Office of Rail Regulation and Network Rail

Part 'A' Reporter Mandate AO/028 - Audit of Asset Data Quality

Executive Summary

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List of Abbreviations

ADCGAM	Asset Data Confidence Grading Measure
ADQIP	Asset Data Quality Improvement Programme
CeCOST	Civil Engineering Cost Model
CEFA	Civil Engineering Framework Agreement
DU	Delivery Unit
eB	Electronic Browser – *an electronic database of records*
ELR	Engineer's Line Reference
EP	Electrical Power
HV	High Voltage
IIP	Initial Industry Plan
LC1.20	Licence Condition 1.20
LED	Light Emitting Diode
LNW	London North Western Route
LX	Level Crossing
LXEU	Level Crossing Equivalent Unit
MDU	Maintenance Delivery Unit
NCAP	National Core Audit Programme
NR	Network Rail
OLE	Overhead Line Equipment
OPAS	Operational Property Asset System
ORR	Office of Rail Regulation
PR13	Periodic Review 2013
RAM	Route Asset Manager
S&C	Switches and Crossing
SBP	Strategic Business Plan
SEU	Signalling Equivalent Unit
SMT	Southern Measurement Train
SSADS	Signalling Schemes Asset Data Store

Executive Summary

Purpose

Arup as the Office of Rail Regulation's (ORR) Part 'A' Independent Reporter was commissioned to undertake an audit of Network Rail's asset data quality. The study was initiated in order for the ORR to be satisfied that the asset databases used by Network Rail in the development of their Strategic Business Plan (SBP) and for day-to-day operations are robust. The scope of work comprised a review of Network Rail's asset inventory and condition data in order to test its:

- Currency;
- Completeness; and
- Accuracy.

This Executive Summary presents our approach to the audit, and our findings, conclusions and recommendations. It concludes by making some recommendations for further work.

Study Approach

Network Rail's asset inventory and condition data are collected and used for a range of purposes. Asset data is used in day-to-day operational management of the network and for strategic business planning. Some asset data is used for both purposes, other data falls outside of these definitions.

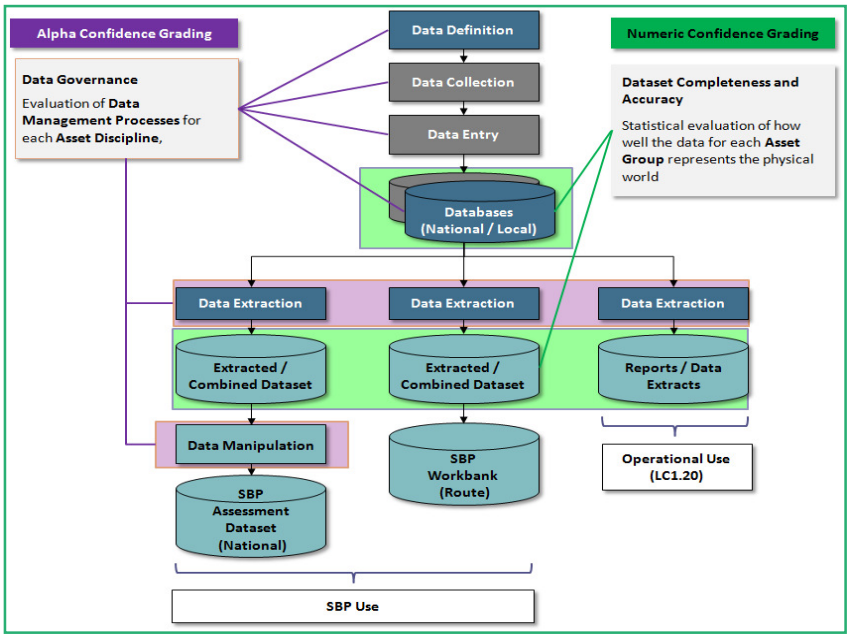
The audit comprised two workstreams to review both the data management process and measure the data quality achieved by this process.

- Governance Grading: The first study workstream was an audit of the processes and governance of data capture, collation, management and data transformation to ensure that the context of the measured completeness and accuracy was fully understood. It provided demonstration and additional confidence that the current data quality was supported by a process that provided for that quality in the long term, or conversely advised that the measured data quality was not reflective of the underlying processes. The review therefore provided information on the current level of quality, potential causes of quality issues, and advice on maintenance and future data quality based on the business-as-usual processes and data management regime.
- Verification Grading: The second workstream looked at the asset data itself. The asset data (from September / October that was included in the assessment was reviewed looking at the levels of tolerance that are appropriate regarding completeness, and the accuracy of the data that was defined by the organisational processes as defined in the study requirements. Measurement of data completeness and accuracy inevitably requires some cross-check between the collected data and reality. As such a review was undertaken of the physical assets in-situ and a comparison of the data with independent records of assets against their recorded attributes / characteristics in the Network Rail data.

Overall these two workstreams provided both a measurement of the robustness of the underlying systems and current data quality to provide sustainable data for the organisation and its decision makers.

Figure 1 provides a schematic presentation of the dataflow from data capture to its use in business decision making. It indicates how the two workstreams of the review align to the process.

Figure 1: Asset Data Flow and Audit Aspects



The audit was undertaken using the Network Rail Asset Data Confidence Grading Assessment Methodology (ADCGAM). This generic toolkit was reviewed at the start of the study to assess its appropriateness for this review. From this it was concluded that it provided a suitable mechanism for assessing both asset data completeness and accuracy, and reviewing the governance of the data management processes as components of the review. However, some adaptation of the methodology was required to suit the nature of this particular assessment.

In order to focus the review, a selection of the most critical assets was considered based on:

- Forecast levels of expenditure (as indicated by the pre-efficient Initial Industry Plan (IIP) figures);
- The asset policies prepared by Network Rail; and
- The Reporter team's experience as railway engineers and asset management experts.

This led to the identification and agreement of the inclusion in the review of the asset disciplines and groups shown in Table 1.

Table 1: Agreed Asset Groups Included in the Audit

Asset Discipline	Group / Sub Group
Track	Plain Line
	Switch and Crossing Units
Signalling	Interlockings
	Signals (coloured light, LED, semaphore etc.)
	Train Detection Equipment
	Point Operating Equipment
Structures	Underbridges
	Overbridges
Buildings	Franchised and Managed Stations
Electrical Power	High Voltage (HV) Switchgear
	Transformers
	Overhead Line Equipment (OLE) Cable Runs
	Conductor Rail
	HV Cables for Direct Current Transmission

Following agreement on the asset groups to be included in the study, the commission then split into the two workstreams. In both cases the overall methodology relied on a period of data gathering; be it issuing a series of questionnaires and holding direct interviews for the review of governance, or obtaining downloads from the core assets datasets from Network Rail and accessing comparative data as part of data verification.

Governance Evaluation

The governance workstream evaluated how Network Rail collects, stores, maintains, reports, and where required transforms asset data in connection with strategic planning and operational use. The audit focussed on those processes relating to the management of asset inventory and condition data, and the primary databases used to hold this information. The databases considered were generally managed centrally to corporate guidelines, but some examples were seen of asset information being maintained locally by Route Asset Management (RAM) teams and Delivery Units (DUs).

The evaluation was based on interviews with National and RAM teams, self-assessment questionnaires, and a review of documentary evidence. This provided an assessment, for each asset discipline, to align with the way the assets are managed at Route level and how the SBP submissions were developed.

The evaluation focused on the way data was managed up to the point that it was used for operational or strategic planning purposes. During this process it was necessary to know how the data was obtained and what it was used for; however, the assessment scope excluded; for example, the inspection process and the way in which data was manipulated within the whole life cost models.

A core set of twenty-five questions from the ADCGAM was used as the basis for a series of interviews held with asset management teams at National, Route and Delivery Unit level. A different question set was used at each level as appropriate. Each question response was assigned a score from 'A' to 'D', or 'N/A' if not applicable. The basis for this scoring was compatible with the ADCGAM guidance and is shown in Figure 2.

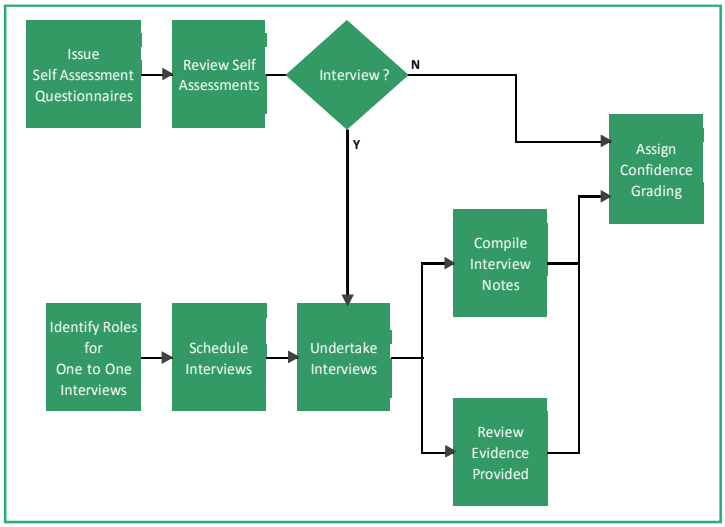
Figure 2: Governance Confidence Gradings

Confidence Gradings			
A	B	C	D
Documented processes in line with good practice supported by evidence	Partially documented processes and/or limited evidence in line with good practice	Evidence of processes some of which are aligned with good practice	No evidence of coherent processes

The approach to the governance assessment was agreed with both ORR and Network Rail. This saw a series of meetings with National asset management team representatives followed by meetings with staff in the RAM teams and DUs responsible for collecting asset data. These included a meeting with Amey who carry out the collection of asset inventory and condition data relating to structures and operational property under a contract to Network Rail. These interviews were supplemented by meetings with Network Rail's Asset Information team and database specialists to ensure the review covered all appropriate aspects of the core data systems. In order to make the process more efficient self-assessment questionnaires were issued to the interviewees in advance of the meetings. These were reviewed during the meeting and back-up evidence provided as necessary to inform the assessment. Such evidence included documentary proof of the processes used by Network Rail as part of its asset management processes.

The overall process is shown in Figure 3.

Figure 3: Governance Assessment Work Flow



The assessment forms were loaded into a scoring tool that extracted the grades so that aggregate scores could be calculated for each topic from the scores assigned

to each question. Confidence gradings were then established for operational and SBP use of data for each asset discipline for the Route and DU self-assessments.

Governance Findings

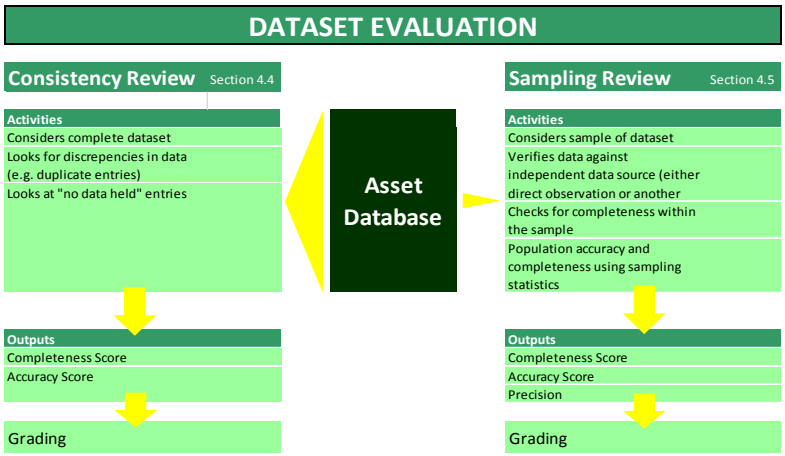
The following are the principle findings of the governance review:

- Data governance gradings were generally good. Individual 'C's and 'D's reflected the quality of self-assessments, information provided at interview, and submitted evidence.
- The review covered the data management processes which are currently in place. Those processes have been recently implemented but may not yet have had an impact on the data currently in the databases reviewed.
- The Reporter team were unable to comment in any great detail on the implementation of data collection procedures used by Amey as one meeting took place with them during the course of the review.
- It was shown that the top-down and bottom-up strategic plan forecasts were based on the same primary inventory and condition data. It was noted that the degree of pre-processing of the asset data for use in the top-down plans was significant to make it compatible with the Tier 1 models requirements.
- The data capture and entry processes which were reviewed were generally robust for the centrally managed systems. The processes set up for locally managed data tended to be less formal in that they were less well documented and regulated.
- Certain of the RAM teams needed access to a range of databases, managed both centrally and locally. Not all of these were currently integrated which hinders consistency and efficiency.
- The DU teams were able to demonstrate good levels of local data management through the Systems Support Manager role combined with the use of Ellipse as the primary asset management system.
- The RAM team involvement in reviewing data quality was variable. There did not appear to be a consistent approach to the verification of the various databases in use however there appeared to be more emphasis on 'owning' the data at MDU level.
- National Core Audit Programme (NCAP) audits were shown to be valuable tools in quality management for the non-CEFA disciplines. However, it was understood that similar processes exist for buildings and structures but this was not directly evidenced.

Dataset Evaluation

The work undertaken to evaluate the current asset datasets was split into two elements as shown in Figure 4. To progress a review of the asset datasets, the attributes of relevance to the strategic planning and operational processes within Network Rail were agreed by the ORR and Network Rail. For the Mandate's Draft 'A' Report, a set of weightings of the attributes were also agreed and these used to determine the completeness and accuracy scores using the ADCGAM methodology. Subsequently, and following discussions between the parties, it was agreed that these weightings should be removed in subsequent analysis. The results presented in this report reflect this change.

Figure 4: Dataset Evaluation Review Elements



The **Consistency Review** comprised an initial analysis of the complete dataset to check for data inconsistencies such as duplicate asset records, missing data values, or data values that were undefined or contradictory. This analysis did not form the assessment of completeness and accuracy; however, it provided an early insight into the underlying quality of the master asset data records. This assessment was used to assess the required sampling and precision of the resultant exercise. For each asset type dataset, the assessment counted the number of instances of duplicate records and where the records exhibited no data in what was considered a mandatory field; or where there was a direct indication that no data were held either though coding or a flag in the database. This was then used to determine an indicative numeric grading for each asset type and Route following the ADCGAM scoring protocols. It should be noted that no precision evaluation was required as the analysis carried out did not involve sampling the dataset.

Figure 5 shows the numeric grading appropriate to the dataset evaluation workstream.

Figure 5: Numerical Gradings Awarded to Each Asset Dataset

Dataset Evaluation	1	2	3	4	5	6
Accuracy	>=99%	>=95%	>=90%	>=75%	>=50%	<50%
Completeness	>=99%	>=95%	>=90%	>=75%	>=50%	<50%
Precision	<=1%	<=4%	<=10%	<=20%	<=40%	>40%

In contrast, the **Data Verification Review** comprised a review of the asset data against the physical assets to provide an assessment of asset data completeness and accuracy. To achieve this, a sampling process was agreed and used, whereby a sample of each discipline's assets was selected and the master database records reviewed against an independent data source, or through direct observation on site. In a separate exercise a further sample was reviewed to determine the completeness of the dataset by means of checking that records exist for given assets.

It was agreed that a sample would be drawn from the National datasets to provide an overall view of the asset datasets as described by the Mandate. In addition, sample sets from two Routes would also be reviewed to determine Route level data confidence. London North Western (LNW) and Wessex were selected for these Route-level reviews.

Based on the foregoing numeric grades were determined for each of the assets and attributes. These were determined separately for strategic planning and operational use. This was because each of these was verified against a different set of attributes.

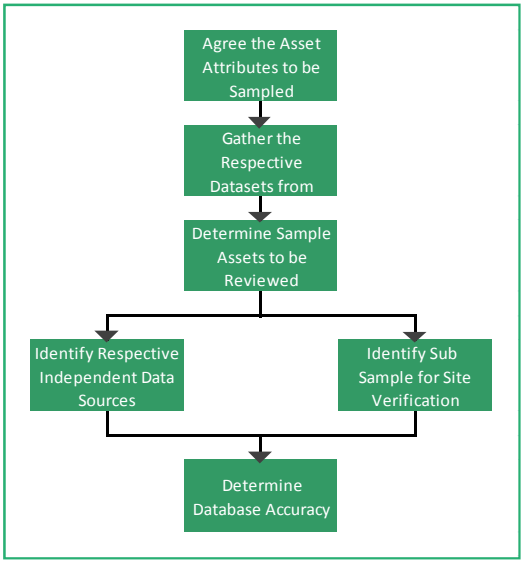
Consistency Findings

The consistency assessment has shown that the quality of the data associated with the production of the SBP is of good quality. This is not surprising since the Network Rail supplied data was enhanced for this purpose to fill any missing information relevant to PR13 planning. In some cases the datasets supplied for the operational evaluation may have also been enhanced and this was also reflected in the consistency evaluation.

Sampling

Figure 6 provides an overview of the overall approach used to undertake the verification of the asset data quality based on sampling.

Figure 6: Dataset Verification Approach



The selection of sample size to appropriately assess these data quality parameters was determined using proportionality sampling theory. The process is described in the ADCGAM. The sample sizes for each of the National or Route level verification exercises were determined taking into consideration the previous assessment of asset data accuracy and completeness carried out by Network Rail and updated by the consistency review carried out as part of this audit. Sample sizes were determined such that, based on the prior assessment of incidence from the consistency review and, subject to the outcome of the testing, a 95% confidence in the predicted accuracy / completeness would be achieved with 4%

precision. Where this is achieved a dataset evaluation grading of '2' would be awarded for that asset data group use using the ADCGAM scoring protocol. In general terms the review was undertaken based on approximately two hundred samples which is broadly the sample size appropriate for an 'infinite' population with the expected pass / fail incidence. This level of sampling is reflective of the set confidence and precision levels.

Having established the sampling mechanism the respective asset datasets were then acquired from Network Rail and 'locked down' before the individual sample assets were shared. This took place in the last ten days of October 2012.

It was necessary to share these sample datasets with Network Rail in order to allow them to assemble data from comparative and independent datasets if these were available from within their systems, and to arrange site visits in accordance with rail safety procedures. In addition to the desk-based review, and to ensure these independent data sources were valid, ten per cent of the selected samples were visited on site in the two selected Network Routes. The purpose of these visits was to provide validation that the independent data sources were sufficiently current and accurate to reflect the actual asset attributes. The means of reviewing the datasets from independent sources (as opposed to site verification) varied for each discipline as shown in Table 2.

Table 2: Data Evaluation Independent Review Datasets

Discipline	Method of Verification
Track	Omnicom video data was reviewed supported by reference to maintenance and faulting records (Track1202)
Signalling	For signal interlocking reliance was placed on the use of eB (the Network Rail electronic document browser system). For level crossings Google Streetview was used supplemented by level crossing asset condition reports. Lineside signalling equipment were identified on Omnicom.
Buildings	No independent verification source was identified and it was thus agreed during the course of the commission that the review of buildings would be dropped.
Structures (Bridges)	Relevant bridge condition and inspection reports.
Electrical Power	For OLE and conductor rail use was made of Omnicom. For HV switchgear, transformer units and HV cabling no independent verification source was identified.

Sampling Review Commentary

The sampling of the various asset datasets was undertaken against a highly constricted timescale. The requirement for a Draft 'A' Report before the close of 2012 combined with the time taken to gather the base data, confirm effective methodologies, and plan site works all resulted in a compressed gathering and analysis period. This created some challenges regarding the sampling sizes.

The compressed timescale has resulted in a number of cases where the low level of sampling of the datasets has resulted in poor gradings which are driven by the limited sample size rather than the poor quality of the observed data. Rather than provide a range for the accuracy / completeness this has been simplified to a single figure – this is based on the following approach.

Since each completeness or accuracy test on an asset record results in a pass or fail result for that asset/asset attribute, a single figure measurement of completeness or accuracy can therefore be determined for a sample from a dataset by the number of asset records that pass or fail the test. The method for this procedure is set out in the Network Rail ADCGAM. As agreed in the post Draft 'A' tripartite meetings the single value has been used to determine the gradings using the scale presented in the ADCGAM.

As a result of sampling there is an inherent precision in the test outcome which is represented by a statistical confidence in the result. The 95% confidence limits have been determined and are presented as ranges in the result tables for information. They have not been used to determine the gradings as agreed. However, where the grading is potentially affected by the precision of the sampled result the grading has been bracketed to indicate this.

As an example; the completeness testing of the plain line dataset comprised 200 samples of which 195 were located using the method described in the report. This results in a completeness measure of 98% (97.5%) with a 95% confidence of +/- 3%. This is graded as a '2' and the precision of the result is consistent with this grading.

This is the basis of the grading which has been used in this report.

Data Verification Findings

The verification review produced highly variable results across the disciplines particularly in the assessment of the accuracy of the results. The following paragraphs outline the findings for each of the disciplines.

Track

Accuracy

The sampled sections of track were of variable lengths. This presented challenges because the Omnicom track information was not sufficiently accurate to find small mileages accurately. As a result the review focussed on those samples greater than 50m in length which could be identified on Omnicom with a reasonable degree of accuracy. In addition, since Omnicom provides a video recording of the track, only those attributes that are visible on the video could be confirmed.

The Omnicom video data was also used to assess the switch and crossing (S&C) units, but again the accuracy of the mileage tracking, combined with an inconsistency in the track identification, meant that for a significant number of the assets it was not possible to clearly identify which asset the data set was identifying. As with the plain line checks, since Omnicom provided a video recording of the track, only those attributes that are visible on the video could be confirmed. It was therefore not possible to verify a number of the S&C attributes.

Completeness

From the plain line dataset, five of the two hundred samples contained missing data. Seventeen of the two hundred locations had S&C missing. Of those seventeen, three may be explained by recent upgrade works or liability boundaries with an adjacent Heritage Railway and private sidings. These counts featured in

the completeness sample measurement only and were not used in the determination of the accuracy grading.

Signalling

Accuracy

eB, whilst being a centralised resource for the supply of signalling data, proved to be highly unstable and difficult to access. As a result, the number of samples able to be interrogated was limited. Focus was put on extracting Signalling Scheme Plans to verify the key attributes of signalling and level crossing equivalent units, signals, level crossings, point operating equipment and train detector counts. The results gave close matches for Signalling Equivalent Unit (SEU) / LX count but did not give a close match for the track detector and point operating equipment counts.

Level crossing attributes were verified against the Level Crossing Asset Condition Reports supplied as a non-mandatory supplement to the Signal Scheme Asset Data Store (SSADS) assessments. These gave high levels of alignment with regard to type (246 matches to 8 mismatches) and assessment dates (259 matches to 17 mismatches) but very poor alignment with planned renewal date (39 matches to 176 mismatches). The SSADS assessments reported Nominal Remaining Life, Notional Remaining Life, and Component Remaining Life. Nominal Life gave the best match as a means to assess the planned renewal date.

Completeness

Of the two hundred signals sampled, twelve Engineers Line References (ELRs) did not have signals (mostly rural Scottish routes), thirty-five were not available on Omnicom and of the remaining ten could not be located within the Dataset.

Of the two hundred level crossings identified, there were no records for thirty-four of them in the dataset. These counts featured in the completeness sample measurement only and were not used in the determination of the accuracy grading.

The method of completeness measurement of level crossings was affected by inconsistent definitions of these assets. On review of our measurements we consider that it is entirely possible that the completeness measurements have not accounted for assets that are out of scope (for example level crossings which are not signalling assets) and the measure has been thus affected. We have removed these from the assessment so that the results were not potentially misleading.

For six additional sites, signalling equipment entries were found for the site but no specific level crossing equipment; barriers etc. identified.

Buildings

Accuracy

As stated above, it was agreed that as a result of the difficulties in identifying a comparative dataset for station buildings no desktop review would be undertaken. However, the site verification work was carried out, clearly not as a check on the desktop process but as verification in its own right. During the course of the reviews we captured all of the identified elements and characteristics at the sites visited. The vast majority of the sample checks confirmed the accuracy of the Operational Property Asset System (OPAS) records. It was noticeable that there

were a number of instances where the review identified that the asset material was not correct in the database.

Completeness

Of the two hundred randomly selected stations one, Warrington Bank Quay, was not found in the database.

Structures

Accuracy

During the course of the review, materials were generalised to one of five categories; concrete, masonry, metallic, timber and unknown. This simplified the process and was done because the nature of the surveys did not allow sufficient accuracy of the details of the material type (e.g. pre-cast reinforced or pre-stressed concrete). It was however noted that the following attributes were not contained in the Network Rail data supplied:

Table 3: Attributes not included in Structures Dataset

Structure width	Structure (span) length
Year of construction of deck	Year of construction of abutments
Feature crossing or being crossed	Any related structures
Type of examination carried out last	

From the dataset provided, the number of major elements per span was used as the value for the number of decks. Investigations however indicated that this has not been consistently applied. Therefore a relatively low matching score was achieved for this attribute.

Approximately two per cent of structures had no inspection reports supplied. For at least three of these a Google Streetview (dated 2012) showed that the structure was extant. The following provides some more detail of the findings:

- One of the underbridges reviewed was not a constructed bridge as such but rather consisted of a naturally eroded flow path for a watercourse through the rock over which the railway ran.
- At least one structure was misidentified as an overbridge when it was an underbridge.
- One overbridge in the sample data identified strengthening works as a second major element within the span. However strengthening elements work in conjunction with the original deck and thus they should not have been noted as separate items.
- A group of three service overbridges, which were located within one chain of each other, were identified as a single structure with three spans when they were actually structurally independent and had either three and four spans each.

Completeness

Sixty-one of the nearly two hundred overbridges randomly selected could not be found within the overbridge dataset provided. Some of these structures may be the responsibility of another agency and therefore correctly not included in the

Network Rail database. One bridge was at the interface of a Network Rail and Heritage Railway line and hence its liability may also be held by others. Of the remaining fifty-four overbridges: eight were motorways; sixteen were fairly major 'A' roads; and the rest were a mixture of minor roads, footbridges, pipe-bridges and others. It was also noted that the rail over rail bridges selected appeared in both ELRs, hence in totality, these bridges may be double counted. The completeness results affect the numeric grading for the asset group. These counts featured in the completeness sample measurement only and were not used in the determination of the accuracy grading.

The method of completeness measurement of overbridges was affected by inconsistent definitions of these assets. On review of our measurements we consider that it is entirely possible that the completeness measurements have not accounted for assets that are out of scope (for example overbridges which are owned by the local authority) and the measure has been thus affected. We have removed these from the assessment so that the results were not potentially misleading.

From a smaller dataset it was found that where underbridges are located in a multiple ELR section they are only recorded in one ELR. They are thus not linking to the second ELR.

Within the sample dataset for underbridges four could not be located. It was also noted that 165 underbridges are named "CeCost Generated Asset" in the dataset. It was not clear what these structures represented.

Electrical Power (EP)

HV cables, switchgear and transformers were not assessed as part of this review since it was not possible to develop a means of verifying accuracy and completeness of these datasets. Instead the review focused on OLE and conductor rails.

Accuracy

The sampling the OLE assets was to be based on the verification of the start and end mileages. However, following the review of the first set of samples it was discovered that there appeared to be no consistent basis for recording the start and end locations. In some cases the mileages were consistent with tensioning points, but in other cases these seemed to represent the transition point where the overlap of the previous wire section terminated. For this reason, the data used for the verification was based on the majority type throughout the asset length.

In general, Omnicom video was used in this exercise where suitable coverage existed. Of the 331 dataset OLE samples viewed on Omnicom it was possible to identify twenty (6%) as not matching the records.

For conductor rail, measurements from the Southern Measurement Train (SMT) were compared against the attributes provided in the EP dataset. It had been assumed that the conductor rail asset entries related to individual conductor rails. Analysis of the data however suggested that this was only occasionally the case, with some sampled entries covering sections where lengths of conductor rail were recorded on both the left and right sides of the train. This was further supported by the fact that around 5% of the records in the dataset had multiple rail weights. It was unclear therefore what each record represented. As a result, the majority attribute on the SMT trace was checked over the length of the asset, and compared

with the attributes in the dataset. Data entries with multiple rails and multiple wear rates could not be verified as there was no way to determine the relative lengths of the different rail types.

Completeness

Of the two hundred OLE locations sampled, the existence or not of OLE as seen on Google Earth or Omnicom was positively matched against the data held in the dataset at all but five sites. Of those five, four could not be verified due to poor quality Google Earth and Omnicom coverage, leaving one location where the data capture conflicted with the dataset.

Of the two hundred conductor rail locations sampled all but ten matched. Of those seven could not be verified due to poor quality Google Earth and Omnicom coverage, leaving three where conductor rail was observed but there were no entries in the dataset for this location.

Confidence Grading

The results of the data verification exercises were collated and scored. This includes only those gradings which are applicable to the assessment at the national level as agreed at the Tripartite Meeting on 14th December 2012.

Subsequently the Tripartite meeting on 20th March 2013 there was general agreement that there would be little benefit gained from seeking to increase the sample sizes. In order to provide a baseline confidence grading against which future data improvements could be assessed there was agreement that:

- The weightings applied to the individual attributes should be removed and the respective grading reassessed;
- For items where sufficient sampling was carried out the numeric gradings score will remain; and
- Where the grading relied on a precision score an appropriate single percentage leading to a grading score will be applied.

It should be noted that the method of completeness measurement of overbridges and level crossings was affected by inconsistent definitions of these assets. On review of our measurements we consider that it is entirely possible that the completeness measurements have not accounted for assets that are out of scope (for example level crossings that are not signalling assets) and the measure has been thus affected. As such we have removed these from the assessment so that the results were not potentially misleading.

Table 4 describes the results of the governance and data verification reviews as gradings and detailed accuracy / completeness ranges to indicate the level of precision achieved in the review.

Table 4: Summary of National Gradings by Asset Discipline and Assessment Scope

Mandate AO/028 Audit of Asset Data Quality Summary of Results - National Dataset			Evalaution[1] of PR13 Planning Attributes		Evaluation[1] of Operational (LC1.20) Attributes	
Asset Discipline	Asset Group/Type		Governance Evaluation	Dataset Evaluation (Completeness and Accuracy)	Governance Evaluation	Dataset Evaluation (Completeness and Accuracy)
Track	***Plain Line***	Completeness		**98% (94%-100%)**		98% (94%-100%)
		Accuracy		99% (94%-100%)		**94% (89%-99%)**
		Grading[2]	B	2	B	3
	S&C	Completeness		**92% (88%-95%)**		**92% (88%-95%)**
		Accuracy		99% (95%-100%)		99% (91%-100%)
		Grading[2]		3		3
Signalling	***Interlockings***	Completeness		100% (97%-100%)		100% (97%-100%)
		Accuracy		**98% (91%-100%)**		**97% (91%-100%)**
		Grading[2]		(2)		(2)
	Signals	Completeness				**93% (90%-97%)**
		Accuracy				97% (91%-100%)
		Grading[2]				3
	Train Detection Equipment	Completeness				
		Accuracy	A		A	**92% (85%-98%)**
		Grading[2]				3
	Point Operating Equipment	Completeness				
		Accuracy				**90% (84%-96%)**
		Grading[2]				3
	Level Crossings	Completeness		80% (77%-83%) *		80% (77%-83%) *
		Accuracy		**99% (96%-100%)**		**99% (96%-100%)**
		Grading[2]		2		2
Structures	***Underline Bridges***	Completeness		98% (95%-100%)		98% (95%-100%)
		Accuracy		**80% (76%-85%)**		**74% (67%-82%)**
		Grading[2]		4		5
			B		B	
	Overline Bridges	Completeness		69% (66%-72%) *		69% (66%-72%) *
		Accuracy		**81% (77%-85%)**		**75% (69%-82%)**
		Grading[2]		4		5

Mandate AO/028 Audit of Asset Data Quality Summary of Results - National Dataset			Evalaution[1] of PR13 Planning Attributes		Evaluation[1] of Operational (LC1.20) Attributes	
Asset Discipline	Asset Group/Type		Governance Evaluation	Dataset Evaluation (Completeness and Accuracy)	Governance Evaluation	Dataset Evaluation (Completeness and Accuracy)
Operational Property	***Franchised & Managed Stations***	Completeness		**100% (97%-100%)**		**100% (97%-100%)**
		Accuracy	B	100% (98%-100%)	B	100% (98%-100%)
		Grading[2]		(1)		(1)
Electrical Power	***HV Switchgear***	Accuracy/ Completeness				
		Grading[2]				
	Transformers	Accuracy/ Completeness				
		Grading[2]				
	OLE	Completeness		99% (96%-100%)		99% (96%-100%)
		Accuracy	B	**98% (95%-100%)**	B	**98% (95%-100%)**
		Grading[2]		2		2
	Conductor Rail	Completeness		98% (95%-100%)		98% (95%-100%)
		Accuracy		**87% (83%-91%)**		**87% (83%-91%)**
		Grading[2]		4		4
	HV Cables	Accuracy/ Completeness				
		Grading[2]				

Notes:

1 Emboldened (lower) score defines grading of data following ADCGAM

2 Gradings where the precision of the sample results should affect the numeric grade are shown in brackets e.g. (2).

* Completeness scoring not considered in grading as on review inconsistent asset type definitions may have affected the measurement

Comparison to Network Rail Review

One of the key requirements of the study was to compare the gradings from this review to those derived by Network Rail in October 2011. The following tabulation and notes provides this comparison and commentary.

Table 5: Review of Overall Asset Data Quality Gradings

Asset Grouping	Network Rail Grading	Arup Grading	Commentary
Track			Inferred improvement in data completeness / accuracy for plain line.
Plain line	B3	B2	Inferred improved completeness/accuracy of data
S&C	B3	B3	Grading unchanged
Signalling			Inferred improvement of data management processes of signalling data
Interlockings	B3	A(2)	Inferred improved completeness/accuracy of data. Note: Data completeness /accuracy grading from this assessment is not confirmed due to level of precision based on sample reviewed.
Point operating equipment	B3	A3	Accuracy / completeness grading unchanged
Train detection	B3	A3	Accuracy / completeness grading unchanged
Signals	B3	A3	Accuracy / completeness grading unchanged
Level crossings	B3	A2	Inferred improved completeness/accuracy of data
Structures			Inferred improvement of data management processes relating to structures data
Underbridges	C2	B4	Inferred decline in completeness/accuracy of data
Overbridges	-	B5	No grading assigned in NR assessment Sept 2011
Operational Property			
Buildings	B3	B(1)	Inferred significant improvement in completeness/accuracy of data
Electrical Power			Inferred improvement of data management processes of EP data
HV switchgear	C3	B1	Measured by data consistency check only Inferred significant improvement in completeness/accuracy of data
Transformers	-	B4	Measured by data consistency check only. No grading assigned in Network Rail assessment Sept 2011
OLE	C3	B(1)	Inferred improved completeness/accuracy of data
Conductor rail	C3	B4	Inferred decline in completeness/accuracy of data
HV cables	C3	B1	Measured by data consistency check only Inferred improved completeness/accuracy of data
HV switchgear	C3	B1	Measured by data consistency check only Inferred significant improvement in completeness/accuracy of data

Overall the study has determined that there are better asset data governance processes in place associated with the recording, management, and access to the data than was evident in the Network Rail study.

The picture with regard to the accuracy / completeness of the data is that this assessment has confirmed or improved on the grades for the majority of the asset disciplines / groupings. However, our review concluded on a lower accuracy / completeness grading for structures.

In terms of the financial impact on Network Rail's SBP of the variation between the gradings, we are of the view that this is likely to be minimal across the

disciplines, with the exception of structures, because of the closeness of the gradings and the generally reasonable accuracy / completeness of information.

This view has been determined based on the general improvement in the governance assessment demonstrating better processes in place and the broadly similar accuracy gradings awarded. The exception is structures as already mentioned. As a comparison to the earlier grading we consider that this will have an impact on the SBP in terms of the data which has been used in the Tier 1 model. This leads us to have a moderately high level of uncertainty regarding the accuracy of this data that fed into the Tier 1 model (CeCOST). This reflects the view put forward in our report on the review of the January 2013 SBP under Mandate 30

Without more information on the way in which the previous study was undertaken it is difficult to draw any more firm conclusions from the comparison.

It is considered that the work presented herein provides a thorough measurement of Network Rail's asset inventory and condition data and may be used as a baseline for further studies and comparisons.

Recommendations

A set of recommendations has been prepared based on the findings of the study. These are included in the Table 6.

Table 6: Study Recommendations

Number	Recommendations to Network Rail	Benefits	Evidence of Implementation	Network Rail Data Champions	Due Date
2012ADQ01	Network Rail should adopt a standard process for uploading asset data changes following renewals	Asset data will be routinely brought up to date following enhancement providing greater accuracy	Adoption as a Standard and then evidence of internal checks on adherence to the process.	Director, Asset Information	Dec 2013
2012ADQ02	Network Rail to undertake audits of its own data (2nd party audit). The asset datasets to be included in the audit to be agreed between Network Rail and ORR. Asset types and attributed that are relevant to be agreed between the parties. Network Rail to have audits conducted and audit reports submitted to ORR.	By undertaking its own audits there will be less risk of difficulties in accessing the data, a lower risk of misinterpretation, and will provide a more efficient process once embedded in the organisational culture.	Audit reports supplied to ORR at stipulated frequency	Director, Asset Information	Sept 2013
2012ADQ03	Network Rail to develop an Asset Data Quality Improvement Plan (ADQIP). This to be based on the ADCGAM methodology. This to include a baseline against which future audits will be reviewed, a planned improvement process, audit periods, methodology and targets. Network Rail to report on progress annually.	Delivers a means of tracking the quality of asset data against an agreed benchmark to provide demonstrable improvements when new systems are commissioned. Provides ORR with a clear benchmark to measure progress in this field.	Reporting of results of baseline exercise and then periodical reporting of variations to the baseline to ORR.	Director, Asset Information	Sept 2013