards, and contractors through the NR (CTRL) SRP process.

The AMIP addresses the need to implement a "management of change process which is aligned to ROGS and NR(CTRL) SRP requirements". It is not clear if these actions will consider wider changes such as alterations to the Asset Management Strategy or objectives for example. If we consider the risks in changing a maintenance schedule, such a change may not trigger a ROGS or SRP issue, but could nevertheless have a bearing on the whole life asset management of the assets considering cost, risk and performance.

HS1 should ensure that the AMIP actions being taken consider all changes to the assets and asset management system, and that the resulting system is able to capture and manage the full range of change to an appropriate level.

5.2.13 Life cycle Activities (PAS 55

Life cycle activities centre on making sure the asset management arrangements are implemented successfully across all life cycle phases. Whilst AMCL report that many facets of this are in place, it is also recognised that, as the asset management arrangements change (through the completion of other improvement actions), the life cycle activities will also need to change and be embedded.

The activities are not trivial and the timescales quoted reflect this. The level of detail in the AMIP will not however allow effective control of the activities and HS1 should consider improving the level of detail in this plan or in more detailed supporting documents.

5.2.14 Performance and Condition Monitoring

AMCL highlight a number of issues including the bias towards reactive issues such as fault population and minutes delay. Where additional information is captured (by NR (CTRL) under the terms of the OA) addressing safety and performance issues AMCL also point out that it does not embrace "the broader asset management information which will assist in the forecasting and future planning of asset maintenance and renewal".

This clause in PAS 55 aims to drive the organisation to learn about the assets and the asset management system so that progress can be effectively managed and changes put in place to make sure the long term objectives of the organisation are achieved. The actions in the AMIP pick this up and in defining the metrics and criteria to apply, HS1 should ensure that they are directly aligned to the HS1 business requirements and that the means of collecting, analysing and then acting on this information is clearly put in place. Performance and Condition Monitoring is only useful if it allows demonstration of compliance (with stakeholder obligations or business plan objectives) or acts as a lever for business improvement.

5.2.15 Audit (PAS 55 4.4.6)

There are three issues here

- The internal audit of HS1
- The internal audit of NR (CTRL)
- The supply chain audit of the NR (CTRL) by HS1

AMCL note that the internal audit within HS1 is focused on safety, contractors, asset condition and Asset Specific Policies (ORR requirement). They note that the internal audit within NR (CTRL) appears sufficient but the audit findings are not necessarily shared with the client. The audit of NR (CTRL) is reported to be constrained by the OA terms.

The AMIP actions address the need to develop a risk based audit plan with NR (CTRL) and to implement it. HS1 should ensure this addresses the supply chain audits to help HS1 gain assurance that there is effective control of the outsourced AM activities. It should also address the level of information which may be shared from the internal NR (CTRL) audits. There is no requirement for the supply chain audits to repeat the same depth of analysis as the internal NR (CTRL) audits – but it is likely that the efficiency of the NR (CTRL) audit process and how audit findings were closed out could form part of any supply chain audit sampling.

HS1 must also implement an internal risk based audit programme which over a period of time covers all aspects of PAS 55. This drives business improvement in addition to promoting adherence to the system, but also provides key input to the Management Review process.

5.2.16 Improvement Actions (PAS 55 4.6.5)

A PAS 55 compliant system makes sure that improvement actions address the root causes of any issues identified to either correct something that has happened or prevent it from happening in the future. The measures need to be proportionate to the risks associated with the problem, and this risk basis also aids the prioritisation of the actions to be taken. Changes to process or significant changes in risk levels lead to the need for a formal risk assessment before the change is implemented.

The AMIP picks up on the need to follow through with the completion of improvement actions but is silent on the need to develop a risk based system for the review and prioritisation of proposed actions. This may be due to there already being such a system in place. Nevertheless, HS1 should assure itself that adequate arrangements are in place, and add any outstanding issues in this areas to the AMIP.

5.2.17 Records (PAS 55 4.6.6)

Records and their management is identified as an area of weakness and the AMIP includes actions to address this. It is important to note that in making the improvements here, the requirements in PAS 55 clause 4.4.6 (Information Management) are also particularly relevant.

The action "Realise a part of ERM system implementation" is not clear, nor its connection with records management.

5.2.18 Management Review (PAS 55 4.7)

It is very common for organisations setting out on a formal PAS 55 based Asset Management implementation to have gaps in the area of Management Review.

The PAS 55 requirements indicate a clear need for "top management" to carry out these reviews at "intervals that it determines". The fact that asset management arrangements are outsourced does not remove the obligation, nor does it prevent such a review being carried out. The review would include consideration of the outsourced aspects. The earlier issues raised in terms of clarity of responsibilities, communication, information flow and audit will all play a part in contributing to this area.

The AMIP includes actions to address this area – it will be important for HS1 to ensure the scope of the management review includes full coverage of the system, including the interface with outsourced arrangements and the performance of the outsourced service provider.

5.3 Other areas for consideration

5.3.1 Asset Management Objectives (PAS 55 4.3.2)

The gap analysis did not raise any concerns here.

HS1 should nevertheless ensure that as the AM Policy and Strategy is finalised, that the AM objectives align fully with these and are seen as part of an overall "line of sight" connection.

5.3.2 Contingency Planning

No issues were raised here and the AMCL report indicates that they had seen evidence of plans in respect of operational and asset related response.

As a result, there is no further comment within the AMIP.

As the Asset Specific Policies develop, HS1 should ensure that the contingency planning remains appropriate to the risks associated with any asset system changes or alterations to process.

5.3.3 Legal and other requirements (PAS 55 4.4.8)

Typically an area where organisations have strong control, the comments made by AMCL reflect this here for HS1.

The narrative indicates compliance monitoring against the requirements of CA, the HS1 Lease and the OA in addition to Environmental legislation monitoring. The scope of the clause is wide ranging, addressing the identification of changes in regulations which may impact HS1 and establishing compliance with them. The Anti Bribery and Corruption legislation is an example which has a bearing on AM supply chain issues (as one example) and the HS1 systems need to ensure examples such as this are also addressed. The requirement of 4.4.8 also needs to be flowed through to the outsourced service provider so that it is an obligation on NR (CTRL) to carry out relevant elements as a service to HS1. Specific technical aspects (such as the forthcoming obligations in respect of the use of common safety methods) may be better managed through the outsourced provider for example. HS1 should ensure these issues are adequately addressed in the current arrangements and enhance them if not.

5.3.4 Investigation of Asset Related Failures Incidents and Non Conformities (PAS 55 4.6.2)

The gap analysis does not flag any major concerns in this area and as such, it does not explicitly appear in the AMIP.

That said, the analysis in the gap report does point out that HS1 does not have its own processes as it relies on the NR (CTRL) processes relating to asset failures. This area of PAS 55 also includes treatment of any non-conformity with the asset management system – part of which directly affects HS1. Given the statement about reliance on the NR (CTRL) process in lieu of an internal process, and that the focus of the NR (CTRL) process will be on the outsourced elements of AM, there would appear to be a gap against PAS 55 4.6.2. This requires inclusion in the asset management improvement planning activity.

It should be noted that the AMIP does include development of root cause analysis for HS1 which is one component of this – but references it to clause 4.5 (Improvement Actions) rather than this clause.

5.3.5 Tools Facilities and Test Equipment (PAS 55 4.5.2)

This is an area of PAS 55 based systems which is relatively straight forward to implement, having considerable overlap with the requirements of long established practice in ISO 9001 based systems for example.

The range of tools and equipment for a modern railway infrastructure asset management organisation is likely to be complex and diverse – ranging from track gauges through to complex radio test sets. HS1 needs to ensure that the outsourced arrangements are clear in respect of control and calibration of such items. A useful test is to establish, should a piece of equipment to be found to be out of calibration, how can we tell where and when it was used and therefore take a view on the risk resulting for the railway and the corrective actions that may be required.

5.3.6 Evaluation of compliance (PAS 55 4.6.3)

AMCL do not note any issues in this area, and no actions result in the AMIP.

HS1 should, as a precaution ensure that the compliance evaluation addresses all the areas covered by the "Legal and other requirements" clause to an appropriate level to close the loop.

5.4 Signalling System Asset Policy

5.4.1 Introduction

The Signalling System Asset Policy (SSAP) [14] provides details of those signalling assets prioritised following an Asset Criticality Analysis carried out in 2010. As such, it covers the major component parts of the signalling system; the Integrated Train Control System (including interlockings), train detection, point operating equipment and signals. It does not cover, at this stage, signalling cables or other sub-systems, e.g. the Automatic Train Protection (ATP equipment used at St Pancras (say). The TVM 430 cab signalling system provided on HS1, based on the UM TVM track circuit and the Ansaldo SEI interlocking, is extensively used on high speed lines in France and in the channel tunnel, but is not used elsewhere in the UK. For this reason alone, it presents a slightly different set of challenges to those found with other signalling systems in the UK. Specific comments on the SSAP and the responses from NR(CTRL) are included in Appendix A.

5.4.2 General

The SSAP is quite detailed, but also refers to more detailed maintenance and other instructions which are not yet available to HS1 Ltd. The SSAP is well written, clear and comprehensive and follows a standard structure, and hence there is a probably necessary degree of repetition within the document when reading through all the component part sections. The SSAP has a section for each of these major component parts which:-

- describes that part;
- provides details of the population;
- gives an overview of inspection and maintenance routines;
- details any plans for refurbishment, overhaul and renewal based on monitoring performance;
- describes any effect of interfaces with other assets;
- details the planned future approach to the asset.

The limiting point for the life of the signalling system is stated to be the ITCS, given as 25 years, because of the nature of the system. This is fairly typical for electronics based signalling systems, and is a reasonable initial planning assumption which will need to be verified as time goes on. Section 1 was opened in 2003, and thus there is still some time before major renewal becomes a significant issue, unless there is seen to be a need to implement ERTMS for other reasons.

5.4.3 Asset Performance

Key performance and failure statistics are provided in Appendix B of the SSAP for the year 2010/11. Whilst this gives a useful snapshot of current performance, it would be useful to see a longer term trend analysis included as that is more relevant to whole life issues. The tables in Appendix B do not specifically mention wrong side or safety affecting failures, but the response to a question on this states that there have not been any wrong side failures of the signalling system in the 9 years of operation which appears to be a very good safety performance. The highest number of faults is, perhaps unsurprisingly, associated with points, although the greatest service delays in 2010/11 were caused by train detection failures and one ITCS failure.[1] There is no comparison provided on how the overall

[1] Appendix C.1.1 of SSAP

system performs compared with the signalling systems used on the conventional lines so it is difficult to judge whether the performance is adequate or not, but it appears that the number of signalling system failures is relatively small, averaging less than one a day for the whole line.

5.4.4 Asset Risk and Criticality

The key risks associated with the signalling system are analysed in section 3.1 of the SSAP. In Table 3, track circuits are shown as having a low impact on performance, but this is not supported by the actual performance where a number of track circuits have had a high impact on performance (i.e. a service delay of 250-1250 delay minutes per year[2]). Table 4 in section 3.2 was difficult to understand. There may be some confusion in nomenclature between performance risks and safety risks, although these are explained clearly in Appendix C. Two sets of points, the London West Portal Scissor Crossing and Wennington Crossover, are identified as critical assets from a performance perspective but at present there are no specific measures taken to control this risk, although NR(CTRL) have indicated this is something they intend to address.

5.4.5 Asset Specific Policy – Integrated Train Control System (ITCS)

This is identified as the main component of the signalling system, and thus will drive the need for full system renewal. The long term strategy or renewing the system has not yet been defined and the SSAP states that management of obsolescence issues (for the electronic components) are the priority for the short to medium term, in conjunction with Ansaldo, the system designer and supplier. Contracts for card repair and third line support are in place with Ansaldo and there is an ESCROW agreement in place with Ansaldo to gain access to design documents in the event of Ansaldo being unable to support the system. This is all that can reasonably be done at present. There are some 3700 NS1 (French) safety relays within the system but these can be expected, if needed, to last at least 40 years and probably longer with a suitable inspection regime.

There are no specific examples of electronic card/component obsolescence issues which are currently being managed and it would be useful to know whether these are being successfully overcome.

The ITCS is connected to the main control system (the RCCS) and all the lineside equipment and so any changes or asset replacement of these may impact on the ITCS.

5.4.6 Asset Specific Policy – Train Detection

The UM TVM track circuits used are inextricably linked to the cab signalling system used on HS1, with conventional (i.e. used elsewhere within the UK) HVI track circuits used in non-cab signalled areas, at St Pancras and Ebbsfleet High Level. There are no specific issues with the track circuits other than normal component obsolescence and monitoring of any adverse failure trends. There have been problems with rail connections on the TVM track circuits but a programme of replacement in wet zones has been completed and this has improved matters.

5.4.7 Asset Specific Policy – Points operating Equipment

Three different types of point machines are used, with the most significant being the French MCEM91 fitted with VCC clamp lock detectors for the majority of points on HS1 (107), with the HPSSS type used in the St Pancras area (47), and a couple of Alstom HW2000 used at the Eurotunnel interface. Point machines are subject to more wear and tear than most other signalling equipment and the list of

[2] Appendix C2 of SSAP

corrective work orders[3] (CWO) shows the items which have given the most trouble – heaters and clutches, both of which are addressed by component replacement.

It is stated that HS1 intend to look at whole-life cost costing and risk-based maintenance for the next iteration of ASPs to more accurately target maintenance and renewal activity to both safety and performance risks.

5.4.8 Asset Specific Policy – Signals

There is nothing stated that indicates the signals used on the line are particularly different or special. It is assumed that most of the 43 (mainly LED) main signals are in the St Pancras area, although there are in addition 121 auxiliary signals, 92 illuminated signs and 381 marker boards. It is not stated whether the auxiliary signals are LED or lamp based. The Corrective Work Order for signals[4] lists the most frequent task, 56% of the total, as "Signal- Inspect and Repair" which is not very specific or helpful.

5.4.9 Continuous Improvement

The changes to the operating environment listed are the introduction of freight services, changes in train service caused by the Olympics and the introduction of open access services in due course. In answer to a query on the anticipated impact of these changes on the signalling system, the most significant issue appears to be the possible effect of damage to points and "physical signal equipment" (unspecified), and more generally potentially less time available for maintenance activities. There is also mention of the installation of a new Wheel Impact System at two locations. Finally, in the response, there is mention of a major issue with wheel/rail interface for the Class 395 which has caused a large amount of work and this may warrant further assessment of whole-life costs. This issue is not raised in the SSAP, and needs looking at in connection with the Track ASP (refer to section 5.8.5).

Two specific improvements detailed are an assessment of the use of remote condition monitoring for points and the use of the IRIS320 Measurement Train to provide information on signalling related assets.

5.4.10 Summary

There is little of concern in the Signalling System Asset Policy.

1 The Signalling ASP sets out the current policy for management of the signalling assets and presents the policy for the four subsystems, ITCS, train detection, points and signals as the signalling assets deemed as 'critical' at this stage.

2 Overall, the approach is considered to present a reasonable and robust approach to the management of the signalling assets, and is expected to maintain them to continue to achieve what seems to be a fairly good failure performance.

3 The signalling system is at an early stage of its life, although the life is shorter than that of some of the other infrastructure assets, with most of the maintenance problems likely to be around ensuring that electronic equipment obsolescence is managed, and that HS1 appear to be doing this.

4 The 2013 ASPs will address simple whole life cost models to support the revised policy.

[3] Appendix B.4.3, page 46 of SSAP

[4] Appendix B.4.4, page 47 of SSAP

5.5 Control Systems Asset Policy

5.5.1 Introduction

The Control Systems Asset Policy (CSAP) [15] provides details of those control system assets prioritised following an Asset Criticality Analysis carried out in 2010. As such, it covers the Route Control Centre System (RCCS) (which is the management and control system for the signalling system), the Electrical Mechanical Management and Information Systems (EMMIS) (used for control and monitoring of E&M systems and plant, include the overhead line) and the Ventilation Control System (VCS) (used for control of the tunnel ventilation systems. Specific comments on the CSAP and the responses from NR(CTRL) are included in Appendix B.

5.5.2 General

All these systems use standard IT system servers and PCs with Windows operating systems and bespoke applications software, and there is a similar approach taken to maintenance and support for all three systems. The systems, including it appears the "office end" hardware and operating systems were upgraded for the HS1 stage 2 commissioning and date from 2008, and with a stated 5-7 year life, next fall due for renewal in 2015/6. All three systems have numerous interfaces to other systems and equipment using a variety of protocols and interface equipment, some of which are IT industry standards and others are standard in the UK railway industry or are bespoke to particular equipment. In general, most connections to remote equipment and other systems is achieved through the Data Transmission Network (DTN).

5.5.3 Asset Performance

Appendix B of the CSAP provides details of the Corrective Work Orders carried out on each of the systems during 2010/11, together with brief details of some (all?) of the faults occurring between period 6 of 2010/11 and period 5 of the following year. On the basis of the CWOs issued, there is an average of one every two weeks for the EMMIS and RCCS systems and only three for an entire year for the VCS.

5.5.4 Asset Risk and Criticality

Appendix C of the CSAP lists only two delay-causing faults between period 6 of 2010/11 and period 5 of the following year, and both of these were for the RCCS, involving automatic route setting problems, with a total delay of 25 minutes. It is stated that the level of safety risk from these assets is small because of the nature of these (non-vital) systems and they have been classified as Very Low in the Criticality Update. Nevertheless, from a train performance perspective, they are important but the results indicate a very high level of reliability.

5.5.5 Asset Specific Policy - Route Control Centre System (RCCS)

This is a bespoke system developed by Ansaldo and forms an integral part of the whole signalling system with its principle interface being with the ITCS. Whilst the hardware and operating software will need periodic renewal, the applications software changes need to be taken into account during these renewals and the CSAP contains details of the development system maintained under contract by Ansaldo in France to assist with this task. The CSAP states that it is envisaged that replacement hardware costs will be less significant than software costs, and this is a reasonable assumption.

5.5.6 Asset Specific Policy - Electrical and Mechanical Management and Information System (EMMIS)

This too is a bespoke system developed by Ansaldo and amongst its functionality, it is used to manage electrical isolations for engineering and maintenance work. It connects to remotely located programmable logic controllers (PLCs) which interface to the end equipment. Details of these PLCs are not included in this version of the ASP, but are not seen by HS1 to be high risk because they are "off the shelf identical equipment." This is acceptable. It is stated that a development platform and contract are in place with Ansaldo to help manage obsolescence issues.

5.5.7 Asset Specific Policy – Ventilation Control System (VCS)

The bespoke software for this system was developed by Ematics and is used by operators to manage the ventilation system for both incident management and maintenance work. In normal operation, no operator intervention is needed. It is stated that a development platform and contract are in place to help manage obsolescence issues.

5.5.8 Continuous Improvement

The potential changes to the future operating environment are again mentioned and although it is not clear what, if any, impact there will on these systems, this will be looked at in the development of the 2013 ASPs.

It is stated in the CSAP that an obsolescence study is well advanced which is looking at all three systems, with the intention to form a strategy to take each system through the next control period. This is very necessary given the type of hardware and software used and there are likely to be some cost implications for the next control period.

5.5.9 Summary

1 All these systems use primarily off the shelf computer equipment and industry standard operating systems with bespoke software. Their life at 5-7 years, is short compared with the norm for railway equipment and therefore more regular renewal/obsolescence intervention will be needed.

2 The Control Systems ASP sets out the current policy for management of the control system assets and presents the policy for the three subsystems, for signalling control, E&M control and tunnel ventilation control.

3 Overall, the approach is considered to present a reasonable and robust approach to the management of the control system assets, and is expected to maintain them to continue to achieve what seems to be a very good failure performance.

4 The 2013 ASPs will address the periodic hardware/software renewal needs for these systems.

5.6 Communications Asset Policy

5.6.1 Introduction

The Communications Asset Policy (CAP) [16] presents the asset policy for communications, with Section 1 identifying these as including:

- Data Transmission Network (DTN)
- Fibre Optic Network
- Cab Secure Radio
- Maintenance Radio System (GSM-R)
- Radio Propagation
- Emergency Response Organisation
- Closed Circuit Television
- Telephone Network

The ASP only focuses upon the DTN as being the only communications asset classed as 'critical'.

Stations are beyond HS1's responsibility, along with associated communications assets (e.g. passenger information, public address). Similarly, Temple Mills depot and associated communications systems are out of scope.

5.6.2 General

The communications assets are generally of conventional types using established, non-novel technologies which would not be expected to introduce unforeseen asset management challenges. The majority of assets are at a relatively early point in their expected operational asset life, with interventions identified to recognise those asset types with shorter operational lives due to electronics component obsolescence (etc.).

Appendix C presents a series of queries raised against the ASP document, along with the HS1 responses. These are generally of minor importance and any relevant points emerging have been noted below.

5.6.3 Asset Performance

Section 2 and Appendix B of the Communications Asset Policy [16] indicates that two DTN faults occurred during 2010/11, with neither being service affecting. This low level of faults and absence of associated delay minutes is considered to be a positive indicator of how assets are being maintained and a reflection on the wider effectiveness of the current asset managements. It is also noted that this level of failure performance represents a significant improvement on the historic levels of faults indicted within the Initial Asset Management Statement [6].

5.6.4 Asset Risk and Criticality

The Communications Asset Policy [16] identifies the DTN as the most critical communications asset, on the basis that it supports many other systems including signalling and voice communications which would be impacted by its failure. It is based upon widely adopted SDH technology, which utilises a ring

architecture to provide protection against single point faults from being service affecting. Consequently, service-affecting DTN failures are generally low likelihood but high consequence.

This conclusion is considered reasonable, however it is not fully understood why other communications systems have not also been classed as 'critical' and also addressed by the ASP. For example, we would have expected that radio propagation systems would have been considered 'critical' because of their safety role of radio communications associated with incidents in tunnels (evacuation, emergency services, etc.). Within Appendix C, the response to query 4 suggests that this has been considered and that the tunnel propagation systems are not classed as 'critical' because of their reliability and availability of alternate communications.

5.6.5 Asset Specific Policy - DTN

The current DTN policy is for regular inspection and maintenance regimes coupled with planned renewals. The SDH technology that the DTN is based upon provides a redundant, fault-tolerant architecture with in-service failures being revealed and alarmed, which supports the achievement of a high level of system availability.

Section 4.3.3 of the ASP states the life expectancy of cables as being 30 years, with the suggestion that indications of degradation will be identified through network performance monitoring. Whilst not critical at this point in the asset life, it is suspected that with the asset age profile there may be some 'cliff edge' degradation modes which could mean that once failures started to appear then there may be little opportunity for a planned renewals.

Transmission system multiplexers are identified as components requiring earlier renewal due to equipment obsolescence or loss of support. Section 1.6 presents the timeline for the planned major interventions, with multiplexers being the first renewals of the DTN system in CP2.

5.6.6 Continuous Improvement

Sections 2.2.2 and Section 5 of the ASP covers continuous improvement, with the key points of future development including:

- Development of ASPs to cover remaining communications assets
- Development of simple Whole Life Cost models to support the 2013 ASPs

The initiatives already undertaken, including procurement of a DTN simulator and changes to management of spares, appear sensible from a cost versus risk perspective.

5.6.7 Summary

1 The Communications ASP sets out the current policy for management of the Communications assets. It presents the policy for the DTN as being the only telecommunications asset deemed as 'critical' due to the dependence of various other systems upon it.

2 Overall, the approach appears robust is considered to present a reasonable and robust approach to management of the communications assets, and is expected to maintain the DTN assets to continue to achieve low numbers of failures.

3 The communications assets are relatively young, being installed as part of the Section 1 and Section 2 systems. Obsolescence of components with a shorter expected life (e.g. transmission multiplexer equipment) is a key factor in the current maintenance regime, and the asset lives and planned interventions are reflected within the Communications ASP.

4 The 2013 ASPs will address remaining communications systems, including simple whole life cost models to support the revised policy.

5.7 Overhead Catenary System Asset Policy

5.7.1 Introduction

The Overhead Catenary System Asset Policy (OCSAP) [17] provides details of those Overhead Catenary System assets prioritised following the Asset Criticality Analysis carried out in 2010. The purpose of the Asset Specific Policy (ASP) is 'to optimise asset lifetime performance through the adoption of a structured whole-life approach to operations, maintenance, renewal and upgrades. This is to be developed through a two stage process, the first stage of which is to present the current policy reflecting existing standards and specifications.'

5.7.2 General

The ASP covers the major components of the OCS system. The ASP is well written and the overall approach to asset management of the OCS appears logical under the circumstances of it being in the early stages of its designed service life. The following assets are within the scope:

- Contact, Catenary and Supporting System;
- Section Insulators;
- Bonding; and
- Switchgear.

These have been broken down into various sub-assemblies or major components in the OCS description although not in the following ASP. Items not specifically listed include connecting cables and bare conductors. Asset service lives are stated in relation to the Control Period(s) in which replacement is expected to become necessary and also stated in absolute terms – the shortest being 2-5 years (for skids asset sub-type of section insulators) to the longest being 50 years (masts – asset sub-type of supporting structures).

The overall approach to inspection and maintenance, including periodicity, is outlined. There is also an outline of future intentions for inspection, maintenance and renewals as currently envisaged. The assumption underpinning the ASP is that the OCS will degrade over time (due to mechanical, electrical and environmental effects) – some assets and sub asset types will degrade more quickly depending upon the severity of effects upon them. This is the expected pattern with OCS systems generally. Since much of the OCS is in the early stages of its life, renewals and replacements are not a significant issue.

5.7.3 Asset Performance

Appendix B (Performance Data) of the OCSAP provides details of the Key Performance Indicators (KPIs) including Corrective Work Orders carried out during 2010/11 (described as Periods 1-13), together with a brief outline of the faults broken down by Severity and Asset type.

On the basis of the information provided (i.e. CWOs issued), there is an average of one failure per two and a half week period with 'Potentially Service Affecting' severity, although not all these faults caused an actual delay. There have also been a small number of high impact faults, including the impact of a pantograph failure on a faulty train and (glass) insulator damage due to vandalism.

No information is provided for comparison purposes with other lines or earlier periods so no judgement can be made on whether or not OCS performance is better or worse than could be expected.

The ASP generally confirms that the OCS asset is in a condition commensurate with its age and the environment it is installed within. Also, that the geometry of the OCS is within tolerance as confirmed by regular measurement and contact wire wear is commensurate with the current number of pantograph passes.

5.7.4 Asset Risk and Criticality

Appendix C of the OCSAP lists only four delay causing faults experienced in 2010/11 causing respectively, 942, 487, 302 and 7 delay minutes although the most significant delay (the first) was probably caused by a fault on the train. It is stated that KPIs do not currently provide enough asset-specific information to identify overall levels of safety risk associated with each asset and consequently typical data from RSSB for the classic network (a system with some subtle differences) has been used. The derived annualised Fatality Weighted Injuries (FWI) is <0.021, which is classified in the Criticality Update as very low (refer Table 17 – these appear as absolute values although with 0.6% of national classic network mileage it is possible that these figures should have been percentages or referred to a common unit of length).

Nevertheless, from a train performance perspective, they are important since the results indicate a very high to high level of service delay (refer Table 17). However, the cause of the very high service delay is probably due to a faulty train and the high level of service delay is due to section insulators (arising from train movements)

5.7.5 Asset Specific Policy – Contact, Catenary and Support System

The current policy is to maintain the existing levels of train service achieved by HS1 by keeping the condition and position of the contact wire within the specified acceptable tolerances. (Note-The quality of the traction system interface with the train is governed by the condition and position of the contact wire.) If the values of condition and position exceed tolerable levels then the policy is to take corrective action immediately or planned-in, dependant on the nature of the defect and level of error. Current intervention frequencies are to be applied equally across the whole of the linear asset (i.e. the contact, catenary and support system).

Also, investigations are being undertaken on moving towards a risk-based maintenance schedule reflecting relative criticalities by the 2013 Policies.

The OCS assets are managed as a linear asset for the purposes of planning interventions, broken into sections known as wire runs and wire routes. However, there does not appear to be an obvious management around areas suspected to be more at risk of early damage and/or deterioration.

Various improvement initiatives have taken place or are on-going to rectify identified problems or issues. These cover, to rectify premature aging/corrosion of mechanism on Schneider FMB switches; prevent moisture ingress into voltage transformers; replace steady arms at locations subject to high radial loads with a more suitable type; replace glass insulators susceptible to damage due to vandalism.

5.7.6 Continuous Improvement

The changes to the operating environment listed are the introduction of freight services, changes in train service caused by the Olympics and the introduction of open access services in due course. However, it is not clear what, if any, impact there will on the OCS, or if this will be considered during the development of the 2013 ASPs, where appropriate. Any change in degradation of the OCS and wear of the contact wire can be expected to be incremental and only become significant with time,

providing the opportunity to monitor asset condition and, if necessary, carry out appropriate work before performance is affected,

Future adoption of a long-term risk based approach to inspection, maintenance and renewal of OCS assets is not considered in the light of continuous improvement, rather as a cost minimisation effort. Its impact on operational performance is uncertain and it is acknowledged that the drivers of degradation of the condition of the asset and the effects of interventions on asset condition still need to be understood.

5.7.7 Summary

There is little of concern in the Overhead Catenary System (OCS) Asset System Policy (ASP) based on the information provided.

1 Without being able to 'drill down' through inspection and maintenance documentation including records, no assessment can be made of their efficacy. However, it is apparent that the OCS technology is well established and inspections and maintenance have been carried out regularly for some years by a competent organisation.

2 The emphasis is on moving towards a minimum whole-life cost, although as, yet the impact of varying tolerances and/or inspection frequencies is acknowledged to not be fully understood (see OCSAP Section 4.3.3). The caveat with such an approach is that longer-term degradation of condition and OCS performance may actually accelerate in future, whereas there may be a case for actually reducing it and extending asset lives (e.g. in areas where premature/faster degradation is occurring or to more closely match lives of associated assets and sub-assets and facilitate common replacement strategies). This is an area where close monitoring of degradation is recommended.

3 Faster degradation of asset condition and OCS performance may be occurring at certain locations, e.g. in areas of high pollution or in (wet) tunnels where the micro-climate is more severe. Also, tolerances may be more critical (narrower) at certain locations. Consequently, the OCS may require more and/or more frequent attention at certain locations than at others.

4 OCS contact wire tolerances (e.g. thickness, height, stagger) may need to be reviewed periodically to ensure that they are still appropriate.

5 Any unplanned train stoppage necessitating train evacuation, including those caused by loss of traction power due to OCS failure, can have safety implications. It is recommended that the way that such failures are managed is described in the 2013 ASP to justify the safety criticality assigned to the OCS assets.

5.8 Track Asset Policy

5.8.1 Introduction

The Track Asset Policy (TAP) [18] contains asset specific policies for switches and crossings and plain line track. For both these track systems the policy does not include the track formation or the trackside drainage which is a sub set responsibility of the civil engineer. An asset policy for track drainage and track formation was not included in the asset policies within this review.

The policy is owned by HS1 but written and developed by Network Rail (CTRL) who is the contracted infrastructure manager. The policy document is stated to be a draft, reflecting the existing approach and procedures already in place. A full Track Asset Policy is planned for 2013. Track interfaces are described in section 1.4.2 but do not include the important interface between the track ballast and the track formation. The Asset Life Timeline chart in section 1.6 shows the expected track system component lives. This is at a very high level showing a broad range of expected renewal dates.

5.8.2 Performance

The policy identifies a number of typical track system performance indicators in current use, however, at this stage of policy development long range asset performance targets have not been established. It is interesting to note that of the 700 corrective work orders issued for track, plain line contributes 3 times as many as S&C. The report states that there were no track faults in 2010/11, however, there were approximately 950 corrective works orders issued and dealt with. In Appendix B.1.5, it is reported that in 14 periods between P6 2010/11 and P6 2011/12 inclusive there were 69 track geometry actionable defects found by the track recording cars.

5.8.3 Risk and Criticality

This section of the policy reflects the current knowledge and understanding of this new railway infrastructure. The policy sets out the current inspection and maintenance regimes that are in place to ensure the successful management of risks to either a failure of track integrity (e.g. a broken rail) or a breach of operating tolerances (e.g. the need to impose a speed restriction due to say a geometry fault). It is the intention to break the route down into individual Strategic Route Sections (SRS) and for each to categorise their criticality ranking and define appropriate intervention regimes.

5.8.4 Asset Specific Policy – Switches and Crossings

The asset specific policy for S&C is stated to be to maintain the asset condition at a high level so that the risk to safety and performance is minimized. In the early years of asset life this is fairly straightforward. The policy document recognises that more work will be required to build on the existing understanding of asset degradation to determine the optimal means of delivering the defined standards and tolerances for minimal whole life cost.

Paragraph 4.4 accepts that the current approach, whilst meeting the successful delivery of HS1's business objectives, may not be achieving this on a minimum whole life cost basis. HS1's approach to whole life cost analysis and modelling is set out within Appendix F of the Track Asset Policy [18], and is consistent with the approach presented for other asset areas.

5.8.5 Asset Specific Policy – Track

The asset specific policy for track is stated to be to maintain the asset condition at a high level so that the risk to safety and performance is minimized. In July 2011, HS1 adopted the principle of Absolute

Track Geometry (ATG) maintenance to maintain its track geometry and, due to its European structure gauge, is able to make use of slightly larger and more powerful on track machines than those used on the classic UK railway infrastructure. It is therefore able to adopt common practices to those used successfully on high speed ballasted tracks in France and Germany.

The current design lives for track components are shown in Tables 8 and 12 of the Track Asset Policy [18], reproduced below:

Asset Type	Design Life
Rail	12-25 years
Rail in Slab Track tunnels	18-25 years
Fastenings	15-25 years dependent upon location
Sleepers	50 years
Ballast	1-25 years dependent upon ballast conditions in locations on section 1
Buffer stops	Expected to be in service for the life of the railway
Adjustment switches	10-25 years
Long expansion switches	20-25 years
High Speed S&C	25 years
Low Speed S&C	20 years

There are no track renewals planned currently, however, on certain stretches of the southern end of the route, ballast performance is not meeting expectation and selected replacement will be necessary in the near future.

There is no specific mention in the track ASP of a rail management policy to address the wheel/rail interface. There are specific references to problems with the class 395 resulting in the need to introduce a new wheel profile; also corrugation problems leading to accelerated rail wear on tight curves due to stiff bogie suspensions. With plans for open access and the introduction of freight traffic this is an area that should addressed in the developing ASP for track.

Whilst HS1 recognises that its current policy of meeting the high level KPIs may not be aligned to a whole life cost approach, it does have plans to move to a more risk based asset management policy based on future research into the drivers of degradation and effectiveness of alternative interventions.

5.8.6 Policy Development

HS1 has set out the key steps it considers are necessary to adopt a whole life approach to track asset management in Section 6.2 of the Track Asset Policy [18]. The steps are common with other asset types, covering the following areas: ASP integration, Asset Coverage, Performance, Risk and Criticality, Policy Justification: Interventions and Whole Life Cost Modelling.

As well as developing its Track Asset Policy, HS1 is also making improvements to specific ways in which it inspects and maintains track. The introduction of ATG and the use of Continental gauge on track machines is described in paragraph 4.7.5.2. Improvements in inspection processes are also planned which will provide better improved asset information.

5.8.7 Summary

1 The current Track Asset Policy describes how Network Rail (CTRL), the infrastructure manger, is successfully managing the track asset to deliver today's expected performance.

2 It is recognized within the policy that this approach does not necessarily adopt whole life cycle strategies and costs

3 Development work on a new policy should be cross referenced to the civil engineering policies for track drainage and track formation

4 Work has commenced to develop a new policy for 2013 that will adopt a risk based approach and the development of a whole life cycle minimum cost track asset policy.

5.9 Structures and Bored Tunnels Asset Policy

5.9.1 Introduction

The Structures and Bored Tunnels Asset Policy (S&BTAP) [19] defines the asset policy for structures and bored tunnels on the HS1 route. Section 1 of the ASP identifies assets included within the scope of the ASP as:

- Structures (bridges, viaducts, retailing walls and culverts)
- Tunnels (bored and cut and cover)

Assets excluded from the scope include:

- Earthworks
- Drainage
- Access
- Under track crossings, cable troughs and minor line side structures
- Stations and Buildings (structural elements)

The current Asset Policy is stage one of a two stage development and reflects the existing approach and procedures already in place. The second stage, which is due to be delivered in October 2013, will include full whole life cost justification for all activities and developed funding scenarios for Control Period Two. The ASP does not include plans for delivering the Olympics and Paralympics. These are already in place and detailed separately.

Our review of the ASP considers whether the current stage one approach is "reasonable", i.e. will it avoid a build up of renewals and remedial works in Control Period One which may compromise the more structured whole life approach to be adopted in later control periods.

5.9.2 General

The assets under consideration are principally "new" assets, designed to modern codes with many safety considerations built in. As many of the assets have long design lives, the first major interventions occur in CP3 at the earliest. Appendix F presents a series of queries raised against the ASP document, along with the HS1 responses available. These queries are of minor importance and do not affect our observations.

5.9.3 Performance indicators

The document recognises that performance KPIs based on the number of faults recorded are not appropriate for these relatively new assets. It identifies two new quantitative measures, Defect Risk Ranking and Condition Marking Measures which are currently in development and which will be presented in the 2013 ASPs. This appears to be a reasonable approach although Appendix B.5.1 notes that the introduction of condition marking is dependent on availability of budget and resource.

5.9.4 Asset Risk and Criticality

The ASP recognises the value of designing the assets to modern codes and identifies some failure modes that can be observed and managed through inspection and corrective work, which is part and parcel of the structures management process. The likelihood of these failures occurring is typically low

and the impact of the failures is variable. In terms of performance, safety and corrective maintenance cost criteria, both structures and tunnels are low criticality.

5.9.5 Asset Specific Policy – Structures (Excluding bored tunnels)

The current policy is for regular inspection and maintenance to enable deterioration to be addressed well in advance of it becoming critical. The aim is for a linear budget and the ASP rightly recognises that a move to risk based maintenance is appropriate for these "new" structures.

The inspection and maintenance regime is similar, but not identical to Network Rail's. It is recognised that the Network Rail Standards may be too onerous for these new structures. The bulk of these structures have a long design life hence the time to the first major intervention is several Control Periods away.

It is recognised that the current approach meets the high level KPIs for HS1 but it cannot be demonstrated that this is being achieved at a minimum whole life cost. To achieve this it is intended to move to a risk based approach to structures management which requires the quantitative measures for risk ranking and condition marking described in section 5.9.3.

The ASP recognises that not all information on the structures is held in one place and that there is a need for a better understanding of the asset portfolio.

5.9.6 Asset Specific Policy –Bored tunnels

The current policy is for regular inspection and maintenance to enable deterioration to be addressed well in advance of it becoming critical. The frequencies for Bored Tunnel inspections are based on upon the risk and age profile of the structures and are less than those for other structures. As with other structures, the aim is for a linear budget for inspection and maintenance. Due to the age of the assets, only minor interventions are required at present and this is likely to continue for some time.

It is recognised that the current approach meets the high level KPIs for HS1 but it cannot be demonstrated that this is being achieved at a minimum whole life cost. To achieve this it is intended to move to a risk based approach to structures management which requires the quantitative measures for risk ranking and condition marking described in section 5.9.3.

The ASP recognises that not all information on the structures is held in one place and that there is a need for a better understanding of the asset portfolio.

5.9.7 Continuous Improvement

This section of the ASP summarises the work required to demonstrate and justify NR(CTRL)'s whole life approach to asset management.

Key to these is:

- Development of simple whole life cost models to test different maintenance and renewal regimes, to optimise costs
- Define and capture additional asset information to support cost and degradation models

The Appendices within the document support the current ASP and expand on the requirements for the future whole life costing and modelling.

5.9.8 Summary

1 The ASP sets out the Structures and Bored Tunnels Asset Policy for CP1. The approach appears robust and reasonable and it is considered most unlikely that it will generate any bow wave of works in later control periods.

2 The ASP anticipates future major interventions and recognises the additional work required to develop a whole life approach to asset management.

3 The ASP takes a pragmatic view of the development of simple whole life cost models and recognises the benefit of improved asset information, including quantitative risk and condition data. These improvements are planned to be delivered in the 2013 ASP.

5.10 Ventilation Equipment Asset Policy

5.10.1 Introduction

The Ventilation Equipment Asset Policy (VEAP) [20] presents the asset policy for tunnel ventilation equipment. The extent of ventilation equipment assets covers:

- Axial fans at tunnel shafts
- Jet fans and Saccardo Nozzle fans at tunnel portals
- Variable speed drives
- Motorised dampers.

The ventilation equipment is controlled by the Ventilation Control System which is addressed under the Control Systems Asset Policy (refer to section 5.5). The tunnel structure itself is covered under the Structures and Bored Tunnels Asset Policy (refer to section 5.9).

5.10.2 General

The ASP describes the role of the ventilation equipment as being to provide movement of air to support maintenance activities, cooling in the event of trains stopped in a tunnel, and also smoke management/extraction in the event of a tunnel fire. The fans are not needed during normal operation, since the passage of trains provides sufficient movement of air. Consequently the equipment is frequently tested to ensure a high level of availability is achieved.

Appendix G presents a series of queries raised against the ASP document, along with the HS1 responses. These are generally of a minor nature and do not significantly affect the observations in this sub-section.

5.10.3 Asset Performance

The historic failure performance and the associated operational impact of failures is an obvious reflection of the effectiveness of the current asset management. Section 2 and Appendix B of the Asset Policy indicate that eight faults and seven Corrective Work Orders were raised during 2010/11, with none being service affecting. This represents a marked improvement from the 61 "Mechanical & Electrical - Ventilation" faults in 2009 shown in the Initial Asset Management Statement [6]. This low level of faults and absence of associated delay minutes is seen as a positive indicator of how ventilation equipment assets are being managed.

5.10.4 Asset Risk and Criticality

The Ventilation Equipment Asset Policy identifies the equipment as critical on the basis of the impact of possessions required to support maintenance. Whilst this is considered as valid, it seems counter-intuitive that that the operational safety criticality score is classed as "V. LOW" within section 3.2 given the important safety role in managing tunnel fires.

5.10.5 Asset Specific Policy – Ventilation System

The ASP is stated as maintaining the asset condition at a high level to minimise the safety and performance risks, and is achieved through a combination of frequent testing, inspection, planned and reactive interventions and maintenance.

Section 4.3.3 of the ASP states that the current expectation for asset lives ranges from 15 to 25 years, with variable speed drives having the shortest expected life, and also notes that the asset lifetime will be reviewed and revised as information is gathered on condition and deterioration over time. Section 1.6 of the Asset Policy reflects the current life expectancies within the planned interventions, with variable speed drives indicatively shown within CP3 and other assets within CP5.

5.10.6 Continuous Improvement

Sections 2.2.2 and Section 5 of the ASP covers continuous improvement, with the key points of future development including:

- An improvement initiative to refurbish jet fans during engineering hours over a three year period, involving development of a bespoke rail vehicle and communications equipment able to be used in a noisy environment
- Development of simple Whole Life Cost models to support the 2013 ASPs

5.10.7 Summary

1 The Ventilation Equipment Asset Policy sets out the current policy for management of the tunnel ventilation equipment. These assets are deemed 'critical' due to the impact of possessions required to support maintenance.

2 Overall, the current asset management approach appears robust. The regime includes frequent testing, inspections, and planned and reactive maintenance. The low number of in-service failures and delay minutes is significantly lower than was experienced in early years, and this is seen as a positive reflection upon the management regime.

3 The assets are relatively young, being installed as part of the Section 1 and Section 2 systems. Obsolescence of variable speed drives which have a shorter expected life than other components is reflected within the planned interventions.

4 The 2013 ASPs will including simple whole life cost modes to support the revised policy.

5.11 Lineside Buildings and Depots Asset Policy

5.11.1 Introduction

The Lineside Buildings and Depots Asset Policy (LB&DAP) [21] defines the policy for lineside buildings and depots assets that are the responsibility of Network Rail (CTRL) Ltd. It identifies assets as the following main types:

- Control and communication building
- AC/DC buildings
- Depots
- Forward Incident Control building
- Pumping building
- Signalling and Telecoms building
- UKPNS buildings
- Tunnel vent shafts building

Photographs of representative buildings are included in Appendix I.

Mechanical and Electrical assets such as heating, lighting, ventilation and other services within lineside buildings and depots are not covered by the ASP. Stations and other operational property are not included in this ASP. The document states that these are managed separately and have their own suite of ASP's. Specific comments on the LB&DAP and the responses from NR (CTRL) Ltd are included in Appendix H. Most of these seek clarification of the ASP or provide suggestions on how it may be improved.

It should be noted the status of the present Buildings and Depots Asset Policy [17] is only "First Full Draft". NR (CTRL) Ltd has compiled a list of Buildings Assets [22], which is not part of the ASP but is an important complementary document. A second draft planned to be complete by October 2013 will take account of some of the suggestions offered in Appendix H and also will include a full whole-life cost justification for all buildings and depots activities with developed funding scenarios for Control Period 2.

5.11.2 General

The LB&DAP addresses the most important aspects of the management of the assets in general terms. It will benefit from a more detailed description of the assets and how they are managed.

The HS1 Buildings and Depots assets are long life assets and all are relatively new and of modern design such that there should be little need for major repairs or renewals within the next two Control Periods. This is reflected in the ASP.

This situation provides a unique opportunity in the context of the second stage ASP that is intended to focus on whole-life costs. Network Rail Corporate (NR) has been developing whole-life cost modelling for their buildings, depots and stations assets using input from the "The Buildings Research Establishment" and others to predict degradation of assets and the optimum timing of maintenance interventions and renewals to obtain lowest whole-life costs. Although the NR modelling is still at a relatively early stage of development it is well structured and follows a logical sequence of analysis. There is merit in NR (CTRL) considering a similar system for their 2013 LB&DAP.

5.11.3 Asset Performance

Meaningful Key Performance Indicators (KPIs) are difficult to define for buildings assets. The fundamental requirement is that buildings provide a safe and effective environment for the people or equipment for which the building is intended and that they support operational high performance. The ASP recognises this. It has in place regimes for inspection to understand how the assets are performing and for maintenance aimed at them continuing to perform without affecting the operation of the railway.

It is understood there are no KPIs relating to the present LB&DAP. NR (CTRL) report that KPIs will be developed if condition based monitoring is appropriate during the 2013 ASP review. There is no reference to KPIs relating to cost efficiency or performance.

5.11.4 Asset Risk and Criticality

The ASP indicates that further work is to be undertaken to analyse the risk and criticality of the buildings taking into account the location and equipment housed within.

As regards operational performance and safety, buildings and depots assets should be low risk and low criticality if properly inspected and maintained.

5.11.5 Asset Specific Policy – Lineside Buildings and Depots

The ASP does not differentiate between lineside buildings and depots as the HS1 buildings assets generally consist of prefabricated or purpose built buildings. It states that the majority of lineside building and depot assets are managed in a similar way and therefore the ASP applies equally to all types. This is acceptable for the number (117 in total) of buildings assets within the limited HS1 portfolio.

It is believed however that consideration should be given to broadening the scope of the ASP for buildings like the Singlewell Infrastructure Maintenance Depot which are much larger and of more complex construction than the prefabricated units. The ASP acknowledges that within the asset portfolio there is a range of construction types and sizes with components of varying size and material. It acknowledges the detail of the exact construction type, sizes and components is not easily accessible for all assets and better understanding of the asset portfolio is required. This should be addressed.

The current policy is to identify deterioration or defects well in advance of damage becoming critical, allowing plenty of time for repairs to be carried out. The assets are inspected and maintained on a regular basis. Annual budgets are set for examination and maintenance of each type of lineside building and depot asset with the aim of maintaining a linear budget spend year on year. The ASP recognises that although this approach is supporting the delivery of HS1's business objectives it cannot be demonstrated that it is being done for the minimum whole life cost.

There is no specific policy for Planned Preventative Maintenance in the ASP.

5.11.6 Continuous Improvement

The purpose of the ASP's is to optimise asset lifetime performance through the adoption of a structured whole life approach to operations, maintenance, renewal and upgrades. This is to be developed through a two stage process. The present ASP is the first stage and NR(CTRL) is working to develop and improve it over the next year.

NR(CTRL) aim to evaluate the move to a risk based approach to inspection, maintenance and renewal. They recognise the need to understand the drivers of asset component degradation, the effects of

maintenance and renewal interventions and the challenge of establishing the optimum balance for these items. This is an initiative that should lead to significant and continuous improvement in the management of the buildings and depots assets.

5.11.7 Summary

1 The LB&DAP demonstrates a good understanding of the key requirements for effective management of buildings assets.

2 It is based upon sound principles for the management of the buildings assets.

3 For this study there has been no investigation of how effectively the principles are being implemented.

4 The HS1 Buildings and Depots assets are long life assets and all are relatively new. If the inspection and maintenance policies are implemented effectively they should not lead to an unsustainable level of deterioration in safety terms. It is considered further development is needed to confirm the policies are efficient in economic terms

5 As the assets are relatively new and standardised, a unique opportunity exists for economic efficiency to be assessed using meaningful whole-life cost modelling, which it is understood will be a significant element of the second draft ASP planned to be complete by October 2013.

6 The ASP does not differentiate between lineside buildings and depots. Consideration should be given to broadening the scope of the LB&DAP for buildings such as the Singlewell Infrastructure Maintenance Depot which are larger and of more complex construction than the general HS1 prefabricated lineside buildings.

7 The ASP does not refer specifically to Planned Preventative Maintenance, which is generally considered to be an important aspect of buildings maintenance.

5.12 Escrow Account

This study focuses upon the engineering aspects of the Asset Specific Policies, along with direction that the asset management strategy is taking for the future 2013 versions of the ASPs.

The scope has not included the review of financial and efficiency aspects of the current policies, however the ORR has expressed a specific interest in whether the rate at which funds raised through the Operations, Maintenance and Renewals Charge (OMCR) are placed into the ring-fenced Escrow account to fund future renewals of the HS1 infrastructure.

Section 6.5 of the 2011/12 HS1 Asset Management Annual Statement (AMAS) [Ref 9] describes the position regarding payments and expenditure:

- £5.1m was transferred into the Escrow account during the year ending 31/03/11
- The balance at 31/03/11 was £8.7m
- There has been no spend to date, nor any committed spend.

The individual ASPs, along with Section 4.2.3 of the AMAS, describe a number of projects and asset renewals which would be expected to call upon the Escrow account. However there is no unit cost information currently available within the ASP documents from which to compare planned renewal costs with the rate at which the contributions to the Escrow account are being made.

During a meeting with the ORR and HS1 on 18 July 2012, it was agreed to consider plain line track renewal as a likely dominant element in through-life renewal costs, with a view to establishing an 'order of magnitude' engineering estimate to allow comparison with the current assumptions underpinning the rate of contribution into Escrow account.

Appendix J presents a conservatively-based engineering estimate of renewal costs for plain line track on the main lines up to 2032-33 along with key assumptions. This concludes that the total estimated costs for the first set of renewals are up to 50% higher than the HS1 assumptions underpinning the contributions into the Escrow account. This estimate is, however, sensitive to assumptions on unit renewals costs which may not apply to other asset groups.

The assumptions behind the 50% shortfall figure have been subsequently discussed with HS1. On a more optimistic basis, primarily associated with renewal volumes per annum and associated unit costs, the shortfall in contributions to the Escrow account is estimated at 25%. The expected shortfall in Escrow account contributions was agreed to fall in the range 25% to 50%.

It is recommended that further consideration is given to the Escrow account once the 2013 ASPs are issued, since these are expected to present a more robust and comprehensive view of renewal interventions although costings will need to be visible.

Whilst it is outside of the scope of this report, other factors which may significantly affect the appropriate rate of contributions to the Escrow account are as follows:

- The base interest rate was assumed to be 7.41%, which is significantly higher than has been achieved.
- No costs for GSM-R are included.

6 Conclusions and Recommendations

The review has examined the high-level asset management policy and strategy documents, the 2011 Asset Specific Policies, and also the 'route map' covering development of the AM strategy and leading to a more comprehensive set of ASPs in 2013.

The majority of assets are at a relatively young age within their expected asset life, and consequently the current asset management activities are aimed at achieving a 'steady state' with the focus being upon minimising delay minutes associates with failures.

Given the above, the existing 2011 ASPs are considered to be sufficiently comprehensive and robust to support the current ongoing maintenance and support of the critical infrastructure HS1 assets.

Considering the set of ASPs as a whole, the following overall comments and conclusions are drawn:

1 The ASPs follow a common logical structure, and consistent with the objectives of the first drafts of the ASPs described in the Initial Asset Management Statement [6].

2 The current 2011 ASPs only cover specific assets which have been deemed 'critical' on the basis of an impact assessment. The 2013 ASPs will cover a broader scope of assets.

3 The focus is currently upon a 'steady state' of maintaining the assets, aimed primarily at minimising delay minutes.

4 The ASPs present a summary of the asset scopes, their condition and performance, current expectations of asset life and interventions for renewals, and improvement initiatives. The maintenance arrangements and current performance are generally considered to be effective and appropriate.

5 The ASPs have highlighted the areas where assets will require renewal through equipment obsolescence (generally electronic systems), however there is little visibility of the obsolescence management process.

6 The 2011 ASPs do not contain any Whole Life Cost modelling, and it is stated that simple WLC modelling will be included within the 2013 ASP to support justification of the policies. It is recommended that if changes to maintenance arrangements are identified as a means of minimising whole life costs, then the impact of safety case constraints are recognised.

Current ASPs and the supporting evidence of asset performance appear sufficient to ensure that a backlog of maintenance activities and/or renewals is not currently building up. There is however limited visibility of costs and efficiency in the documentation made available, but despite that, the current asset management arrangements demonstrated through the ASPs appear appropriate.

Detailed comments and recommendations to take into account during development of the 2013 ASPs are detailed within the relevant subsections of Sections 5.4 through 5.11. A number of common topics have been noted below:

7 Determination of Asset Criticality. The ASPs focus upon the more critical assets from performance and safety points of view, however the visibility of this 'filtering' is not too clear. E.g. tunnel radio propagation systems may have a greater safety significance than indicated. Issue will be resolved by the suite of ASPs in 2013 which will cover all assets. Associated with this is the use by NR(CTRL) of the RSSB risk model for the 'classic' network as a means to determine safety criticality. It is not clear whether this will appropriately take account of the differences between HS1 and the 'classic' network infrastructure (e.g. tunnel systems) and consequently underestimate the criticality in some areas.

8 Visibility of Maintenance Procedures. The only visibility of the way in which the assets are being maintained is through the ASPs; we (and HS1) have not had visibility of the supporting maintenance procedures due to the nature of the concession agreement between HS1 and NR(CTRL). Similarly, competence and resources requirements are not addressed within the ASPs.

9 Failure History Performance Indicators. Although ASPs give an indication of the number of faults in 2010/11 and associated delay minutes, the ASPs do not give a good indication of the fault and maintenance history, as an indication that the assets are in a stable or improving condition. By comparison, the remedial actions for each asset area in the Initial AM Statement provides graphs of the monthly number of corrective work orders by asset group.

The above are suggested as areas for improvement within the next draft of the ASPs. With regard to item 8 above, it is recommended that greater visibility of the maintenance policy should be provided.

With regards to the 'road map' for development of the asset management regime to become compliant with PAS 55, our detailed comments on the gap analysis are included in sections 5.2 and 5.3. The main thrust is to ensure HS1 properly defines the scope of the Asset Management system clearly defining the split of responsibilities between themselves and NR (CTRL) and then manage the relationship so that all aspects of the AM system are in place and robust. There is no requirement for HS1 to do everything in-house – there is a requirement (paraphrasing) for them to make sure it is all happening and that they have sufficient control over the activities. Alignment of the asset management activities with the overall objectives and obligations of the business is essential. Ensuring the Asset Management strategy is clearly articulated is an important aspect here and HS1 needs to ensure that the various elements of the strategy contained in various documents are consistent, aligned to the business goals and provide full coverage of the asset base.

We have recommended some specific areas to consider in developing the risk management approach. Risk management is at the centre of asset management decision making and, along with the scoping and strategic alignment issues, should be addressed as a priority.

From consideration of the rail and ballast renewals and associated costs, our engineering estimate is that the costs for the first set of renewals are in the range 25% to 50% higher than the original HS1 assumptions underpinning the contributions into the Escrow account. This estimate is, however, sensitive to assumptions on unit renewals costs which may not apply to other asset groups. We therefore recommend that the contributions to the Escrow account should be further considered once the 2013 ASPs are issued, since these are expected to present a more robust and comprehensive view of renewal interventions.

7 References

1 ORR/HS1 Mandate for Consultancy Support - Review of HS1 Asset Specific Policies, R-AE-RR-00002-02-HSO (Final), November 2011

2 LR Rail Proposal - Review of HS1 Asset Specific Policies on Behalf of the ORR, 166030lbm120106, 6 January 2012

3 HS1 Infrastructure Asset Management Strategy, version 1.4, 25 June 2010 (headed R-HS-HS-00017-02-INT version 02)

4 PAS 55-1:2008 Asset Management: Specification for the Optimised Management of Physical Assets

5 PAS 55-2:2008 Asset Management: Guidelines for the Application of PAS 55-1

6 HS1 Initial Asset Management Statement, version 1.3, 25 August 2010

7 NR(CTRL) Asset Criticality Analysis, version 2.0, 29 October 2010

8 NR(CTRL) Infrastructure Asset Information Strategy, version 2.0, November 2010

9 HS1 Asset Management Annual Statement & Collection and Overview of OMRC Payments – 12 Month Update from 1st April 2010 to 31st March 2011, HS1 LA-AE-OW-00041-02-HSO, Version 4, May 2011

10 Asset Specific Policy Development Plan for HS1 Route, Draft v7

11 HS1 PAS 55 Asset Management Improvement Plan (AMIP), Draft A, 10 April 2012

12 Gap Analysis Assessment Report PAS 55:2008, Version 1.0, 10 April 2012

13 HS1 Executive Briefing on PAS 55 Gap Analysis (presentation), Draft A

14 NR(CTRL) Signalling System Asset Policy, C-10-CS-51-2002 (CCMS 61902202), Issue 1.0, 3 October 2011

15 NR(CTRL) Control Systems Asset Policy, C-10-CS-51-2001 (CCMS 61900334), Issue 1.0, 3 October 2011

16 NR(CTRL) Communications Asset Policy, C-10-CO-51-2001 (CCMS 61900197), Issue 1.0, 3 October 2011

17 NR(CTRL) Overhead Catenary System Asset Policy, C-10-EP-51-2001 (CCMS 61901967), Issue 1.0, 3 October 2011

18 NR(CTRL) Track Asset Policy, C-10-TK-51-2001 (CCMS 61902356), Issue 1.0, 3 October 2011

19 NR(CTRL) Structures and Bored Tunnels Asset Policy, C-10-CE-51-2001 (CCMS 61900001), Issue 1.0, 3 October 2011

20 NR(CTRL) Ventilation Equipment Asset Policy, C-10-EP-51-2002 (CCMS 61902452), Issue 1.0, 3 October 2011

21 NR(CTRL) Lineside Buildings and Depots Asset Policy, Draft Issue 1.0, 231 March 2012

22 List of Lineside Buildings and Depots, filename "Lineside Buildings and Depots 30-03-12"

23 Email "RE: Request for data to support the HS1 ASP review", David White (HS1), 06/08/12

24 HS1 Excel workbook "ORR-budget – 2012-13.xls"

25 HS1 Excel workbook "Track capital expenditure in business model at sale (9-10) prices.xls"

Appendices

Appendix A Queries and Responses on the Signalling Asset Policy

Ref	Section	Query	Response
1	1.3	Scope. Cables are left for the second iteration of the ASP. Given the problems experienced in the UK with both cable degradation and theft, why are they considered a non-critical asset at this stage?	Cables are no critical at this time as they are 5 and 10 years old and enclosed in troughing. We have the BTP and our own security service to protect the railway, including trembler systems and smart water. HS1 is leading the way in this respect and suffers minimal losses with respect to national issues.
2	1.6	ITCS stated to have a life of 25 years. This is not unreasonable as a planning assumption.	N/A
3	2.1.1	Do the "potential service affecting faults" bring out specifically "wrong side" or safety affecting failures in the KPIs?	We have not had any wrong side failures in 11 years of operation due to the nature of the signalling system. Safety effecting KPI from April are given a categorisation that is not seen in the present KPI following comment from the ORR.
4	2.2	ITCS and point failures seem quite high to me, given the volume installed. It would be interesting to see performance going back to earlier years, accepting that the railway was not as busy then, to see what the trend is. There is a hint about previous performance in 2.2.2	OK
5	3.2	Table 4. I may not understand this but why is ITCS rated 5 for planned maintenance? It seems unusual to me. Also rating on safety for track circuits is 1 which seems counter-intuitive	The ITCS system is the signalling system requires a high level of planned maintenance per annum to ensure the system is 100% operational. Track circuit impact is low as they fail safe, indeed HS1 track circuit levels are monitored in real time and alarm when out of tolerance well before hitting an operational threshold for the maintenance teams to remedy.
6	4.2	It's a lot of cards in the IITCS - 5231, and also a lot of relays for an "electronic" interlocking system!	N/A
7	4.3.2	Have alternative suppliers been sought for NS1 relay repair?	HS1 have purchased equipment to accurately test the relays in house, performed by competent staff.
8	4.3.3	Are there active obsolescence policies for key electronic components/cards/ subsystems or is this all left to Ansaldo, other than the ESCROW agreement?	Yes we are actively working with Ansaldo and our other third line support contracts to highlight obsolescence early, this detail will be fed into the new ASP in October 2013.

Ref	Section	Query	Response
9	4.4	Is there an in-house or supplier independent competence on electronic system component obsolescence issues?	Unfortunately as the signalling system is SIL 4 no modifications are permitted to be made to this system other than Ansaldo. Speaking to Ansaldo recently they continue to produce and sell TVM430 to countries that do not have GSMR or the frequency spectrum available.
10	4.5	Is there a plan to integrate all the asset data and records into one system, for all signalling, let alone other functional assets?	Yes HS1 has completed a PAS55 gap analysis recently and the organisation has an aim to integrate all data sources into one single source of truth.
11	5.3.2	A 12 month visual inspection for UM TVM track circuits seems quite long, particularly compared with the 3 months used for HVI track circuits. Why is this and are connection problems a significant cause of failure?	TVM track circuit maintenance, there are a number of levels of maintenance, one part is the physical on site tests, the monthly signalling room voltage checks, and real time monitoring of track circuit voltage levels. Connection problems have been a significant issue as any ingress of moisture causes corrosion and increases the track circuit impedance dropping the hold voltage. A program of replacement and improvement of the track circuit inserts in wet zones has been completed improving the connection properties.
12	5.3.4	Are there any issues with rail insulations degrading/failing impacting on track circuit performance?	No
13	6.3.2	Are there any enhanced maintenance routines for critical points, as described in 3.2?	No, however this is an area HS1 is keen to explore with a risk based approach to reduce whole life costs of maintaining points that are rarely utilised.
14	6.4	Is there a policy on routine overhaul of POE? What is French practice on their high speed lines? This is linked to the statement in 6.3.4 on affinity with S&C assets	The Signalling Standards and SMTH are developed from NRIL and SNCF standards and detail the routine maintenance and replacement of component parts. The heavy maintenance will be covered by the track maintenance ASP, and detection and motion covered by this ASP, both sets of detail will be included in the 2013 ASP.

Ref	Section	Query	Response
15	6.5	Given the performance (and safety) criticality of points, what plans are there to provide condition monitoring systems or are they already provided? I note this is covered in 8.3, but I had thought condition monitoring of points was already in quite widespread use in Network Rail.	Condition monitoring has been trialled a number of times using various manufacturers all of which have been un-successful, and difficult to build up a business case due to the low level of failures and impact on operations. However a system is under test at the present time on the HS1 test rig. HS1 also uses the real time data from the signalling system to look at point throw times, this is a basic form of condition monitoring that is used to identify potential failures.
16	7.2	The number of signals surprised me. Where are they used in general?	At St Pancras and entry into loops.
17	8.1	Traffic intensity is usually not a significant factor in signalling system reliability except for point systems. What are the issues with greater usage thought to be?	Generally this is a true statement however with freight running this adds additional possibility of damage to points and physical signalling equipment, plus the requirement to install a new Wheel Impact System at two locations. Additional services impact on the availability of maintenance periods to perform planned maintenance or repair failures during service as pressure on capacity increases (may require additional plant and machines). Clearly the wheel rail interface issue that exists with the 395 at this time was not expected so the statement echoes this type of unexpected issue and the huge amount of work required to identify and stabilise the present wheel real interface problem.

Appendix B Queries and Responses on the Control Systems Asset Policy

Ref	Section	Query	Response
1	1.4.2	Does the VCS interface to ventilation equipment via the EMMIS or some other method? Appendix A3 states that there is an interface to the DTN via master PLCs	The VCS system presents information onto the EMMIS screen for the operator via a LAN system and utilises the DTN to communicate from Ashford to the equipment on site via PLC.
2	1.6	The asset timeline is given as 5-7 years. Is that from 2004 or from 2011? Is this timeline driven primarily by the hardware obsolescence or the Windows 2000 operating system obsolescence or both? What language is used for the applications software?	The timeline is from 2008 to coincide with the date the system was last updated with hardware during the commissioning of section 2. It is driven primarily by the hardware, but obsolescence will be studied for the software to understand if the core components (windows, ilog C++) still supported. Updates will be recommended in renewals plan. C++
3	2.2.2	Mention made of on-going system design faults to be fixed in October 2012. Do these date back to 2004 or since phase 2 and why so long to resolve?	2007, the cost is very high and we accumulated a number of issues and enhancements to ensure a business case stacked up.
4	4,5,6	Largely common approach used for all 3 systems covered	Yes because the RCCS, EMMIS and VCS systems are interlinked and implemented and maintained in the same manner.
5	4.3.4	Is there not a common interface protocol used at present?	No, different interfaces use different protocols including BR1810, SACEM, TCPIP, CIF.
6	4.5	What level of detail is held in eAMS - card level or sub-system?	eAMS holds Least repairable units – workstations, servers. The configuration database holds information pertaining to specific software, firmware and hardware configurations.
7	5.1	Why is the field equipment (PLCs) not included in this version of the ASP? How many are there and are there any particular issues with them? Are they all the same?	This is control systems and does not include this off the shelf low risk identical equipment.
8	6.3.1	Does the VCS also use Windows 2000 as its operating system or is it bespoke operating system. Noted the applications software is bespoke, developed by Ematics	The servers use Windows Server 2003 and the workstations run on windows XP

Ref	Section	Query	Response
9	7.1	Traffic intensity is usually not a significant factor in control system reliability. What are the issues with greater useage thought to be?	The traffic intensity is not necessarily an issue, but the way the system is intended to operate with a new service. The new service will need to be considered against the current acceptable modes of operation to ensure they are compatible and to identify if modifications are required to deliver the intended service.
10	7.3	Some brief words on migration of software and hardware. This is a key issue	The data is from 2010 onwards as this reflects a steady state environment for the railway and coincides with the introduction of the domestic high speed service. Previous years saw low frequency, single operator service not representative of todays operating environment.
11	App A1	What equipment is used for the workstations - are they standard PCs?	Standard DELL PC
12	App B	No trend failure information (1 year only) and also not clear what, if any, impact there was on the service	Failure trend information is available however HS1 have requested that the ASP data set go back one year as previous data sets spike due to the completion of section 2 in 2007/8 and the introduction of the LSER service in 2009 / 10 and are difficult to make valid comparison, this year will be used as a base line. 2011/12 until 2013 will be used to provide detail on condition and degradation for the 2013 ASP. Service impact is detailed in Appendix C1.1 and noted as delay min.
13	App C	Shows low number of service affecting failures (ref comment 11)	N/A
<end>			

Appendix C Queries and Responses on the Communications Asset Policy

Ref	Section	Query	Response
1	General	In addition to hardware failures being a cause of service-affecting failures, there is the potential to disrupt services through network management, e.g. potential for user error during provisioning of circuits, recovery from faults, application of patches, etc. Can an explanation of this management process please be provided? It is also noted that Section A.1.5 refers to network management terminals for the Nortel and GE parts of the network - does the 'splitting' of network management across these present issues?	NR(CTRL) have a competency management system that defines what and Engineer or technician can work on. Only competent staff can work on this system which is strictly limited to a small number of TCS engineers. The Nortel and GE networks were designed and manufactured by one company (GE), the higher order system was then sold to Nortel. There is no issue with using these products as one 3rd line support contract is used for both systems (Horsebridge).
2	General	Can an explanation of how the competence of maintainers is managed, and how sufficient resources are provided to deliver planned and unplanned maintenance effectively?	Through NR(CTRL) competence system and an assessment of the competencies required by each department.
3	General	The scanned front sheet of the pdf file provided for review does not include the preparation, approval and authorisation signatures. Can evidence of this please be provided, or otherwise provide confirmation that this is the correct formally issued version of the document?	Email sent as requested as evidence.
4	1.4.3	Within Table 3, the radio propagation system entry would appear to be a significant system, particularly given the importance of communications in the event of an incident in tunnels. Can further details of why tunnel communications have not been classed as 'critical' as a result of their safety significance?	As discussed before the failure and safety criteria incidents are very low (as per criticality analysis), the system is very reliable. WRT our operating requirements if the radio does not work drivers have signal post telephones as a fall back.
5	1.4.2	This section states that the DTN is protected against single points of failure, which presumably relates to failures of equipment hardware (SDH ring topology etc.). Does this protection against single point failures extend to power supplies and other support systems such as HVAC? Also, are there any physical locations which are vulnerable and which may impact upon the way in which assets are managed? (Section A.1.4 relates in description of the fibre architecture).	With any system there is always eventually a SPOF, however power supplies are protected by UPS, HVAC do have 100% overcapacity to cope with a failure in signalling rooms. All important systems are housed in purpose built signalling rooms that are protected by fences, alarms and CCTV.

Ref	Section	Query	Response
6	1.5	Table 4 lists the key maintenance documents for the DTN, radio systems, telephone systems and CCTV systems. Visibility of these is requested to understand the scope and nature of the documents.	This is not possible as they are a level 2/3 NRCTRL standard.
7	2.3	Paragraph 1 states that equipment manufacturers have given notice of component support being withdrawn. Is consideration of equipment obsolescence dependent upon manufacturers/suppliers notifications, or is there a more pro-active process to review component availability into the future. (Section 4.4 also relates).	It is a requirement of all 3rd line support organisations to be pro-active and provide details of obsolescence as early as possible (such as GE / Nortel). For these two systems a DTN strategy exists to replace the systems. The ASP will cover this in the 2013 version as no other systems have reached this point. The DTN strategy was an interim document before the ASP were introduced.
8	4.3.3	This section discusses the renewals approach. How will the decision on whether to replace unsupported equipment, or to continue operating with unsupported equipment, be made in an optimised manner? This decision will presumably need to reflect the risk appetite, cost of renewals, cost of spares and risk of operating with a potentially degrading asset.	That is correct and will be expressed in the road map for 2013 ASP, with new metrics being put in place from April 2012 to measure the degradation of the asset to feed into the 40 year renewal plan and 2013 ASP. The concession agreement demands that we provide justification for bringing renewals forward or delaying planned renewals.
9	4.4	For communications assets, it would appear that effective maintenance is partly dependent upon the communications asset itself, e.g. the GSM-R maintenance hand-portables may be needed to support interventions, but may be impacted by (for example) a major DTN failure. Has this been accounted for in the criticality assessment?	Again handsets are not considered critical as SPT are available, a DTN failure is unlikely to effect all GSMR base stations.
10	B.1	Table 11 indicates that two DTN faults attributed to the DTN in 2010/11. This seems significantly lower than the historic level of corrective works orders in the Initial Asset Management Statement C-10-CO-51-2001 Issue 1.0, which indicates 7 in 2007, 15 in 2008, and 6 in 2009. Can an explanation please be provided, and if fault numbers in 2010/11 have been lower than the historic norm for an unknown reason, then has this affected the policy?	The section 2 handover of the DTN system (2007/8) had a number of issues, especially on the Temple Mills ring, these issues have been analysed and resolved, hence the lower number of faults in 2011.

Ref	Section	Query	Response
11	C.1.2	This section explains that "classic network" data from RSSB has been used to indicate the levels of risks associated with assets. Has consideration been given to the differences in the usage of communications between the "classic network" and HS1? An example may be the use of GSM-R to support maintenance.	Does this point have a consequence for DTN as in my view useage has no consequence to the system operation, as it is always operational.
12	C.2	This section presents criticality scores for DTN (presumably) and refers to a corporate risk matrix. Can it please be confirmed that this is HS1's corporate risk matrix?	HS1 divests all safety responsibilities to NR(CTRL) and it is for NR(CTRL) to determine what risk profile they determine for the assets. Clearly we review the AMAS, ASP and have an input through our Asset Management Policy.
13	D.1	Editorial - bullet 1 should presumably read "verified" instead of "validated".	OK semantics here, I will be interested to hear what you believe the difference is and why.
14	D.1	This section refers to a 40-year timeframe, stating that this is consistent with the Strategic Plan. Is this document available (or is it misnamed and one of the documents already made available).	The plan is within the Infrastructure Asset Management Strategy as July 2012, this has been modified to October 2013.
15	General	The 'Review' statement on page 2 (which states that the procedure will be reviewed every 3 years) seems inappropriate given the intentions to reissue ASPs in 2013.	Note that this is a first version and the 2013 ASP is the final version (initial sweep), I believe this is simply in line with the level 2 standard process for NR(CTRL).
16	C.1.2	It is presumed that the title of this section should be "Safety Risks"	Well spotted - Typo

Appendix D Queries and Responses on the Overhead Catenary System Asset Policy

Ref	Section	Query	Response
1	General	Safety is an issue with electrical equipment. Deterioration/degradation of equipment will at some stage undermine electrical performance and safe operation. How is this being considered?	Safety is always our number one priority. Degradation/deterioration of the asset is managed via a robust preventative and predictive maintenance regime; all assets are inspected visually from ground level every 5 weeks and annually at height. Additionally we regularly measure and monitor the geometry and dynamic performance of the asset using the IRIS 320 measurement train.
2	General	Can an explanation be provided of how the competence of maintainers is managed, and how sufficient resources are provided to deliver planned and unplanned maintenance effectively?	Response provided for communications - please edit as appropriate: Through NR(CTRL) competence system and an assessment of the competencies required by each department.
3	General	The scanned front sheet of the pdf file provided for review does not include the preparation, approval and authorisation signatures. Can evidence of this please be provided, or otherwise provide confirmation that this is the correct formally issued version of the document?	Response provided for communications - please edit as appropriate: Email sent as requested as evidence.
4	1.1	An area we haven't seen is actual maintenance instructions or procedures and table of periodicities. These exist in Network Rail for the UK railway network, excluding HS1, and there is probably an equivalent for HS1 (or they are using the same documents?). Whilst Network Rail's maintenance instructions or procedures and table of periodicities for the rest of the UK are based, in part at least, on experience (and manufacturers' recommendations) any documentation for HS1 may not be so directly based on experience. What are the origins of the maintenance instructions and periodicities being followed and how appropriate are they to this railway?	We have a full suite of Level 1, 2 and 3 maintenance standards. These standards are different to those on NRIL and have been drafted using an amalgam of French and UK standards and best practise, manufacturer's recommendations, European and UK National standards and French and UK experience.
5	1.1	The term 'lowest whole-life cost' is not defined. It would be useful to know more about the model or philosophy to be followed, including what factors are to be considered and any indication of weighting factors.	This will be included in the 2013 ASP

Ref	Section	Query	Response
6	1.4.1, 1.4.2	There is a contractual, operational and maintenance interface with EDF who are responsible for the traction power supply system and supply of power. It would be useful to know where these interfaces and responsibilities are?	HS1 hold the contract, NRCTRL perform the day to day interface as per the OA agreement.
7	1.5	Can C-03-EP-15-1200 Management & Maintenance of Traction Power Supply Equipment and C-03-EP-15-1100 Management & Maintenance of Electrification Contact Systems and other key documents relevant to maintenance be made available?	Response provided for communications - please edit as appropriate: This is not possible as they are a level 2/3 NRCTRL standard.
8	1.6	Is there an authoritative basis for these timescales or are they assumptions based on industry averages?	Industry averages and specified design life.
9	2.1.3	Should section insulators be considered? These have a shorter life than the contact wire.	There is no systematic programmed replacement of Section Insulator's on HS1. Section Insulators are subject to detailed inspection during 5 weekly and annual maintenance passes. Component parts of the SI's such as runner's skids, arcing horns and insulator's are replaced as and when required.
10	2.2.1	There is a co-ordination problem between the pantograph and the contact wire which can lead to de-wirements and inadequate maintenance may be a contributory factor.	There are no specific co-ordination problems that we are aware of, however, dynamic performance of the current collection system and the geometry of the OCS is measured and monitored on a frequent basis to ensure the later is within specified tolerances and there are no issues with the former .
11	2.2.2 (1)	Were electrical ratings and performance affected?	No impact upon electrical rating. The switch operated noticeably slower in service but did not impact operations and did not compromise safety.
12	2.2.2 (2)	Is refurbishment a practical option, since insulation may have been damaged?	All VT's found with 2 part insulators and/or bronze hv termination cap and/or moisture ingress are returned to the manufacturer who assumes full responsibility for the decision whether to refurbish or replace.

Ref	Section	Query	Response
13	2.2.2 (3)	Should lower risk areas also be considered for replacement before possible failure occurs (presumably in lower risk areas failure will take longer to occur)?	There have been no recorded incidents of failure outside of those areas under high radial load and all steady arms have been checked for potential failure during planned preventative maintenance, therefore it is not considered necessary to change any further steady arms on HS1.
14	2.2.2 (3)	Are there any issues with use of poloymeric insulators that need to be understood and managed? For example, will pollution and tracking cause premature deterioration/degradation?	All insulators from Singlewell to St Pancras are of the polymeric type. All insulators within tunnels on HS1 are regularly pressure washed to remove pollution and maintenance requirements for all other polymeric type insulators installed in open route areas are no different to those applied to glass alternatives.
15	2.2.2 (4)	Have any other items liable to vandalism or theft been identified?	Yes, OCS is susceptible to vandalism at pedestrianised over bridges - extended stainless steel capping has been applied to all bridge parapets as a mitigation measure. Cables have been identified as susceptible to theft – a number of mitigation measures are in place such as trembler devices, troughing lid locks and SMART water to deter/detect potential theft.
16	3.1	There is a co-ordination problem between the pantograph and the contact wire which can lead to de-wirements and inadequate maintenance may be a contributory factor. Dewirement could, therefore, occur during service life with likelihood higher than low. Dewirement occurring at speed could bring down a section of the contact wire extending over a distance.	There is no known specific co-ordination problem between pantograph and contact wire. Dynamic performance of the current collection system and the geometry of the OCS is measured and monitored on a frequent basis to ensure the latter is within specified tolerances and there are no issues with the former.
17	3.2	Is some bonding liable to theft?	Yes a small amount has been, but it is usually earthing. BTP and Landsheriff patrol the area, plus regular inspections will maintain safety and operation of the system.
18	4.1, 4.3.2	Maintenance requires access and it may be expedient to carry out maintenance on some assets prematurely because the access is available at that time.	Access for maintenance is planned at least 6 months in advance of the programmed work, should any short term planning issues arise these are dealt with on a case by case basis.
19	Table 12	What is the definition of Severity 1, 2 and 3?	Severity 1 – Service affecting with delay minutes. Severity 2 – service affecting with zero minutes. Severity 3 – Fault reported by third party.

Appendix E Queries and Responses on the Track Asset Policy

Ref	Section	Query	Response
1	1.3	Scope: Given the importance drainage to the track system, how is the interface managed?	This is managed through a geospatial system called gismo where each visit is recorded into this system following an appropriate work order generation from eAMS dependant on an appropriate frequency.
2	1.4.2	OCS: Did the initial design of the longitudinal track profile and the catenary profile leave headroom for track to be lifted during tamping operations? How critical are the relative gradients longitudinally on a high speed line and does this create design and cost issues for future maintenance?	The design level of the Catenary was based upon high speed tolerances between track and contact wire. These values denote the distant between track and contact wire to French TGV tolerances. Prior to tamping operations the contact wire height is adjusted to allow for the design lift to bring the track to its design track position. Settlement is also considered given the tamping lift value and general ballast conditions. Gradients and there management are critical however the asset management plan for Track Geometry and track position uses a robust system interlinking regular cyclical Track Recording and the TAD – Through Alignment Design.
3	1.4.2	The critical interface between the ballast bed and the track formation is not mentioned. As new construction I presume the formation for both ballasted track and slab track was installed to specific 'modulus of deformation' values as part of the track system design?	Yes both were installed to specific design specification.
4	1.6	Asset Lives: Notwithstanding the design asset lives, should there not be a recognition that each section of HSI (south and north of Ebbsfleet) will require respective staggered asset renewals to avoid each section having all of its track assets becoming life expired on the same day?	Yes this will be detailed in the 2013 ASP, however this is not the only driver to asset renewal.
5	2.1.3	Degradation: Can the ballast bed be considered totally independent of the formation?	The ballast bed and formation are considered as part of the track system but are treated as different sub sets of the track and civil system. The two are intrinsically linked and managed as such.
6	2.2.2	Rail management: RCF is present and rail grinding is used to mitigate possible rail damage. Is it realistic to show in para. 1.6 that rail renewal will commence in 2025?	A renewal plan will be given in 2013 ASP and Asset Renewal plan, this is an estimate wrt to present track condition.

Ref	Section	Query	Response
7	3.1	Longer term risks, asset degradation and the need for asset renewal. Is it correct to say that this work has yet to commence?	We have had no renewal of track (indeed renewals are yet to be defined), again to be defined in the 2013 ASP and renewal plan
8	3.2.2	Noting that track access for maintenance is not a problem today, has work commenced to consider the engineering access that will be required when renewals commence? There are parallels in France where major ballast cleaning has commenced on their early TGV routes.	To be defined in the 2013 ASP and renewal plan, however HS1 was designed so that access to the trackbase is much easier than classic issues. We have one small area that will need ballast renewal in CP2.
9	4.3.2	S&C Inspection: Is the opportunity taken to measure detail geometry (say with measuring trolleys) through high speed turnouts, including the crossover with the points reversed?	S&C is measured dynamically using different Track Recording vehicles. The main route is recorded during main line runs with the x-over and deviated routes being recorded during specific S&C runs. These are supplement by trolley measurements. All S&C is measured in both classes of route.
10	4.3.2	S&C Inspection: Have any remote condition measuring devices been fitted to high speed turnouts? (also see table 10, page 26)	All points have the TVM system which provides limited information (actuation time) as a RCM component. HPSS have RCM built in but is yet to be remote, we are working on trials of RCM as we speak. Due to the low number of points failures it is difficult to build a solid business case, hence reliability of points systems need to be a multifaceted approach, including the addition of points rollers.
11	4.3.2	RCF: is the primary means of detection by Ultrasonic Test Train?	RCF is detected both visually and using UTU and Sperry stick testing. We also use the Speno grinding trains which use Eddy Current technologies to measure crack depth in grinding sites both pre and post grinding.
12	4.4	Future Approach: It would be helpful to understand the latest developments. For example, have any decisions been taken on areas of research that will lead to an early understanding of HS1 track system degradation and possible interventions that meet performance and whole life cost considerations?	The Track System is continually monitored to understand Asset Condition that allows system condition to be continually assessed. There are initiatives in place to understand ballast conditions on section 1 and the relationship between accelerations and forces created by vehicles at differing track stiffness locations.

Ref	Section	Query	Response
13	5.3.3	Table 13: Some very broad ranges in this table. What plans are there to be more site, asset and time specific?	We have Asset Management plans that detail this and this information will be entered into the detailed ASP and renewals plans due in 2013. The broad ranges are due to differing asset life, construction types, track tonnages/track classifications and rolling stock types.
14	5.3.3	Top of page 33. Will not some renewals need to be planned before these conditions are met due to large segments of the routes being of the same age.	Yes we expect so but to be confirmed in the 2013 ASP and 40 year renewal plan once a range of new condition monitoring requirements are put in place.
15	6.3.2	ATG: best practice is probably undertaken on Austrian railways where TAD files for every curve are held in a database on board the tamping machine.	OK
16	6.3.4	Geometry measurement: Any measurement through crossovers?	As mentioned in section 4.3.2
17	A8	IBJ's: how are these assets managed? What is their design life? Do you see them as performance critical?	IBJ's by there very natures are critical given there direct link to the signalling system and train performance. IBJ's have there own bespoke routine inspection that is carried out every 2 weeks. The inspection is recorded on a proforma and photos taken of the IBJ conditions. Their design life is linked to the rail asset adjoining them. Given the proactive inspections and maintenance that is carried out on them we feel this to be robust without any faults in the past 2 years related to lipping or failure of the IBJ.
18	A9	Lubricators: This seems a small population, although I would not expect to see them used on the main HS running lines.	No none used on the main line only at St P due to the tight curve.
19	Page 47	Switch Wear: 75 lipped switches seems a high number? Does this require broader action?	The vast majority of these are very minor lipping removed on long high speed switch blade. This is a proactive grind removing minor amounts of metal from the back edge of the blade. This is planned preventative maintenance that is carried out so lipping doesn't build up to a point whereby it reaches an actionable defect that requires reactive works.

Ref	Section	Query	Response
20	Page 49	Major Top Repair Faults: Please give more information on location and how they are found and repaired. Are they a performance or safety risk?	Major tops fault repairs are classified as defects that required corrections over lengths greater than 20m. The defect itself doesn't span 20m but will be the entire area that's lifted and packed when you factor in the ramp in and out within the allowable tolerances for vertical change per mm/m. We have adopted a proactive stance to the repair of TG defects. We intervene at the WV indicator rather than let the defect enter the AV tolerance band. This prevents extended periods of strains and forces degrading the Track System components.
21	C.3	Ballast/Slab transitions: Is there a clue to the problem by analysing the design? Could be useful if a renewal is required.	We do not consider there to be a problem. The ballast slab transitions are stable however we closely monitor them. When a renewal is required we will adopt a 'like for like' policy.
22	C.3	Rail wear at St Pancras: sounds like a good solution.	OK
23	C.3	Ballast Quality Section 1: If this ballast renewal can only be done on Christmas day, what will you do when even more ballast needs to be cleaned? (see 8 - TGV)	We have specifically requested blockades available from CP2 onwards if we need them
24	D.1.1	see 4.3.2 - do you inspect the crossover under traffic?	As detailed in D.1.3
25	D.1.3	"Track undergoing renewal is expected to return to the green area" Why when renewed should it not be better than the green area? (meet your construction standard rather than your maintenance standard)	These are the same tolerance bands and contained within the Module E of the track standards. The TV tolerances are tighter than NRIL TRK2102 tolerances.
26	D.2.1	Lubrication: see 18 above.	No none used on the main line only at St P due to the tight curve.
27	D.2.2	When crossovers are tamped is this the whole unit or just one half?	Whole unit is tamped using absolute base design tamping.
28	F.1	Is there a project plan for this further work?	Yes to be detailed in the road map - awaiting delivery

Appendix F Queries and Responses on the Structures Asset Policy

Ref	Section	Query	Response
1	Glossary	Explanations of abbreviations, IAMS (page 5), TSI (page 14), TCMI (page 19), TPS (page 19) and DB (page 23) are required.	OK will be included in 2013 ASP.
2	General	The essence of the ASP is that all the structures are new, have long design lives, and are low risk particularly in the short term. It would be helpful to include a statement early in the document confirming that all the structures are "new". (If this is not the case, then a justification for treating "old" and "new" structures the same is required)	OK will be included in 2013 ASP.
3	1.3	The point that assets not currently in scope may have higher criticality in the short term is valid	N/A
4	1.5	The applicable standards are not NR standards. Presumably this reflects the different structure types, ages, line speed, clearances etc.	N/A
5	1.6	This ASP considers a comparatively short time frame (to 2031). Presumably WLC will be addressed by the 2013 ASPs?	N/A
6	2.1	The term Corrective Work Order (CWO) implies reactive maintenance yet in Appendix B see tables 16 and 17, and Asset Criticality Analysis v2.0 it appears to include structures and tunnel inspections. Does the term also include reactive and planned maintenance in Table 4? Additional maintenance and Minor Repairs referred to in section 4.3.2, would these be included in CWO? Some clarification of these terms, particularly CWO would assist the reader.	CWO is a fault found during a planned preventative maintenance activity. In the future we are going to use CWO as a leading indicator, and faults only as a lagging indicator to gain greater clarity of the fault cause and effect relationship.
7	2.3	I assume the condition KPIs noted in section 2.1.3 be developed by 2013?	N/A
8	3.1	No mention of masonry arches within table 3. Is the risk of failure considered to be too low?	There is only 1 masonry arch overbridge examined by NR CTRL (owned by HS1) located along the main high speed civils infrastructure route (Galley Hill Road Bridge). The structure is located over an access road leading into a NR CTRL compound. The risk of failure and associated impact is therefore low.

Ref	Section	Query	Response
9	3.2	In the second paragraph is "relative" the intended word rather than "reactive"? Should the reference be to Table 4 (not Table 3)	Not sure what is meant here, is this the correct paragraph?
10	3.2	The reactive maintenance criticality is V High in Table 4 yet it is the planned maintenance criticality in Table 20 which is high. Is this correct and could some explanation be added?.	This is a typo. Table 20 has the correct headings and table 4 should read reactive maintenance 1 – v.low and planned maintenance 5 –v.high for structures and bored tunnels. The criticality rankings reflect the regular cyclical examinations (detailed and visual) which are undertaken to the structures and bored tunnels and defects rectified in a cyclical nature. This approach of steady state maintenance results in very low reactive maintenance.
11	4.1	Move to risk based maintenance (and examination) is justified	N/A
12	4.1	Extraction of asset data is essential and should commence immediately	N/A
13	4.3.2	Typical NR inspection intervals. Should review based on risk, as NR are currently doing.	N/A
14	4.3.3	Reference missing in second line of final paragraph.	OK will be included in 2013 ASP.
15	4.5	In Table 10, should description of future requirements include SCMI for bridges as well as TCMI for tunnels?	This is covered in table 14 (bored tunnel section), a typo is present and should read TCMI and SCMI
16	5.5	In Table 14 SCMI scores should be changed to TCMI scores	Looks like a typo, to be updated.
17	B.5.1	Clarification of roles of Infrastructure Maintenance Contractor and Minor works Contractor would be beneficial	The IMC is the inspection team TPS and the minor works contractor are the teams used for reactive repair works, the contractor depends on the nature of the works.
18	D.1	The requirement to record the severity and extent of defects and the severity and extent of change in condition implies that defects will be quantified, i.e. objective not subjective.	N/A

Appendix G Queries and Responses on the Ventilation Equipment Asset Policy

Ref	Section	Query	Response
1	General	Can an explanation of how the competence of maintainers is managed, and how sufficient resources are provided to deliver planned and unplanned maintenance effectively?	Through NR(CTRL) competence system and an assessment of the competencies required by each department."
2	General	The scanned front sheet of the pdf file provided for review does not include the preparation, approval and authorisation signatures. Can evidence of this please be provided, or otherwise provide confirmation that this is the correct formally issued version of the document?	Email sent as requested as evidence.
3	1.3	We would be grateful to understand why an ASP for Ventilation Equipment was developed if none of the M&E assets was identified s 'critical'.	HS1 identified these assets as mission critical over and above the criticality analysis outcomes due to the systems ability to stop trains if the minimum operation requirements are exceeded.
4	1.5	Table 2 lists the key maintenance standard and other documents relevant to E&P assets. Visibility of these is requested to understand the scope and nature of the documents.	"Response provided for communications - please edit as appropriate: This is not possible as they are a level 2/3 NRCTRL standard."
5	4.1	This section describes a daily testing regime for 'critical' assets, but it is not explained what 'critical' means. Can it be please be confirmed that all ventilation components (including any 'standby' components provided for redundancy purposes) are included in routine testing?	The critical assets subject to daily test are those specified within the O&M Manual as Pressure Relief Dampers, Train position Sensors and Cross-Passage Doors. Many other VCS component parts and sub-assemblies are tested either remotely or locally at pre-defined frequencies but not on a daily basis.
6	4.4	In addition to the future approach balancing the asset interventions with degradation modes, it is presumed that there are safety case requirements regarding ventilation system availability and performance in the event of incidents. Will the future approach also seek to revise the safety case requirements (if appropriate) or work within the constraints currently imposed?	There are currently no plans to revise either the safety case and/or any constraints currently imposed.

Ref	Section	Query	Response
7	A.2	This section states that "… non-availability of one of the axial fans at a particular location should not prevent the tunnel ventilation system from being able to achieve smoke control and non-incident tunnel pressurisation". Can it be confirmed that the "should not" should read "does not"? If it is not the case that effectiveness of redundancy has been proven, then it would seem that the criticality of individual fans would be significantly increased.	If all other equipment is available non-availability of a single axial fan at a particular location will not prevent the tunnel ventilation system from being able to achieve smoke control and non-incident tunnel pressurisation.
8	A.3	Similar to query 5 above, the final sentence in this section states "… should not prevent …" Can similar assurance of the effectiveness of redundancy please be provided?	If all other equipment is available non availability of one of the fans at a particular location will not prevent the tunnel ventilation system being able to achieve smoke control and non incident tunnel pressurisation (safe haven).
9	A.4	This section states the Minimum Operating Requirements in terms of minimum plant to be available for each tunnel. Where do these requirements come from?	They were written and provided by the designers of the system Parsons Brinkerhoff.
10	B.2	Table 22 indicates that 8 ventilation equipment faults occurred (presumably) in 2010/11. There is a marked contrast between this number and the 61 "Mechanical & Electrical - Ventilation" faults in 2009 shown in the Initial Asset Management Statement C-10-CO-51-2001 Issue 1.0. Can an explanation please be provided? If the "Mechanical & Electrical - Ventilation" totals are for a broader extent of equipment then can an indication of the historic fault levels for ventilation please be provided since this provides an reflection on the maintenance arrangements?	The 61 ventilation faults encompasses general building ventilation whereas the 8 in table 22 does not. There has been a general declining trend in historical fault levels for those assets associated specifically with the VCS since section 2 hand-over in June 2007 reflecting an effective maintenance regime and the gradual elimination of construction defects present at hand-over.
11	C.1.2	Similar to the equivalent query against the communication ASP, the relevance of the RSSB risk model for the 'classic network' is queried given HS1's dependence upon tunnel infrastructure and associated safety issues. If the system has been designed to SIL2 then it suggests that the safety risk associated with failure would be greater than "1 - V.LOW".	As stated in C1.2 this is our current view but it will be developed and reviewed in the context of overall system safety by the 2013 ASPs.

Ref	Section	Query	Response
12	3.1	Editorial: the penultimate sentence in bullet 4 refers to 'signalling system' - this should read 'ventilation system'.	OK - typo

Appendix H Queries and Responses on the Lineside Buildings and Depots Asset Policy

Ref	Section	Query	Response
1	General	It would be helpful to have a section in the Introduction to the document that summarises the Policies to apply for Buildings and Depots. (For example; 1. "assets will be maintained such that they do not adversely affect railway operations - another part of the document can define in more detail what this means in relation to safety, operational performance and so on; 2. to have an asset register that has data for 100% of the assets and no data in the register to be older than 12 months; 3. asset condition will be monitored and recorded to ensure any defects are known and addressed to ensure compliance with the operational and safety policy objectives;4. the assets will be maintained in such a way as to provide minimum whole life cost"). Section 3.1 of the Policy is a good starting point but includes ambiguous wording such as "regular basis" and generally completed".	OK to be included in the 2013 ASP
2	Page 2, Review	This states the Policy will be reviewed every three years. Would it be better to review every five years to correspond with the Control Period Reviews?	Review period is in accordance with other ASP.
3	Glossary	Explanations of abbreviations, IAMS (Table 1, page 5), UKPNS (page 6), eAMS (page 9), CCMS (page 11) and DB (page 12) are required. It would be helpful also to explain "Project Wise" on page 11.	OK to be included in the 2013 ASP
4	1.1	The purpose of the document is to define the NR(CTRL) policies for maintenance, renewal and upgrade of Buildings and Depots assets. Perhaps this should be added to the section ahead of "The purpose of the ASP's ……"	OK to be included in the 2013 ASP
5	1.2	It would be more logical for Section 1.2 to be Section 1.1. The present Sections 1.1 and 1.3 could then be combined to make the document easier to read and comprehend.	OK to be included in the 2013 ASP

Ref	Section	Query	Response
6	1.3	This implies the Policy only covers the "main types of lineside buildings on the HS1 Route". Are there other lesser buildings in the asset inventory? If so what is the policy for them?	The policy covers the lineside building on HS1. It does not cover very small ancillary items e.g. loc cases etc. These are covered by maintenance teams as part of their normal preventative maintenance procedures.
7	1.3	It is noted that "stations and operational property are not considered as part of the Lineside Buildings Policy ……". So which policy applies to these assets?	Stations and Operational property are outside the scope of the ORR.
8	1.3	Does the scope of the policy include M&E assets included in the Lineside Buildings and Depots (heating, lighting, lifts and other services) or does it only apply to building infrastructure (building structure, fabric and finishes)?	M+E assets are excluded and will be included in a separate policy document for M&E in the 2013 ASP.
9	1.3	What Depot assets are covered by the policy? Depots can comprise major structures. They can include large plant such as overhead cranes, wheel lathes, carriage washing machines, toilet emptying facilities and so on. These can be high cost, operationally critical items. Which policy applies to those assets?	The only Depot assets covered by this ASP is Singlewell Infrastructure Maintenance Depot. Comment refers to a TOC depot facilities, none of these facilities are located at SIMD.
10	1.4.1	This makes no reference to Depots. See comment 9 above.	See comment above
11	1.4.2	Why not combine paragraphs 1.4.2 and 3.3.4 and make the document easier to follow?	OK to be included in the 2013 ASP
12	1.5	Why not combine paragraphs 1.5 and 3.3.3 and make the document easier to follow?	OK to be included in the 2013 ASP
13	1.5	Why are the Control Period numbers different from the remainder of the UK Network? Would it be less confusing to use the same terminology for HS1 and the remainder of the nation?	These are the control periods which apply to HS1 as per the Concession Agreement with the DfT.

Ref	Section	Query	Response
14	1.5	It is considered the Figure 1 timescales are too general. The HS1 assets are relatively new, which provides a unique opportunity to put in place processes for predictive maintenance and renewal and to gather factual data about degradation of asset components. It is recommended that a detailed modelling of the Buildings assets be developed using predicted degradation rates and maintenance interventions in similar manner to Network Rail's policy for buildings and depots asset management.	HS1 consider these timescales are acceptable and reflect the condition and complexity of these structures for the 40 year timescale of this ASP. As we know where every building is and their construction, we do not have the complexity to deal with as per NRIL, hence we do not believe at this time detailed modelling of buildings is required.
15	3.1	This would be better located at the beginning of the document. See comment 1 above.	OK to be included in the 2013 ASP
16	3.1	The objective of having a linear budget spend year on year is understandable but this should be balanced against delivering lowest whole life costs. These are assets that have components with long lives (at least 60years = design life). It is acknowledged that the whole life approach can result in peaks of spend when similar assets reach the end of their design life but in practice this can be smoothed. It is likely that linear budgeting will result in premature repairs and renewals (= inefficient costs).	HS1 consider a linear budget is acceptable for this point in its design life. This will be reviewed during the development of the 2013 ASP.
17	3.2	Why not combine paragraphs 3.2 and 3.5 and make the document easier to follow?	OK to be included in the 2013 ASP
18	3.2	It is of concern that "the sizes and components present for each asset is not accessible for all assets. A better understanding of the asset portfolio is required". Comprehensive and reliable asset information is the foundation on which asset management is built. A challenging target date (such as 1 year) should be set to for NR(CTRL) to have 100% asset information.	HS1 do not consider this is required. The lineside buildings on HS1 are relatively straightforward structures and therefore the cost of accelerating asset information is not deemed cost effective versus gaining this information through examination cycles.
19	3.2	What is the policy regarding inspection of inaccessible components. It is these that invariably lead to unforeseen failures.	Inaccessible components is not covered within the asset policy. This is covered by the examination standards. HS1 do not consider this is a requirement to be stated in the asset Policy.

Ref	Section	Query	Response
20	3.3.1	How is the process of "examining and maintaining in accordance with the designer's requirements" managed, recorded and monitored to ensure the examinations and maintenance activities take place when they should and that they are to the required standards.	This is covered by engineering standards as referenced in section 1.5
21	3.3.2	Where are the inspection and examination procedures documented? What are the procedures for ensuring they are done at the required frequency and that they are done competently? Asset condition data from inspections and examinations is crucial for effective asset management.	This is covered by engineering standards as referenced in section 1.5
22	3.3.2	What guidelines are there for determining whether additional examinations are required?	This is covered by engineering standards as referenced in section 1.5
23	3.3.2	What guidelines are there for establishing consistency in assessing risk qualitatively?	This will be covered in the future work undertaken HS1 on the 2013 ASP production
24	3.3.3	See comment 14 above. It is considered Table 4 also is not sufficiently comprehensive. It has no reference to walls, type of roof covering and the effect of this on asset component life, depot structure, etc, etc. It is of concern that there is so little relating to depots in the policy as these are generally much more complex than lineside buildings.	HS1 consider these timescales are acceptable and reflect the complexity of these structures for the 40 timescale of this ASP. This will be reviewed in the 2013 ASP.
25	3.3.3	Although "it is not seen as an immediate priority " to develop longer term plans for buildings assets, a target date should be set for having these prepared.	This will be reviewed with the development of the 2013 ASP.
26	3.3.3	Whole life plans should be developed for longer than 40 years. Modelling should cover at least the design life and ideally 100 years as for some components it may be found that maintenance interventions prolong asset component lives more cost efficiently than renewal at theoretical design life.	HS1 Concession is for 40 years and the modelling covers this period only.

Ref	Section	Query	Response
27	3.3.4	Why is proximity to the live railway or overhead electrification equipment not shown as a key interface. This will be the case at some locations in depots such that maintenance will require possession of the line and isolation of the overhead system.	This interfaces are considered minimal for the majority of the HS1 lineside buildings, however wording will be included in 2013 ASP.
28	3.3.4	How are the key interfaces managed such that they optimise operational efficiency and ensure safety?	Building Interfaces are managed through individual ASP's/engineering standards for other systems.
29	3.4	What are the KPIs for buildings and depots; how are they measured; are they meaningful and do they drive correct behaviours for the maintenance of the assets?	KPIs will be developed if condition based monitoring is appropriate during the 2013 ASP review.
30	3.5 Table 7	What method will be used to establish the Condition Marking Index score for buildings and depot infrastructure?	This will be developed if condition based monitoring is appropriate during the 2013 ASP review.
31	General	A key requirement for the Policy should be that the effects of changes in Policy can be measurable. That is, if policy is changed, how does this change the amount or nature of work that is needed to husband the asset portfolio. There should be a "line of sight" from Policy through to delivery. This line of sight is not clear from the present Policy draft. It is acknowledged this should become clearer as the Policy moves towards evaluating the costs to be included in the next Control Period.	Comment noted and will be reviewed in the 2013 ASP.

Appendix I Photographs of Typical HS1 Buildings Assets

Headhouse

Signalling Rooms 10 and 13

C&C Room

Singlewell IMD

Appendix J Commentary on the Escrow Account and Track Renewal Costs

J.1 Introduction

HS1 make provision for asset renewals through contributions from operational revenue being placed into a dedicated Escrow account. One of the ORR's objectives for this review has been to understand whether the current rate at which contributions to the Escrow account are appropriate.

During a meeting with the ORR and HS1 on 18 July , it was agreed to consider track (i.e. covering plain line rail and ballast) renewal as a likely dominant element in through-life renewal costs, with a view to establishing an 'order of magnitude' engineering estimate to compare with HS1's initial assumptions.

This appendix summarises this estimate and provides a comparison with the HS1 assumptions underpinning the current rate of contributions to the Escrow account.

J.2 HS1 Track Renewal Cost Assumptions

HS1 has provided information relating to the Escrow account and renewals data as follows:

- Statement 5 within the AMAS OMRC Collection & Application Budget for year ending 31st March 2013 [24] presents contributions to and drawdowns from the Escrow account. Rows 21 to 25, Columns BQ through EP present the nominal renewals costs from the original annuity calculations over a 76 year period, split into categories of 'civils', 'electro-mechanical', and 'other'.
- A spreadsheet has been provided by HS1 [25] presenting the latest track capital expenditure forecasts, as included within the HS1 business model at November 2010. Row 2 of the worksheet shows the profile of expenditure on ballast/rail/sleepers, with the profile being a flat (undiscounted) £3,575K commencing in 2016/17 through to 2040/41.
- Further information was provided [23] detailing 2010/11 tonnage data of 2602 million tonne km, 62km of plain line track and 47km of slab track (bidirectional).

Within the Track Asset Policy [18], Section 5.3.3 presents HS1's assumptions for track renewals based upon a lifetime EGMTPA of 600MT.

J.3 Estimated Track Renewal Costs

Table 1 below presents a spreadsheet showing following conservatively-based estimates over the period 2013-14 to 2032-33:

1. Volume (in km) of rail and ballast renewals
2. Cost of rail and ballast renewals at best-estimate unit rates
3. Cost of rail and ballast renewals at lower rates (comparable to Network Rail rates)
4. Cost of rail and ballast renewals as assumed by HS1, to allow comparison with (2) and (3) above.

The estimate is necessarily based upon a number of key assumptions, as summarised below:

1. HS1 assume a maximum lifetime EGMTPA of 600MT or 25 years for UIC60 rail. This is broadly consistent with the 2010-11 tonnage data provided by HS1, and has been used to establish the points at which all rail would need to be replaced (i.e. it is assumed that projected asset lives cannot be exceeded).

2. Annual EGMTPA is assumed not to exceed 24 EGMTPA average for first 25 years of operation. (It is presumed that any tonnage growth would be reflected in revenue contributions to the Escrow account and would compensate for accelerating the renewals programme).
3. Phase 1 opened in 2003 and Phase 2 opened in 2007, giving the assumed dates for completion of rail and ballast renewal of 2028 and 2032 respectively.
4. The assumed profile of renewal volumes is based upon the above, the relevant track distances (50 route km of ballasted track in Phase 1, 12 route km of ballasted track in Phase 2, 47 km of slab track) and an assumption that some rail and ballast life as low as 16 and 12 years respectively.
5. Rerailing capital costs are assumed to be £220K per km of track. This is based upon a Network Rail 2011/12 rate of £164K per km, and adjusted upwards by 30% to allow for HS1 engaging their suppliers for short periods each year.
6. Ballast cleaning includes washing new ballast and replacing pads and fastenings, with an assumed unit cost £350K per km. This is based upon a Network Rail 2011/12 rate of £260K per km, adjusted as above.
7. The premature degradation of ballast quality has been allowed for, with ballast cleaning commencing on Phase 1 in 2014/15.

J.4 Commentary

In summary, the conservative estimate total for plain line rail and ballast renewals from 2014/15 to 2032/33 is £91M, which is circa 50% higher than the HS1 assumption of £61M for the same period. From the data provided by HS1 [24, 25], the rail and ballast renewal costs are a significant proportion (over 50%) of the total HS1 renewal costs.

One of the key assumptions relates to unit rates for rerailing and ballast cleaning; unlike Network Rail, HS1 does not operate it's own plant and equipment and the assumed unit rates have been adjusted upwards to reflect this.

The assumptions behind the 50% shortfall figure have been subsequently discussed with HS1. On a more optimistic basis, primarily associated with renewal volumes per annum and associated unit costs, the shortfall in contributions to the Escrow account is estimated at 25%. The expected shortfall in Escrow account contributions was agreed to fall in the range 25% to 50%.

As noted above, this is not a financial review, but a relatively simplistic engineering based one. It does not take into account discount rates, nor any profile of how contributions into the Escrow account may be planned in relation to revenue.

Table 1 Rail and Ballast Renewal Volumes and Costs

Volumes (km)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	Totals
Rail Renewal Phase 1							7	7	14	14	14	14	14	14	14	14	14				140
Rail Renewal Phase 2											8	8	8	8	8	8	8	8	8	8	80
Ballast Renewal Phase 1		2	2	2	2	2	2	2	2	2	2	5	15	20	20	20					100
Ballast Renewal Phase 2															2	2	2	2	8	8	24

Capital Outlay (£K)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	Totals
Rail Renewal Phase 1							1,540	1,540	3,080	3,080	3,080	3,080	3,080	3,080	3,080	3,080	3,080				30,800
Rail Renewal Phase 2											1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	17,600
Ballast Phase 1		700	700	700	700	700	700	700	700	700	700	1,750	5,250	7,000	7,000	7,000					48,400
Ballast Phase 2															700	700	700	700	2,800	2,800	8,400
Totals per annum £K		700	700	700	700	700	2,240	2,240	3,780	3,780	5,540	6,590	10,090	11,840	12,540	12,540	5,540	2,460	4,560	4,560	**91,800**

Capital Outlay (lower unit rates) (£K)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	Totals
Rail phase 1							1,148	1,148	2,296	2,296	2,296	2,296	2,296	2,296	2,296	2,296	2,296				22,960
Rail phase 2											1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	13,120
Ballast phase 1		520	520	520	520	520	520	520	520	520	520	1,300	3,900	5,200	5,200	5,200					36,080
Ballast phase 2															520	520	520	520	2,080	2,080	6,240
Totals per annum £K		520	520	520	520	520	1,668	1,668	2,816	2,816	4,128	4,908	7,508	8,808	9,328	9,328	4,128	1,832	3,392	3,392	68,320

HS1 Assumed Capital Costs	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	Totals
Totals per annum £K				3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	3,575	60,775

Lloyd s Register Rail

T +44 (0)20 7709 9166
F +44 (0)20 7600 1441

71 Fenchurch Street,
London EC3M 4BS

www.lr.org

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