Network Rail and Office of Rail and Road

Independent Reporter - Lot 3

Mandate L3 AR 002: Review of Asset Measures Data Processing and Evaluation

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Background

As part of its CP5 Delivery Plan, and to demonstrate its management of its asset base, Network Rail has established asset management indicators. These reflect the robustness (reliability) and condition (sustainability) of the assets resulting from Network Rail's application of its asset policies and delivery of its anticipated renewal and maintenance plans.

This also aligns with Network Rail's licence, which states under condition 1.20 that 'The licence holder shall maintain appropriate, accurate and readily accessible information about the relevant assets, including their condition, capability and capacity'.

ORR and Network Rail have identified a requirement to review the reporting of the robustness and sustainability measures adopted by Network Rail in CP5, in order to determine confidence grades for the system reliability of reporting these measures.

This work is being split over a number of tranches, with the initial focus being on the robustness measures (relating to asset performance) that were introduced formally in the CP5 determination. The reviews should also include any continuing CP4 measures which either had not been assessed or were previously noted as weak.

Purpose and Objectives of Review

The measures included in the review are listed in Table 1 below.

Table 1: Measures under Review

Measure	Principal Asset	Coverage	CP4 Confidence Grading	Rationale	Measure Reporter
Immediate action geometry faults per 100km	Track	National	N/A	New measure for CP5	CaRRT
L2 exceedances	Track	National	None	Existing measure w/o confidence grading	CaRRT
Rail breaks and immediate action defects per 100km	Track	National + Route	None	Existing measure w/o confidence grading	CaRRT
Track failures (service affecting)	Track	National + Route	None	Existing measure w/o confidence grading	STE

Measure	Principal Asset	Coverage	CP4 Confidence Grading	Rationale	Measure Reporter
Signalling failures (service affecting)	Signalling	National + Route	None	Existing measure w/o confidence grading	STE
Points failures (service affecting)	Signalling	National + Route	None	Existing measure w/o confidence grading	STE
Telecoms failures (service affecting)	Telecoms	National + Route	None	Existing measure w/o confidence grading	STE
DC traction power failures (service affecting)	EP	National + Route	BX	Existing measure with weak confidence grading	STE
Non-traction operational power supply failures (service affecting)	EP	National + Route	N/A	New measure for CP5	STE
Buildings – Re-active faults (2 & 24)	Buildings	National + Route	N/A	New measure for CP5	TBC
Structures – Number of open work items with a risk score ≥ 12	Structures	National + Route	None	Existing measure w/o confidence grading	AMA

(Note: the X in the BX Confidence Grading for 'DC traction power failures (service-affecting)' indicates that that the data accuracy could not be measured, because the measure was based on a very small data sample or could not be assessed for some other reason.)

For each measure, the purpose of the review was to verify the consistency and accuracy of Network Rail's reporting processes, procedures and associated governance, to ensure that the measure is being correctly reported. The review includes an assessment of the processes associated with the measure, summarised by means of the system reliability confidence grading set out in Appendix 2 to the review Mandate (the Mandate is included as Appendix A to this report). The review also includes a comparison of the numbers reported for each measure in the 2014/15 Annual Return with Network Rail's underlying aggregated input data.

The overall confidence grades for each measure are based on the following aspects of system reliability:

- Whether clear evaluation processes are established for each measure
- The robustness of the process for correcting erroneous data in the source data
- The process for review and assurance of the final reported outputs

Process maps were developed for each measure under review, highlighting the data sources used and the steps taken to process the data to produce the results shown in the 2014/15 Annual Return.

Approach

Following the project inception meeting, meetings were held with the Data Champions (i.e. those responsible for collating and aggregating the source data) at Network Rail Centre (Milton Keynes and Glasgow). Further meetings were held with the members of the Corporate and Regulatory Reporting Team (CaRRT) responsible for the processing and reporting of the collated data.

In addition to the descriptions and explanations of the processes used, measure definition and Work Instruction documents (where available) were obtained, together with the 2014/15 Period 13 datasets used to generate the results presented in the 2014/15 Annual Return. The documentation and datasets were used to compare the two sets of data.

Further meetings and/or telephone discussions were held with staff on the Scotland, Wessex and Western Routes with responsibility for the assets covered by each measure. These meetings were used to develop an understanding of the data collection (where applicable) for each measure, the application and limitations of the measure on the Routes, and the processes for review and (where necessary) amendment of the published Periodic and Annual Return values for the measure.

The overall findings were then reviewed to establish the confidence gradings reported below.

Conclusions

Although these measures were not reviewed in the course of the CP4 Part A Independent Reporter activities, recurring themes and recommendations made in CP4 related to the needs to improve process documentation, increase process automation and reduce dependency on individual members of staff within Network Rail. The findings of this review indicate that the processes used for these measures largely meet those criteria.

Some gaps remain in the measure definitions and process documentation, but these are relatively minor and to some extent subject to the law of diminishing returns, with the ‘low-hanging fruit’ already having been picked. There is limited documentation of e.g. RACI arrangements and training needs and attainments at the Route level, and of the processes for reviewing, approving or challenging measure outputs, but this does not seem to cause any significant problems, and the review and challenge process appears to work well on the basis of ‘organised informality’. Effective use is made of visualisation boards to monitor and review the measures on the Routes, as part of Network Rail’s Lean initiative.

There remains some scope for further automation and, in parallel with this, the introduction of technology to facilitate the interrogation and interpretation of data to obtain more useful information and enable increasingly proactive asset management: examples include the ORBIS (Offering Rail Better Information Systems) programme and the introduction of AIRS (Asset Information Reporting System).

The documentation and automation of processes has helped to reduce dependency on individuals, and has generally been complemented by ensuring that multiple members of staff are available and trained to undertake these processes and to cover holidays, sickness and other absences. However, in the case of the service-affecting failure measures, there remains an excessive reliance on the Systems Reliability Improvement Manager's detailed understanding of the underlying methods and wider performance relationships.

The comparison of the numbers published in the Annual Return with the underlying aggregate data shows that the Annual Return accurately reflects the collated source data. The confidence grades and numerical comparison for each measure are summarised in Table 2 and Table 3 below.

Table 2: Confidence Grades

Measure	Clarity of Evaluation Processes	Robustness of Source Data Correction Process	Review and Assurance of Final Outputs	Overall Grade
Immediate action geometry faults per 100km	C	A	B	C
L2 exceedances	A	A	A	A
Rail breaks and immediate action defects per 100km	C	A	A	C
Track failures (service affecting)	B	A	A	B
Signalling failures (service affecting)	B	A	A	B
Points failures (service affecting)	B	A	A	B
Telecoms failures (service affecting)	B	A	A	B
DC traction power failures (service affecting)	B	A	A	B
Non-traction operational power supply failures (service affecting)	B	A	A	B
Buildings – Re-active faults (2 & 24)	A	A	A	A
Structures – Number of open work items with a risk score >=12	A	A	A	A

Table 3: Comparison of numbers reported in 2014/15 Annual Return with pre-evaluation datasets (national network totals)

Measure	2014/15 Annual Return	Network Rail system-produced value	Percentage difference
Immediate action geometry faults per 100km	0.9	0.9	0
L2 Exceedances	10,442	10,442	0
Rail breaks and immediate action defects per 100km	2.72	2.72	0
Track failures (service affecting)	5,493	5,493	0
Signalling failures (service affecting)	16,228	16,228	0
Points failures (service affecting)	4,008	4,008	0
Telecoms failures (service affecting)	3,957	3,957	0
DC traction power failures (service affecting)	283	283	0
Non-traction operational power supply failures (service affecting)	263	263	0
Buildings – Re-active faults (2 & 24)	5,835	5,835	0
Structures – Number of open work items with a risk score >= 12	1,834	1,834	0

Recommendations and Observations/Suggestions

Our recommendations are based on the meetings and discussions held with Network Rail staff in the Centre and on the Routes, and our review of measure documentation and data. Some useful observations and suggestions for improving the usefulness of the measures were also made by the Routes. The recommendations and observations/suggestions are set out in Table 4 and Table 5 below.

Table 4: Recommendations

Reference	Recommendation	Benefit	Report Ref	Owner	Suggested completion date	Potential Confidence Grade on Completion
2016AM01	Prepare a measure definition document for 'Immediate Action Geometry Faults per 100km'	Improve transparency and reduce risk of reporting error	Section 3.1.2	Network Rail	January 2017	A
2016AM02	Update the Track Geometry Work Instruction document to explicitly cover 'Immediate Action Geometry Faults per 100km'	Reduce reporting errors	Section 3.1.2	Network Rail	January 2017	A
2016AM03	Update the Rail Breaks measure definition document to explicitly cover Immediate Action Defects per 100km	Improve transparency and reduce risk of reporting error	Section 3,3	Network Rail	January 2017	A
2016AM04	Provide further documentation and knowledge-sharing of the processes used to generate the service-affecting failure measures	Reduced reliance on a small number of individuals and improved business continuity	Section 3.4.2	Network Rail	July 2017	A
2016AM05	Review the measurement of 2- and 24-hour performance and the setting of targets for the 'Buildings – Re-active faults (2 & 24)' measure, with a view to reducing the apparent tendency on Routes to under-report 2-hour incidents, and thus ensuring that the measures are reported accurately	Improved monitoring, reporting and understanding of Buildings asset condition	Section 3.5.4	Network Rail	July 2017	N/A

Table 5: Observations/Suggestions

Reference	Observation/Suggestion	Benefit	Report Ref	Owner	Suggested completion date	Potential Confidence Grade on Completion
2016AMObs01	Consider including complex S&C and terminal track geometry in a (perhaps additional) measure	Provide more comprehensive asset information	Section 3.1.2	Network Rail	N/A	N/A
2016AMObs02	Investigate issue of time lags between Measurement Train data collection and issue to Routes	Enable timely interventions	Section 3.1.3	Network Rail	N/A	N/A
2016AMObs03	Consider disaggregation of aggregate measures and aggregation of disaggregate ones, to facilitate root cause investigation and trend analysis respectively	Improved information provision	Sections 3.1.2, 3.2.4	Network Rail	N/A	N/A
2016AMObs04	Review make-up and contents of the 'Immediate Action Defects per 100km' measure with a view to increasing its usefulness to the Routes	Improved information provision and asset management	Section 3.3.3	Network Rail	N/A	N/A
2016AMObs05	Consider the potential benefits of providing additional detail to accompany the service-affecting failure measures, to provide a 'richer picture' to the data users and assist with performance improvement	Improved understanding of failure root causes and potential performance benefits	Section 3.4.4	Network Rail	N/A	N/A
2016AMObs06	Review contents of the 'Structures – Number of open work items with a risk score $\geqslant$ 12' measure with a view to increasing its usefulness to the Routes	Improved information provision, asset management and comparison between Routes	Section 3.6.4	Network Rail	N/A	N/A
2016AMObs07	Provide further documentation and knowledge-sharing of the relationships between Immediate Action Defects and wider performance issues	Reduced reliance on a small number of individuals and improved business continuity	Section 3.4.2	Network Rail	N/A	N/A
2016AMObs08	Identify and apply consistent and accurate measure(s) of total network length for normalisation and reporting purposes, taking account of the inclusion or exclusion of complex S&C and terminal tracks as necessary	Improved accuracy and consistency of reporting	Section 3.1.2	Network Rail	N/A	N/A

1 Introduction

This report presents the findings of the review of Network Rail's Asset Measures data processing and evaluation for the purposes of the 2014/15 Annual Return, undertaken as part of Arup's role as Lot 3 Independent Reporter. The review was undertaken in response to Mandate L3 AR 002 (included at Appendix A), issued by ORR and Network Rail on 24th February 2016.

Following this introduction, the objectives of the review and the methodology employed are described in Chapter 2. Chapter 3 describes the findings for each of the measures under review, based on

(i) meetings and telephone conversations held to review data collection on the three sample Routes (Scotland, Wessex and Western), data collation at Network Rail Centre, and data processing at Network Rail Centre to produce the outputs included in the Annual Return, and

(ii) documentation and data provided during or subsequent to the meetings.

A Process Map is included for each of the 11 measures under review. The Confidence Grades for each measure are presented and explained in Chapter 4, and, finally, the conclusions drawn and recommendations made as a result of the review are presented in Chapter 5, followed by a brief account of the lessons learned in the course of the work. Appendix A contains the mandate for the review, and Appendix B contains the templates/questionnaires used for the Route and Centre interviews.

2 Review Objectives and Methodology

The measures under review and some of their relevant characteristics are shown in Table 2.1. They were selected for review either because they have not previously been reviewed by the Independent Reporter, because they have weak confidence grades, or because they are new measures for CP5.

Table 2.1: Measures included in Review

Measure	Principal Asset	Coverage	CP4 Confidence Grading	Rationale	Measure Reporter
Immediate action geometry faults per 100km	Track	National	N/A	New measure for CP5	CaRRT
L2 exceedances	Track	National	None	Existing measure w/o confidence grading	CaRRT
Rail breaks and immediate action defects per 100km	Track	National + Route	None	Existing measure w/o confidence grading	CaRRT
Track failures (service affecting)	Track	National + Route	None	Existing measure w/o confidence grading	STE
Signalling failures (service affecting)	Signalling	National + Route	None	Existing measure w/o confidence grading	STE
Points failures (service affecting)	Signalling	National + Route	None	Existing measure w/o confidence grading	STE
Telecoms failures (service affecting)	Telecoms	National + Route	None	Existing measure w/o confidence grading	STE
DC traction power failures (service affecting)	EP	National + Route	BX	Existing measure with weak confidence grading	STE
Non-traction operational power supply failures (service affecting)	EP	National + Route	N/A	New measure for CP5	STE
Buildings – Re-active faults (2 & 24)	Buildings	National + Route	N/A	New measure for CP5	TBC
Structures – Number of open work items with a risk score ≥ 12	Structures	National + Route	None	Existing measure w/o confidence grading	AMA

(Note: CaRRT: Corporate and Regulatory Reporting Team; AMA: Asset Management Assurance)

2.1 Objectives

As part of ORR's wider objective of verifying the consistency and accuracy of Network Rail's reporting processes, procedures and overall governance, the overall objective of this review was to assess the processes used to report the robustness (reliability) of the measures listed in Table 2.1, and to summarise the findings in terms of the system reliability confidence gradings outlined in Appendix 2 of the Mandate document (see Appendix A of this document).

The scope of the review also included a comparison of the aggregate output produced by Network Rail for each measure (prior to final evaluation) with the numbers reported in the Annual Return.

2.2 Methodology

A series of meetings was held with the Measure Reporters (i.e. Network Rail's 'Data Champions') for each measure, with the Corporate and Regulatory Reporting Team (CaRRT) responsible for producing the outputs for inclusion in the Annual Return, and with representatives of the Scotland, Wessex and Western Routes (these Routes were chosen to represent a combination of long-distance inter-city, commuter and regional train services). These meetings were used to develop an understanding of the processes, documentation and tools used in the production, collation and final processing of the data used to calculate each measure and produce the values presented in the 2014/15 Annual Return. The schedule of meetings is shown at Appendix B. All the Centre (Milton Keynes and Glasgow) and some of the Route (Scotland) meetings were held on a face-to-face basis; the remainder were conducted by telephone.

One of three standard templates/questionnaires was issued to the Route data providers, Data Champions and CaRRT representatives prior to each meeting, and used to structure the discussions and to enhance consistency between meetings and across measures; copies of the three templates/questionnaires are included at Appendix C.

Based on the discussions held and the documentation and other files provided by then, the initial and emerging findings were presented to ORR and Network Rail on 8th July 2016 for information and feedback. These, and all subsequent discussions and documents and files provided, are reflected in this report.

3 Review of Measures

In the following sub-sections, each of the measures under review is briefly described, and, where possible, the 2014/15 Periodic results for the measure are illustrated. This description and summary is followed by the findings of the review for the measure, presented under the headings of data collection (on the Routes or equivalent), data collation, data processing and reporting (both at Network Rail Centre), and data review/amendment and application (on the Routes).

3.1 Immediate Action Geometry Faults per 100km

This track geometry measure was reported in this format for the first time in the 2014/15 Annual Return, in which it is defined as follows:

> *The reporting of Twist and Track Gauge faults only. It does not include Cyclic Top figures or combination cyclic top/twist and cyclic top/alignment figures.*

No Asset Reporting Manual definition for this measure was available at the time of the review. It was initially understood that this normalised measure is largely a re-naming of the L2 Exceedances measure (see next sub-section), although the latter measure continues to be reported. In common with L2 Exceedances, but in contrast to other measures under review, the data were available on an annual basis only, and therefore could not be plotted Periodically.

The following document was provided by Network Rail:

- The spreadsheet 'Immediate Action by Route Criticality.xls', containing the numbers of Immediate Action Geometry faults for England & Wales, Scotland and the total Network, disaggregated by route type/criticality (Primary, Secondary or Rural), together with the corresponding track km values, and the normalised values reported in the Annual Return.

Work Instructions (WIs) for the Track Geometry reporting process were also provided (see following sub-section), since this measure is based on the same data source as L2 Exceedances.

3.1.1 Data Collection (by Measurement Train)

On the basis of discussions with Route Access Managers (RAMs) for Track on the Scotland and Western Routes, and with Engineering Data Analysts on the Western and Wessex Routes, it is understood that the data for this measure is collected by Network Rail Centre (Derby), via Network Rail's Measurement Trains. The data is processed and uploaded to the Track Geometry Reporting (TGR) system for subsequent collation and analysis by the Corporate and Regulatory Reporting Team (CaRRT) (note: this is one of the three measures under review for which both data collation and processing are undertaken by CaRRT; for most of the measures under review, the data is collated by other measure reporters prior to processing by CaRRT).

3.1.2 Data Collation, Processing and Reporting (Network Rail Centre)

At the meeting held with the CaRRT Manager (and Data Champion for this measure), Senior Analyst and two Track Geometry Analysts on 16th May 2016 at Network Rail's offices at Milton Keynes, the data collation process was described and explained. No Measure Definition (see above) or dedicated Work Instruction documentation was available for this measure.

The data used to produce the measure is extracted in .csv format from TGR on the Monday of Week 1 of each reporting Period (or the Tuesday, if the Monday is a Bank Holiday), using the Oracle-based Ad Hoc reporting system. The initial processing of the data is undertaken as part of the process used to generate the L2 Exceedances outputs. The documentation provided does not make clear how the two processes diverge.

The subsequent processing and reporting of the data are also undertaken by CaRRT, as noted above and described at a subsequent meeting with the CaRRT Manager and Senior Analyst, held at Network Rail's Milton Keynes offices on 17th May 2016. The final output of the process is the spreadsheet 'Immediate Action by Route Criticality.xls', described above. A review of the collated data held in the spreadsheet for 2014/15 Period 13 confirmed that its contents corresponded exactly with the results reported in the 2014/15 Annual Return. However, the data contained in the spreadsheet appear to have been pasted in, and the source of the values is unclear, as noted above. While the reported numbers tally with those shown in the Annual Return, the underlying non-normalised data includes 280 Immediate Action Geometry Faults nationally, whereas the L2 Exceedances dataset includes 10,442 L2 Exceedances across the national network; it therefore seems likely that the Immediate Action Geometry Faults dataset is a subset of L2 Exceedances, and a measure definition document should be put in place to clarify the situation.

It was also noted that the total network length used for the normalisation of Immediate Action Geometry Faults (31123.88 km) is slightly different from the value used for the normalisation of Immediate Action Defects (31091.94 km) – the discrepancy is equivalent to only approximately 0.1% of either value, however.

3.1.3 Data Review/Amendment and Application (Routes)

A meeting was held in Network Rail's Glasgow office on 15th June 2016 with the RAM for Track on the Scotland Route, and telephone conversations were held with the RAM and Engineering Data Analyst for Track on the Western Route and with the Engineering Data Analyst for Track on the Wessex Route on 12th July 2016. The purpose of these discussions was to obtain insight to the provision of data (where applicable) for the measure by the Routes, and to the application of the measure on the Routes, and to any perceived limitations of the measure.

The data for the measure is collected by Network Rail Centre (Derby) by means of Measurement Trains, so the Routes are not responsible for data provision. However, it was noted by the Western Route that Multi-Purpose Vehicles (MPVs)

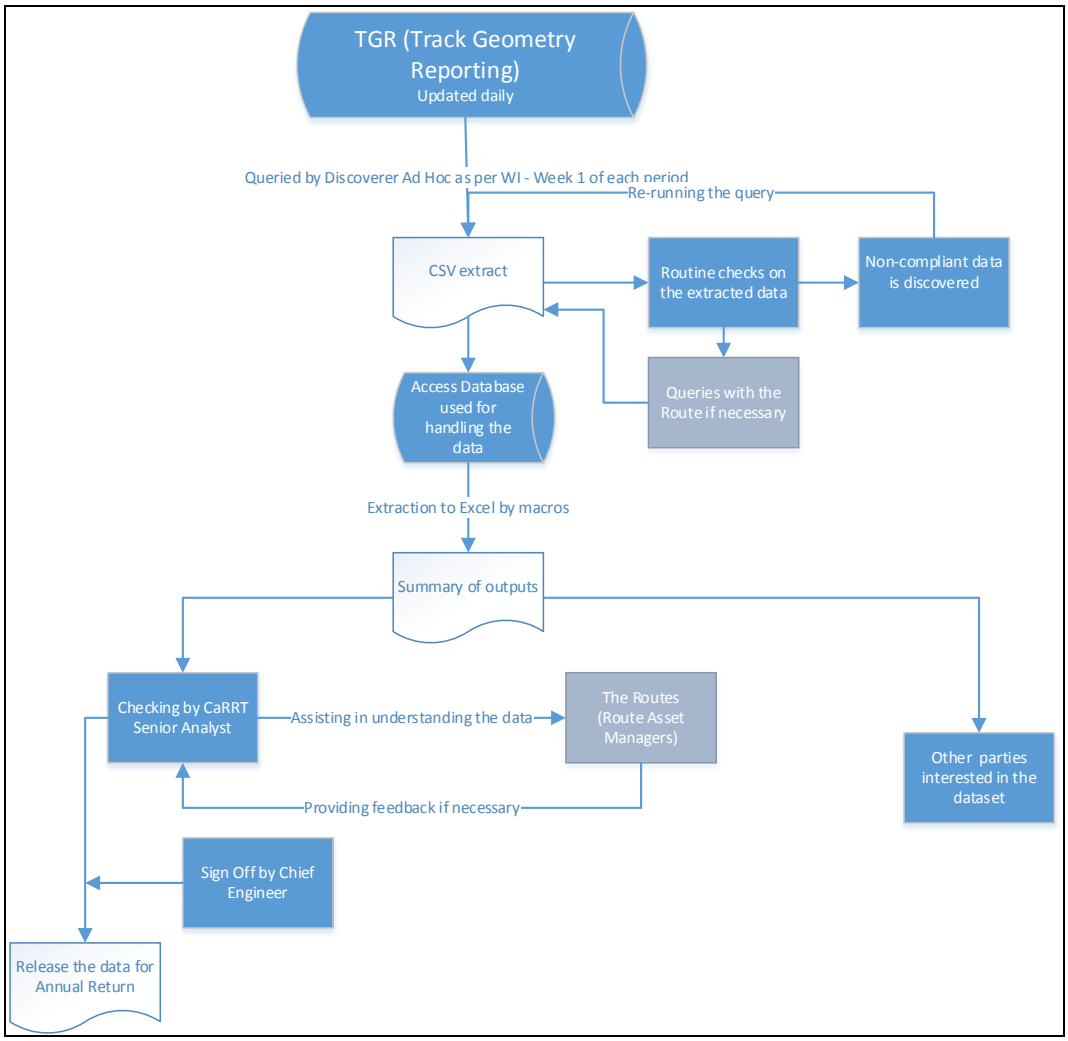
are used to measure track geometry at complex Switch and Crossing (S&C) layouts and at terminals, and that these measurements are excluded from the measure. It was also observed that there have recently been time lags of up to a week between data capture by Measurement Train and data provision to the Route, meaning that time-sensitive interventions may be delayed.

The normalised data are used to monitor and review asset condition and trends, but the normalisation can lead to some loss of useful detail, so that further investigation is required when negative trends are identified. Possibly reflecting its recent inclusion as a measure, Immediate Action Geometry Faults per 100km seems to have limited recognition on the Routes, with the normalised L2 Exceedances per 100km measure being used by preference (this is also referred to as Intervention faults, some of which are in the Immediate Action category, supporting the hypothesis above that Immediate Action Faults are a subset of L2 Exceedances).

Spurious or unexpected data or results (from the Measurement Trains or from CaRRT) are relatively unusual, but, when they arise, are routinely challenged by the Routes by means of a relatively informal, undocumented process. Training requirements for these purposes on the Routes are limited, with most of the learning being done ‘on the job’. Cover for staff absences tends to be limited, but planned absences are organised around varying workloads across Periods, and staff from other Routes can be drawn upon as necessary. It is anticipated that the introduction of the Asset Information Reporting System (AIRS), as part of the ORBIS (Offering Rail Better Information Services) programme, will provide improved flexibility, reduce dependency on individual staff members, and enable more proactive interrogation of asset data and improved asset management opportunities.

The Process Map for the measure is shown in Figure 3.1 (note: in the absence of a dedicated Measure Definition or Work Instruction for this measure, a generic Process Map, based on the L2 Exceedances documentation is used).

Figure 3.1: Process Map for the 'Immediate Action Geometry Faults per 100km' Measure



3.2 L2 exceedances

Network Rail's Asset Reporting Manual (NR/ARM/M5DF) defines this measure as

> *the total number of Level 2 exceedances per track mile (to include Top, Line, Gauge and 3m Twist), based upon the most recent data.*

The Annual Return refers to both Level 2 Exceedances and Level 2 faults per 100km, although the reported numbers are not normalised. There is thus some inconsistency between the definitions (and the distance units used), although the reported numbers are consistent with the checked collated values.

Exceedances are categorised as Levels 1 to 4 in decreasing order of severity. L2 signifies immediate (within 24 hours) action while L1 requires immediate closure (Level 1 Exceedances are recorded elsewhere).

According to the Asset Reporting Manual, the reported data may be subject to amendment after the Period for which it is reported. The end of year data is

therefore defined as the data available at the end of the first Period of the following year (although it may subsequently change further). As for Immediate Action Geometry Faults per 100km, the data were available on an annual basis only, and therefore could not be plotted Periodically.

In addition to the ARM Measure Definition, the following documents were provided by Network Rail:

- Work instructions x 3 (AR-WI-32A, -32B and -32C)
- Final output spreadsheet containing 132 worksheets and the reported numbers

3.2.1 Data Collection (by Measurement Train)

As in the case of Immediate Action Geometry Faults per 100km, the data for this measure is collected by Network Rail Centre (Derby), via Network Rail's Measurement Trains. The data is processed and uploaded to the Track Geometry Reporting (TGR) system for subsequent collation and analysis by the Corporate and Regulatory Reporting Team (CaRRT) (note: this is another of the three measures under review for which both data collation and processing are undertaken by CaRRT).Data Collation, Processing and Reporting (Network Rail Centre)

The data collation and processing for this measure were also described and explained at the meeting held with the CaRRT Manager (and Data Champion for this measure), Senior Analyst and two Track Geometry Analysts on 16th May 2016 at Network Rail's offices at Milton Keynes.

As for the preceding measure, the source data for this measure is extracted from TGR in .csv format on the first Monday of Week 1 of each reporting Period, and imported to an Access database as specified in Work Instruction AR-WI-32A.

Routine checks are performed on the extracted data, including monitoring of the number of exceedances. The CaRRT Senior Analyst reviews the outputs, and, where necessary, feedback on and explanation of the results is provided by the appropriate RAM for Track. The subsequent data processing and reporting are also performed by CaRRT, in accordance with the Work Instructions AR-WI-32B and AR-WI-32C, as described at the meeting held with the CaRRT Manager and Senior Analyst at Milton Keynes on 17th May 2016. After extracting the data from TGR, it is subsequently processed in a large, linked Access database, over four days, and Excel is used for the final stage, to produce and present a summary of outputs. The extraction to Excel is handled by macros, with some manual copying and pasting. The summary output is passed to the CaRRT Senior Analyst and shared with other Network Rail teams via a data portal. The final spreadsheet contains a large amount of information in 132 worksheets, different elements of which are of interest to and used by a range of different groups within Network Rail.

The contents of the summary spreadsheet are checked for consistency from Period to Period; as the reported numbers tend to be fairly stable, anomalies can be easily identified. Outputs and processes are under continuous review, and are updated as necessary to accommodate changes in the business structure, for example. The

Period 13 results reported in the Annual Return, and the data for 2014/15 Period 13 were checked and found to be consistent with the numbers reported in the 2014/15 Annual Return.

The processes used for the production of the measure are subject to review with the aim of improving process resilience: while the process is well-documented, it is quite time-consuming, and must be completed in Week 1 of each Period. The planned introduction of AIRS is expected to reduce the time needed to generate the required outputs.

3.2.2 Data Review/Amendment and Application (Routes)

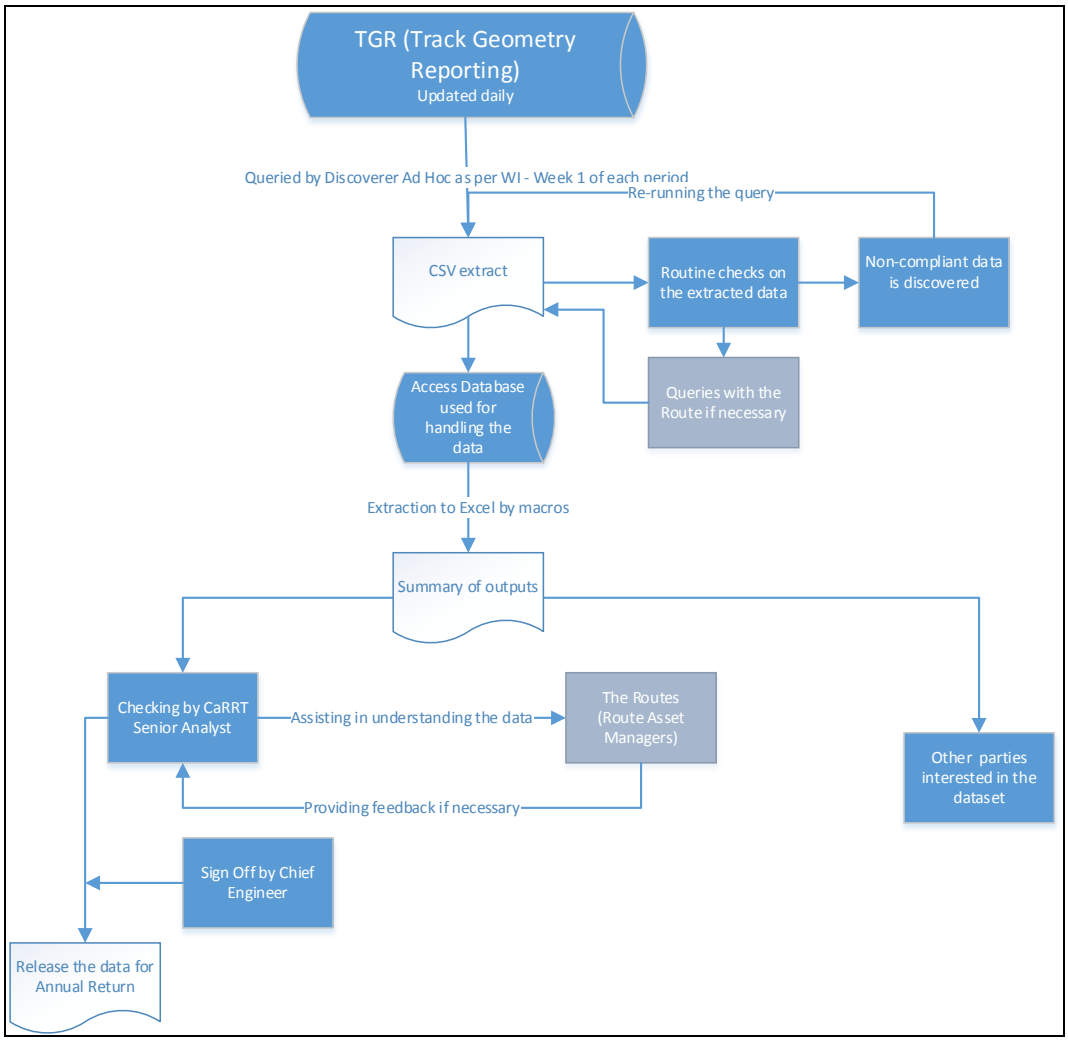
This measure was also discussed at the Scotland, Wessex and Western Route meetings. As for Immediate Action Geometry Defects per 100km, and again with the exception of complex S&C layouts and terminal areas, the data for the measure is collected by Network Rail Centre (Derby) by means of Measurement Trains, so the Routes are not responsible for data provision.

In contrast to the normalised Immediate Action Geometry Defects per 100km, the L2 Exceedances data, by its nature is not used for monitoring trends, and tends to be circulated only to those responsible for it. While it provides the level of detail that is missing from the normalised data, it was observed that the reporting of absolute numbers is inconsistent with the normalised values used in the measure targets, thus making it difficult to monitor progress relative to targets.

The observations made for Immediate Action Geometry Defects per 100km in respect of review and challenge of measures, and training and resourcing, also apply to L2 Exceedances. Questionable data or results are relatively unusual, but are routinely challenged by the Routes using informal, undocumented processes. Route training requirements are limited, and most learning is done ‘on the job’. Staff absences are planned and covered pragmatically, taking account of anticipated workload, and it is anticipated that the introduction of AIRS, once it is working properly, will assist with data management and interrogation and reduce staffing constraints.

The Process Map for the measure is shown in Figure 3.2.

Figure 3.2: Process Map for the 'L2 Exceedances' Measure



3.3 Rail breaks and immediate action defects per 100km

There are two elements to this measure. Network Rail's Asset Reporting Manual (NR/ARM/M1DF) defines a broken rail as

> *a rail which, before removal from track, has either:*
>
> - *A fracture through the full cross-section, or*
> - *A piece broken out of the railhead exceeding 50mm in length and extending down to the web*
>
> *This includes broken welds.*

No equivalent ARM definition was provided for immediate action defects. The suggestion was made that Immediate Action Defects are equivalent to Immediate Action Geometry Faults, but it is understood that this is not in fact the case, as indicated below. The 2014/15 Annual Return defines the two as follows:

> *A broken rail is a rail which, before removal from track, has either a fracture through the fill cross section, or a piece broken out of the rail head exceeding 50mm in length. This measure includes broken rails on Network Rail running lines and excludes broken rails in sidings.*
>
> *Immediate action defects are rail defects in running lines that require the line to be blocked, or the imposition of a speed restriction of 20mph or less.*

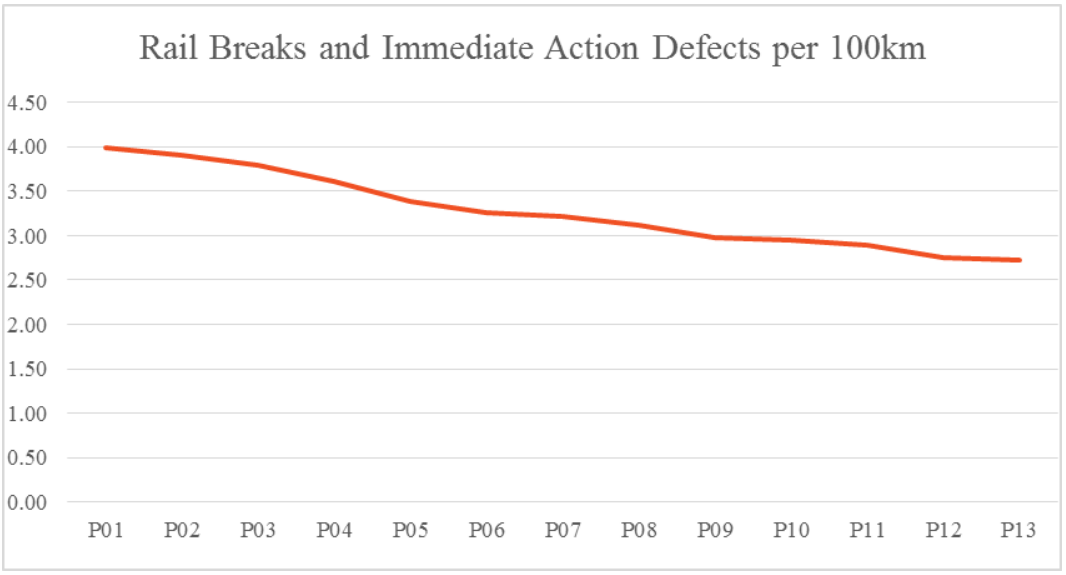
Immediate Action Defects (categories 1A and 1B) were previously referred to as Serious Defects, and the old nomenclature can still be found in some filenames and documentation, and appears to be in quite widespread use (the same applies to Immediate Action Geometry Defects, referred to above).

In addition to the ARM Measure Definition for Broken Rails, the following documents were provided by Network Rail:

- Work Instruction AR-WI-001 (Broken Rails)
- Work Instruction AR-WI-040 (Serious Defects, i.e. Immediate Action Defects)
- Data collation spreadsheets for both measures
- Immediate Action Defects database

The 2014/15 Periodic outputs for the measure, as reported in the Composite Reliability Index, are shown in Figure 3.3.

Figure 3.3: Rail Breaks & Immediate Action Defects per 100km in 2014/15



Source: 2014/15 Composite Reliability Index (CRI) Report Period 13

3.3.1 Data Collection (Network Rail Centre and Routes)

Immediate Action Defects are initially detected by ultrasonic test train and logged in the Rail Defect Management System (RDMS) as suspect incidents, for

subsequent local checking and verification at Route level. Broken rails are detected by a range of means, including driver reports and routine track inspections.

The data for both indicators is processed and uploaded to RDMS for subsequent collation and analysis by CaRRT (note: this is the last of the three measures under review for which both data collation and processing are undertaken by CaRRT). The reporting of both measures is required within seven days and within the Period in which they are recorded, meaning that the reporting 'window' shrinks during the final week of a Period.

3.3.2 Data Collation (Network Rail Centre)

The data collation, processing and reporting for this measure were described and explained at meetings held with the CaRRT Manager (and Data Champion for this measure) and Senior Analyst on 16th and 17th May 2016 at Network Rail's offices at Milton Keynes.

The data is extracted from RDMS: the Immediate Action Defects data is downloaded on Tuesday of Week 1 of each Period, while Broken Rails data is extracted at least once a week, and typically twice. For Broken Rails, reference is also made to the National Control Centre Daily Log, provided daily to ORR, to enable consistency checks and the raising of any necessary queries with the Routes.

The RDMS data extract is in .csv format, and is copied and pasted into a spreadsheet, and manual checks are made as specified in the Work Instruction. This process has some scope for further automation, which is being considered as part of an ongoing review of data quality. The spreadsheet data is then imported into and processed in an Access 'Serious Defects Outputs' database. This database is always refreshed i.e. existing data held in it is overwritten, without any archiving being undertaken (this is a pragmatic approach to local data management, assuming the source data is archived and available for re-use as necessary).

As for the two preceding measures, the processing and reporting of the data and measure are a continuation of the collation process, and is usually undertaken by the CaRRT Senior Analyst.

The data is processed further in the 'Serious Defects Output' database, which can automatically identify input data errors. Such errors (typically incorrect mileage or ELR) are usually resolved internally by manual correction using reference to 'Quail' maps (for initial 'location-type' information) and Sectional Appendices (for detailed information), and, when they occur, are added to the exceptions list in the WI. The exceptions list is subject to continuous review by various means, including the checking by the Routes of CaRRT's outputs. This manual review and associated checks provide additional oversight of the reporting process.

The data for the measure is produced Periodically, and the results for Period 13 (updated as necessary to reflect any amendments by the end of the following Period 1) provide the input for the measure to the Annual Return. The process is subject to review this year, including the development of a data requirements

template to include sources and other relevant information, with the overall aim of process improvement and the provision of greater resilience in the CaRRT team.

The data for 2014/15 Period 13 were checked and found to be consistent with the numbers reported in the 2014/15 Annual Return.

3.3.3 Data Review/Amendment and Application (Routes)

This measure was also discussed at the Scotland, Wessex and Western Route meetings described in the preceding sub-sections. Some of the data for the measure is again collected centrally by inspection trains, but this is supported for Immediate Action Defects by local inspections, while Broken Rail data is generated by a range of sources.

Within the Routes, the second element of the measure tends to be referred to as Serious Rail Defects, again suggesting that the updated terminology has yet to be fully adopted. It was confirmed that the Immediate Action Defects measure is distinct from Immediate Action Geometry Faults.

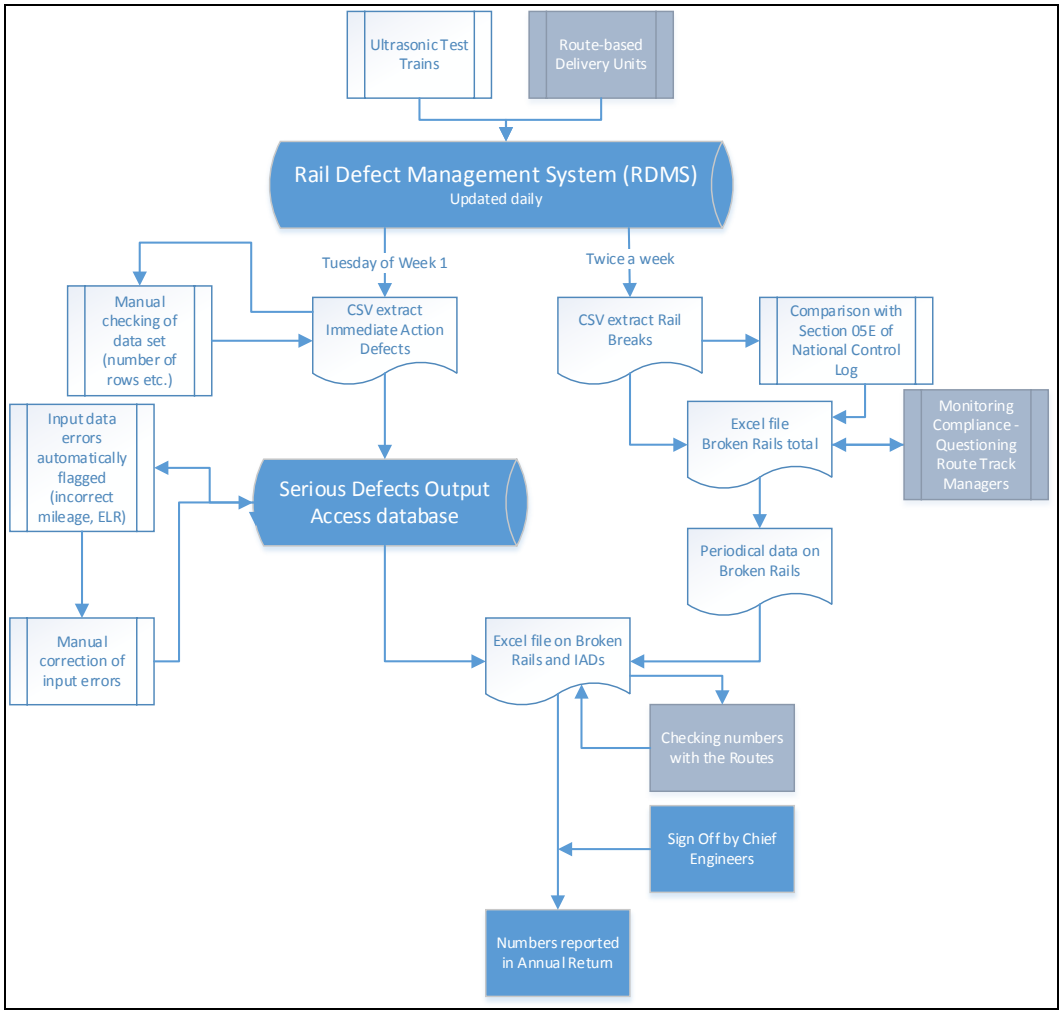
As for the previous two measures, this one is used to monitor trends and inform maintenance activities, but it is seen to have significant limitations:

- Combining two measures in a single measure, is seen as unhelpful, since it combines wrong- and right-side failures, and lagging and leading indicators in a single measure: it would be more useful to separate them, and to split Immediate Action Defects by jointed and unjointed rail types, in order to identify causal relationships.
- The detection of Immediate Action Defects actually constitutes an inspection success, but, when speed restrictions are imposed as a consequence, they are also recorded as Service Affecting Failures (Track), thus imposing a ‘double penalty’ on the Route in question.
- The use of average values, as noted above, hides the underlying detail, although this can be obtained by other means.
- The measure only includes 1A and 1B defects, and excludes speed restrictions resulting from S&C defects.
- The measure is not actively used on the Western Route for some of these reasons: instead, the Route extracts its own data from RDMS for monitoring and management purposes, and compares the outputs with the measure as a consistency check.

The Routes routinely review and challenge (where necessary) questionable results by means of informal, undocumented processes. No particular formal training needs or resourcing/cover issues were identified in the course of the discussions.

The Process Map for the measure is shown in Figure 3.4.

Figure 3.4: Process Map for the 'Rail breaks and immediate action defects per 100km' Measure



3.4 Service-Affecting Failures

The Mandate lists six Service-Affecting Failure measures, one each for Track, Signalling, Points, Telecoms, DC Traction Power and Non-traction operational power supply. The six measures are all based on data from a single source (TRUST), and are generated by means of common, shared data collation and processing methods and tools. The review and findings for all six are therefore presented together, in a single sub-section of this report, with any distinguishing characteristics or findings presented by exception.

The service-affecting failures under review are defined in the following elements of the Asset Reporting Manual:

- NR/ARM/M20DF (Track)
- NR/ARM/M9DF (Signalling)
- NR/ARM/M47DF (Points)
- NR/ARM/M69DF (Telecoms)
- NR/ARM/M12DF (DC Traction Power)
- NR/ARM/M61DF (Non-Traction Power)

In each case, the measure is defined as "the annual total number of all ... failures causing train delays" caused by a failure of the equipment in question. Broadly similar definitions are used in the corresponding sections of the 2014/15 Annual Return. The procedures for the reporting of service-affecting failures (NR/ARM/M9PR) also state that

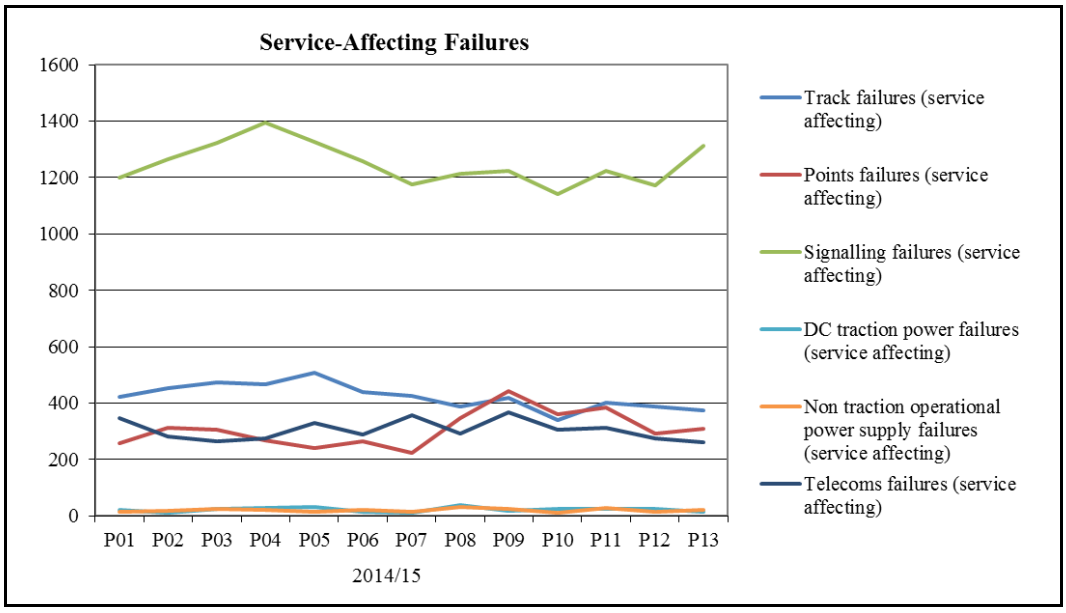
> *the annual total for failures is the sum of the number of failures causing delay for each period of the year (i.e. it is the sum of period values, including counting incidents which span multiple periods in each period in which they cause delay).*

In addition to the measure definition documents, the following documents were provided by Network Rail:

- Asset Reporting Manual for all Service Affecting Measures
- Work Instruction for Service Affecting Failures for Composite Reliability Index (CRI)
- Delay Attribution Guide (2015 and 2016 editions)
- Internal Delay Attribution Guidance (IDA22, 2015 and 2016 editions)
- Work Instruction on SRS route criticality
- Example of SRS database
- Failure count per period
- Final output of data processing (containing Annual Return reported failures)

The 2014/15 Periodic outputs for the six measures, as reported in the CRI, are shown in Figure 3.5.

Figure 3.5: Service-Affecting Failures by Cause in 2014/15



Source: 2014/15 CRI Report Period 13

It can be seen that the numbers of failures varies considerably by cause, with signalling failures dominating, and power supply failures affecting only small numbers of train services.

3.4.1 Data Collection (Routes)

Train delay records are recorded and attributed by cause (including the six under consideration here) in TRUST, in accordance with the procedures set out in the Delay Attribution Guide (DAG) and supporting documentation, including Network Rail's Internal Delay Attribution guide (IDA 22). The relatively high-level contents of TRUST are complemented by the Fault Management System (FMS), containing additional, disaggregated details on the nature and causes of all individual failures.

Correct attribution can be quite technical and challenging, requiring distinctions between e.g. high-voltage transformers (electricity and power supply) and low-voltage transformers (signalling) for non-traction operational power supply failures. Partly because of its role in triggering compensation payments, delay attribution is subject to rigorous review (and challenge and dispute resolution where necessary).

3.4.2 Data Collation (Network Rail Centre)

The data extraction and collation processes were described and demonstrated in the course of a meeting held with Network Rail's Data Champion for the measures (the Systems Reliability Improvement Manager) at Network Rail's Milton Keynes offices on 17th May 2016.

Data for all six measures is processed together. The data from TRUST feeds into Network Rail's BO-PSS (Business Objects – Performance System Strategy) system, an Oracle data warehouse. The necessary data is downloaded from BO-PSS each Period, and saved automatically onto a shared drive. The primary download process is set up to occur on Tuesday of Week 1 of each Period, with several backup downloads set up to ensure data availability in the event of a system failure. The data is provided in a single multi-worksheet Excel file, of which two worksheets are used.

An IT check is in place for the technical aspects of data extraction, and the extracted data is processed as specified in the provided Work Instruction. Further cross-checks are made between automated and manual processes, and by comparison between different BO 'universes'. Conditional formatting is used to check for errors. A summary of the Periodic dataset can be extracted at an early stage of the process, and then used for comparison with the emerging detailed results. An automated process is used to distinguish between AC and DC power supply failures on Routes where both systems are in use. Results are weighted by Route criticality for subsequent inclusion by CaRRT in the CRI. The overall data collation process is highly automated, and can be run as necessary by members of CaRRT (and others as necessary) to generate the data for the six measures, by following the Work Instruction. However, not all the underlying queries and algorithms are fully documented, and the overall process is quite complex (as

shown in the process map below), as are the wider relationships between the measures and wider system performance, There is considerable reliance on the Systems Reliability Improvement Manager in these respects, with limited backup, and thus a need for some additional documentation and/or sharing of the knowledge of the underlying system and wider relationships.

3.4.3 Data Processing and Reporting (Network Rail Centre)

The data processing and reporting for the six service-affecting failure measures were described and explained at the meeting held with the CaRRT Manager and Senior Analyst on 17th May 2016 at Network Rail's Milton Keynes offices.

The collated data for the six measures are provided by Systems Reliability Improvement Manager in a single Excel file in Week 1 of each Period. A single process is used to generate all six measures, as set out in the single Work Instruction.

The data processing is automated where possible, using Excel-based macros to check data and to populate and run an Access database, but includes some manual copying and pasting, for which conditional formatting is set up for error checking and trapping. The process includes the re-setting of Track Criticality weightings to one, to generate incident counts for reporting purposes. Because the Non-traction operational power supply failures measure is new for CP5, pseudodata for the measure has been created for preceding years. The results are reviewed for consistency with those for previous Periods, and any resulting queries are raised with the Systems Reliability Improvement Manager, as the provider of the data, who in turn liaises with the Routes as necessary.

For all six service-affecting failure measures, comparison of the collated datasets with the numbers reported in the Annual Return confirmed that the values were consistent.

3.4.4 Data Review/Amendment and Application (Routes)

Discussions were held in Network Rail's Glasgow offices on 15th June 2016 with the Performance Data Quality Manager on the Scotland Route, and by telephone on 12th July 2016 with the Head of Performance on the Western Route and on 14th July with the Performance Data Quality Manager on the Wessex Route.

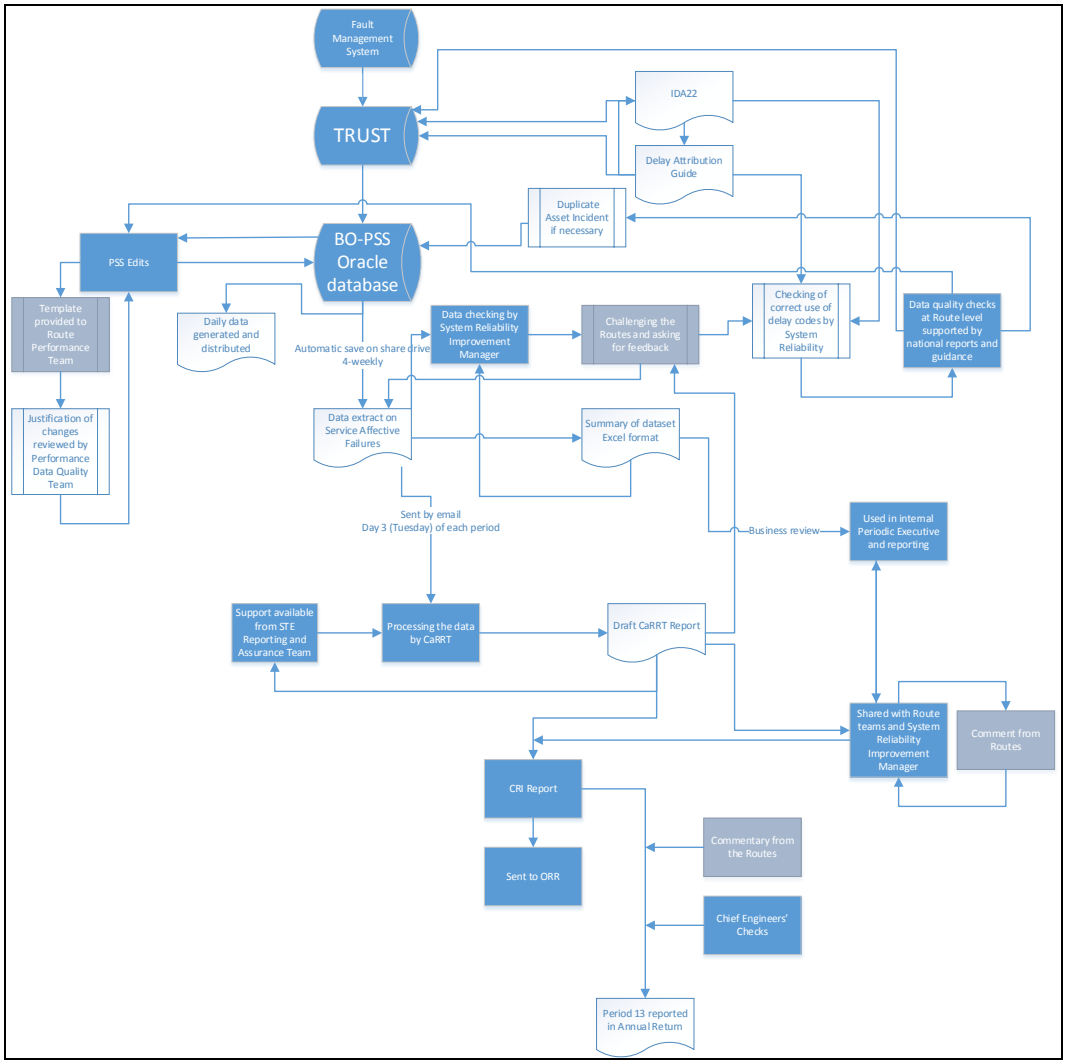
On each Route, the measures are used to monitor asset performance, and to identify problems and necessary remedial actions (on the Wessex Route, because of the Alliance between Network Rail and South West Trains (SWT), the measures are also used in conjunction with SWT's to identify means of improving PPM).

It was observed that the measures provide 'direction rather than detail', and that additional information is needed to understand root causes (this is partly due to TRUST's primary role as part of the compensation regime). It was suggested that a Network Rail equivalent of the BUGLE performance management software used by Train Operating Companies (TOCs) could help to remedy this. It was also noted that 'not all failures are equal', in that failures at busy locations and times

have a much greater effect than others (this limitation can be overcome to some extent by using the Track Criticality-weighted values included in the CRI). It was also noted that annual measure targets are expressed as percentage reductions on scorecard values for the previous year, which are difficult to express on a weekly or Periodic basis, necessitating conversion to equivalent count values.

The common Process Map for all six Service-Affecting Failure measures is shown in Figure 3.6, and, because of its size and comparative complexity, an enlarged version is included as Appendix D.

Figure 3.6: Process Map for the Service-Affecting Failure measures



3.5 Buildings – Re-active faults (2 & 24)

This measure's inclusion in the Annual Return is new for CP5; it is defined in the 2014/15 Annual Return as follows:

> *the number of reactive faults requiring urgent intervention within Network Rail Operational Property Assets. Each fault is categorised by location, severity and the risk the fault poses. The fault categorisations are '2 hour' faults and '24 hour' faults. All '2 hour'*

> *faults require attendance on site within two hours, immediate investigation and to be made safe. All '24 hour' faults require attendance on site within 24 hours, investigation and to be made safe.*

In the Asset Reporting Manual measure definition document, (NR/ARM/M40DF), the measure is named as 'Faults requiring attention within 2 or 24 hours', and is defined as the

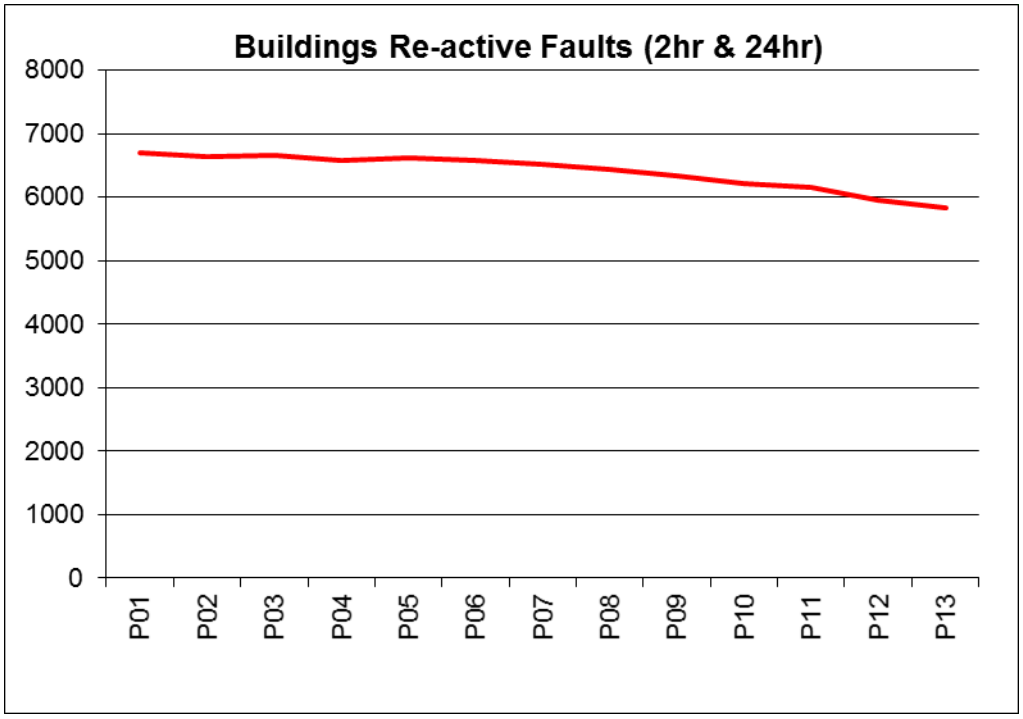
> *number of 2 and 24 hour faults recorded by Network Rail's Operational Property Helpdesk (OPHD).*

In addition to the measure definition document, the following documents were provided by Network Rail:

- Work Instruction for extracting the data from the Operational Property Asset System (OPAS) database and preparing it for submission to CaRRT
- Work Instruction AIS-WI-012 for processing the data for inclusion in the CRI and thus the Annual Return
- Collated and processed datasets for 2014/15 Period 13

The number of reported faults by Period in 2014/15 are plotted in Figure 3.7.

Figure 3.7: Number of Building Re-active Faults (2hr & 24hr)



Source: 2014/15 CRI Report Period 13

3.5.1 Data Collection (Operational Property Helpdesk)

Data for this measure is collected via Network Rail's Operational Property Helpdesk (OPHD), and held in the Operational Property Asset System (OPAS) database, i.e. staff on the Routes are not directly responsible for the provision of data to Network Rail Centre, in common with most of the other measures under review. Each reported fault is categorised by location, severity and the risk posed, and subsequently supported by engineering reports and photographs.

OPHD staff follow a script to interrogate incoming reports and screen out faults that do not fall within the 2- or 24-hour categories, and to resist attempts by reporters to 'escalate' faults unnecessarily with a view to getting them dealt with sooner than is strictly necessary. Telephone conversations are recorded, and data quality is monitored and audited. Discussions with staff at Network Rail Centre and on the Routes (Scotland and Western) indicate that the OPHD data collection process is generally accurate and reliable and works well.

3.5.2 Data Collation (Network Rail Centre, Glasgow)

In contrast to the other measures under review, Network Rail's Data Champion (the National Performance and Support Manager – Buildings and Civils) and the data collation team for this measure are based in Glasgow. A meeting was held with the Data Champion on 15th June 2016 at Network Rail's offices in Glasgow, during which the data collation process was explained.

The data for the each Period is extracted from OPAS by means of a scheduled, automated process on Monday of Week 1 of the following Period. The resulting Excel-based data dump, ordered by date, 2-/24-hour Order Number and building element (access and boundary elements are excluded), is processed and tabulated in accordance with the provided Work Instruction, and the outputs (tabular and the underlying data) are saved on a shared drive, and CaRRT are notified by e-mail.

3.5.3 Data Processing and Reporting (Network Rail Centre, Milton Keynes)

The subsequent processing and reporting of the data was explained at the meeting held with the CaRRT Manager and Senior Analyst at Network Rail's Milton Keynes offices on 17th May 2016. The data is processed as specified in the provided Work Instruction, and reported in Periodic reports and the Composite Reliability Index. The cumulative results for Period 13 are used to populate the Annual Return.

The data provided by the National Performance and Support team is reviewed by CaRRT for any apparent anomalies and inconsistencies relative to trends, and to targets and forecasts set by the Buildings discipline. Reported values tend to be quite stable, but minor errors are not readily detectable at this stage, and the overall data quality is thus highly dependent on data assurance at the 'upstream' collation and, especially, collection stages.

The collated cumulative data for 2014/15 Period 13 was compared with the numbers reported in the 2014/15 Annual Return, and the two datasets were found to be consistent.

3.5.4 Data Review/Amendment and Application (Routes)

When CaRRT circulates the Periodic and Annual results to the Routes, the results are reviewed, and any queries from the Routes tend to be directed initially to CaRRT, who then contact the OP team as required. The querying and amendment (as necessary) process is relatively informal, and is not documented.

A meeting was held in Network Rail's Glasgow offices on 15th June 2016 with the Acting Route Asset Manager, Buildings Management, for the Scotland Route, and followed up with a telephone conversation with the Senior Asset Engineer on 6th July 2016. Telephone discussions were also held on 12th July with the Acting Route Asset Manager, Buildings on the Western Route, and on 25th July with the Acting Route Programme Manager (RPM), Buildings and Civils, on the Wessex Route. On the basis of these discussions, the data collection, collation and processing/reporting processes appear to be robust, with only minor discrepancies (e.g. asset misuse or vandalism being recorded as a fault; a small number of 24-hour faults being recorded in the 2-hour category) entering the system, which can subsequently be detected and corrected at the review stage.

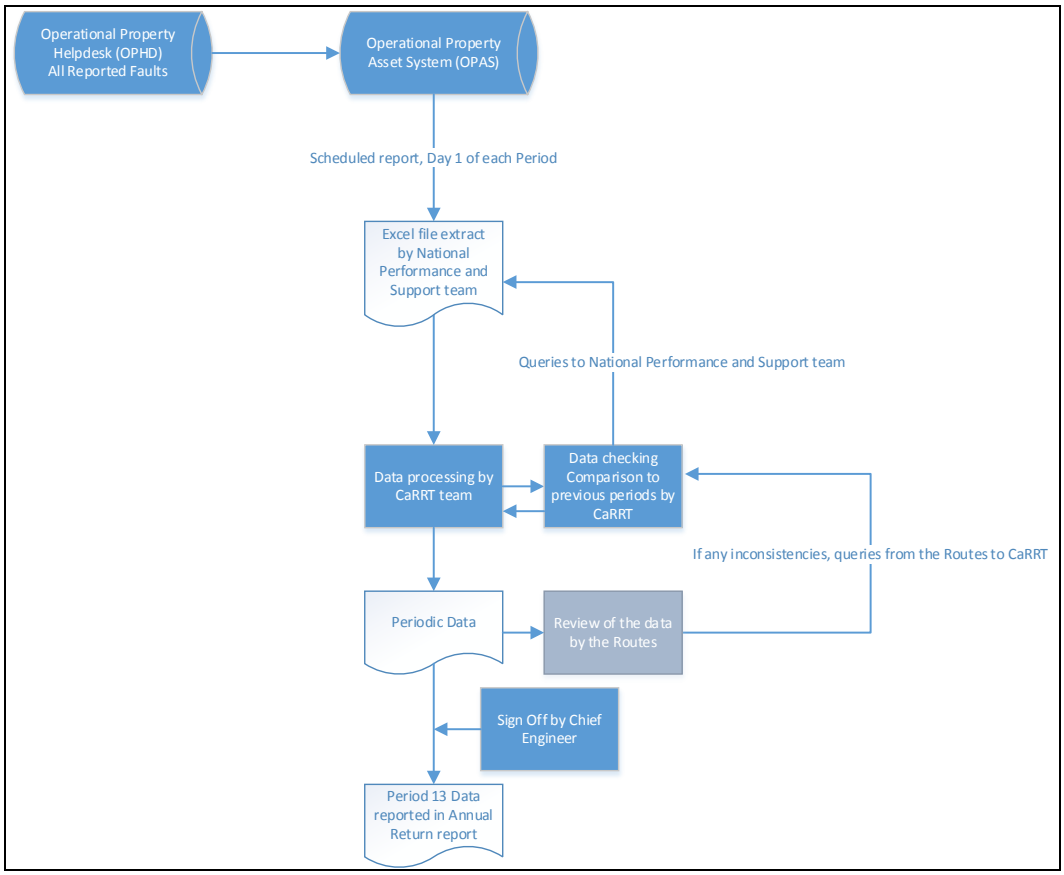
The Periodic reports and measure are used for visualisation purposes on the Routes, and to identify repeat faults, 'rogue assets', and thus needs for larger-scale interventions and opportunities for improvements to asset management practices. The number of reported incidents appears to reflect the rigour of the inspection regime (for example, the SQUIRE initiative in Scotland seems to have generated an increase in reported faults). In addition to the tendency to attempt to 'escalate' reports, as noted above, there appears to be an inclination on at least some Routes to re-classify 2-hour faults as 24-hour or longer-term faults, to improve their results; this suggests that some reconsideration of target-setting and assessment in this area is required, and/or that understanding of the measures on the Routes should be improved.

It was noted on the Wessex Route that, for the purposes of Periodic reporting to the Route Asset Management Team, it is necessary to process and disaggregate the measure data by 2- and 24-hour category, and by Buildings and M&E. It would therefore be useful if the measure reports included the disaggregate as well as the aggregate outputs, and would help further if the results were split by discipline.

More generally, OPAS is considered to be relatively inflexible, although this issue should be at least partly addressed by the implementation of the ORBIS programme, which aims to enable proactive interrogation of the outputs and better targeting of preventive maintenance; it was also suggested that the one-line incident description in OPAS could be improved, to allow easier identification, grouping and cataloguing of incident types.

The Process Map for the measure is shown in Figure 3.8.

Figure 3.8: Process Map for Buildings – Re-active Faults (2&24) Measure



3.6 Structures – Number of open work items with a risk score ⩾ 12

This measure is defined in the 2014/15 Annual Return as

> *the number of open work items in the Civils Asset Register and Electronic Reporting System (CARRS) that have been assigned a risk score ⩾12 from our standard NR/L3/CIV/006/11A 'Handbook for the examination of structures part 11A: reporting and recording examinations of structures in CARRS'. A risk score of 12 equates to an item that is 'probable' to lead to a line or road closure; or, 'likely' to result in a reduction of linespeed unless addressed within twelve months. This captures all work items that are delivered through structures maintenance teams and relate to the asset groups of 'bridge', 'tunnel' and 'wall'.*

In the Asset Reporting Manual measure definition document, (NR/ARM/M44DF), the measure is named as the 'Structures Reliability Measure', and is defined as the "number of open work items with risk score ≥ 12", based on the risk scores defined in Standard NR/L3/CIV/006/11A, Appendix A – Structure defect risk 5 x 5 matrix. The measure definition document specifies the objectives, requirements and RACI for the measure (note: the 'Informed' field in the RACI section of the

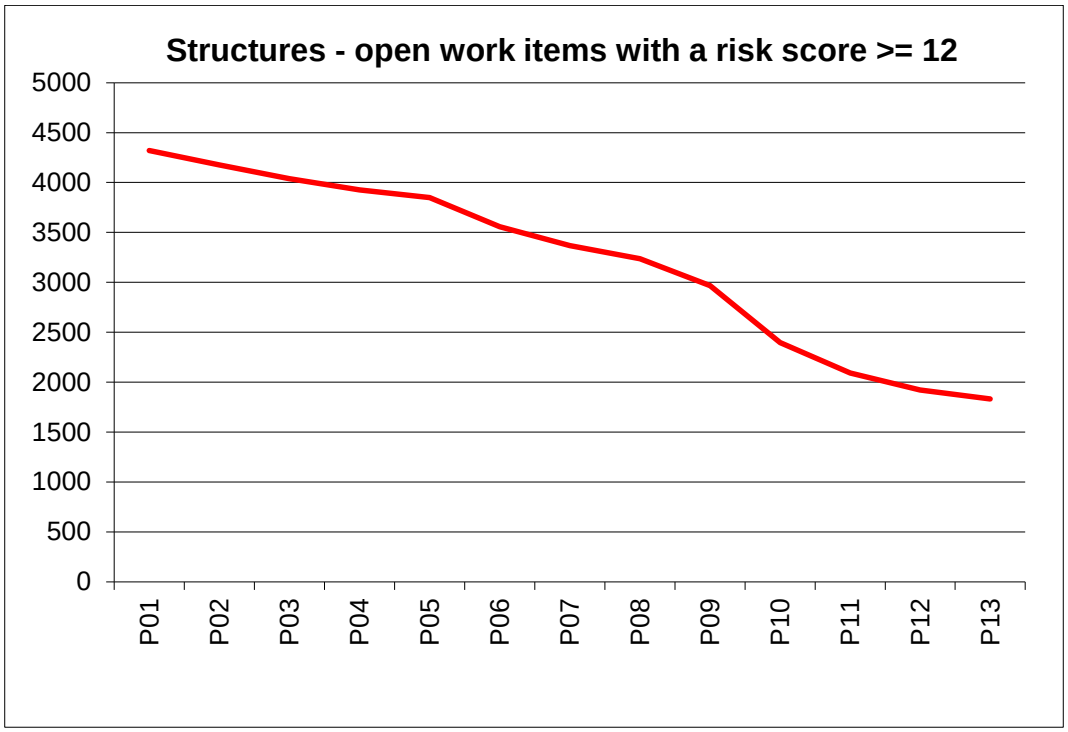
measure definition document is empty, for reasons that are not clear; it is understood that staff changes were underway at the time the definition was compiled, with the results that an appropriate individual could not be identified at the time).

In addition to the measure definition document, the following documents were provided by Network Rail:

- Work Instruction for running the CARRS report for structures defects and issuing it to CaRRT
- Work Instruction AR-WI-011 for processing the data for inclusion in the CRI and thus the Annual Return
- Collated and processed datasets for 2014/15 Period 13
- Other documents, including the Handbook for the examination of Structures. Part 11A: Reporting and recording examinations of Structures in CARRS, examples of reports on open work items, and a spreadsheet used for tracking overdue work items on a Route (Scotland)

The number of open work items by Period in 2014/15 are plotted in Figure 3.9.

Figure 3.9: Structures - number of open work items with a risk score ≥ 12



(Source: 2014/15 CRI Report Period 13)

3.6.1 Data Collection (Routes)

Data for this measure is uploaded to CARRS (an Oracle database), usually following routine structural inspections, although inspections may also be triggered by reports from other railway staff or from members of the public (e.g. in the case of bridge strikes by road vehicles).

3.6.2 Data Collation (Network Rail Centre)

A meeting was held with Network Rail's Data Champion (Asset Management Analyst) for the measure on 16th May 2016 at Network Rail's offices at Milton Keynes, during which the data collation process was described and explained.

As indicated above, the data for the measure is obtained from CARRS, which is updated continuously in near-real time, although some delays may occur in practice. The data is extracted from CARRS on Monday of Week 1 of each Period as an Excel file, using a standard query that is set up on each extraction, based on criteria set out in the Work Instruction. The data extraction process has been streamlined and documented since CP4, reducing the need for manual intervention. (Note: it is understood that CARRS is due for imminent – within the next year – replacement by the Civils and Structures Asset Management Solution (CSAMS).) Data review and cleansing has resulted in an improvement in the reported numbers, by closing previously open records in CARRS which are in practice managed in various disparate systems and where the work has been verified as having been completed. The dataset is therefore in a more mature state than previously. It is anticipated that the introduction of CSAMS will enable the rationalisation of data systems, and the elimination of at least some of this data duplication. Discussions with the Routes (see below) indicated that the contents of CARRS are closely monitored, typically on a weekly basis, with independent downloads being used to ensure that all completed work items are closed out in the database, and for comparison with outputs from the Centre.

The CARRS outputs are compared by the Asset Management Analyst with those for the preceding Period, and any significant changes are identified and reviewed, first by re-running the query and then, if necessary, by discussion with the Routes. The checked spreadsheet is then e-mailed to CaRRT for subsequent processing.

3.6.3 Data Processing and Reporting (Network Rail Centre)

The subsequent processing and reporting of the data for this measure was described and explained at the meeting with the CaRRT Manager and Senior Analyst, held on 17th May 2016 at Network Rail's Milton Keynes offices.

The data is provided in Excel format to the CaRRT inbox on Day 2 of each Period, and the dataset is then processed as set out in the Work Instruction for the process. The results are routinely sense-checked against previous outputs to monitor consistency, and any queries are raised with the Asset Management Analyst. The number of open items at the end of Period 13 forms the input to the Annual Return.

The numbers of open work items with a risk score ≥ 12 included in the collated data for 2014/15 Period 13 were compared with the values reported in the 2014/15 Annual Return and found to be consistent.

3.6.4 Data Review/Amendment and Application (Routes)

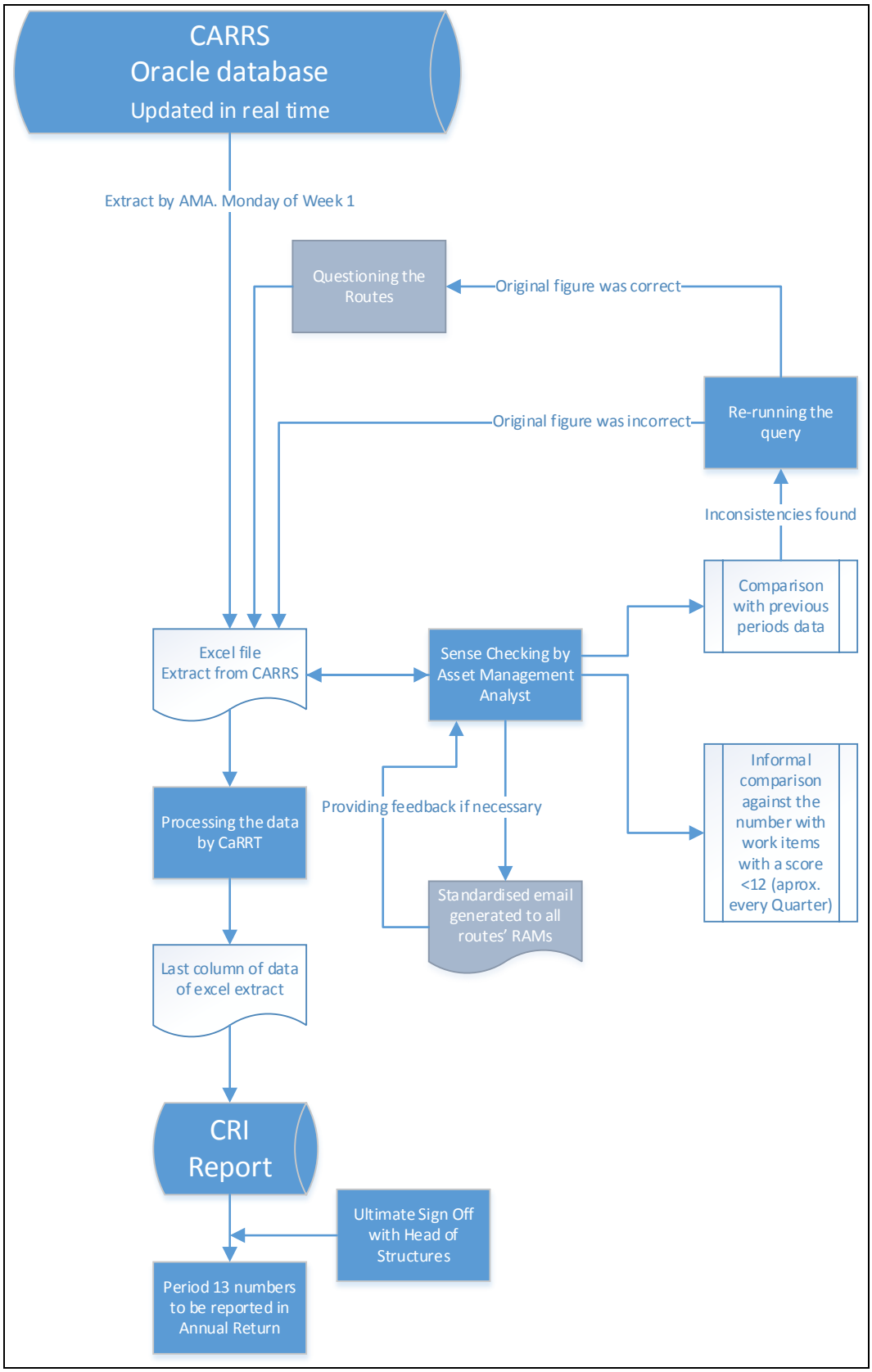
Discussions were held in Network Rail's Glasgow offices on 15th June 2016 with an Asset Engineer on the Scotland Route, by telephone on 18th July 2016 with the

Route Asset Manager (RAM) for Structures on the Wessex Route, and by telephone on 21st July 2016 with the RAM for Structures on the Western Route.

In all cases, the measure is used to monitor and manage asset condition, and to monitor the status of and progress with open work items. The measure is generally considered to be well-defined and robust, although it was noted that the total number of open work items at a given time does not necessarily provide a full overview of asset management. A fuller picture could be provided by including the cumulative annual total number of work items, and the number and percentage of work items resolved to date (the percentage value would enable comparisons between Routes). While the measure does not take account of different Route criticality weightings, these can easily be obtained from other data sources.

The Process Map for the measure is shown in Figure 3.10.

Figure 3.10: Process Map for the 'Structures - number of open work items with a risk score ≥ 12' Measure



4 Confidence Grades

For each of the measures, the derived confidence grades are based on an assessment of the measure with respect to the criteria specified in the Mandate:

- Whether clear evaluation processes are established;
- The robustness of the process for correcting erroneous data in the source data; and
- The process for review and assurance of the final reported outputs.

For each measure, each of the three criteria was reviewed and assessed, and the overall grade was based on the three individual grades, generally taking a conservative view. This reflects that the overall reporting processes, procedures and associated governance by Network Rail is only likely to be as strong as its weakest link. This means that overall grades typically reflect the weakest of the three individual grades.

4.1 Immediate action geometry faults per 100km

No measure definition document is available for this measure (other than what is presented in the 2014/15 Annual Return), and there is a lack of clarity as to its relationship with L2 Exceedances. The measure shares a data source, and some initial data collation and processing, with L2 Exceedances, but it is not clear at what stage the two measures diverge in the process, and there is no specific Work Instruction for the production of the measure: confidence grade C.

The data are collected automatically by Network Rail's Measurement Trains and reviewed at Route and CaRRT level for anomalies: confidence grade A.

Discussions with the Routes indicated that this measure is not yet as widely accepted as others, and the Periodic and Annual Return review and challenge process is therefore unlikely to be as rigorous and thorough as for other measures: confidence grade B.

The overall confidence grade for this measure is therefore C.

4.2 L2 exceedances

Clear, documented processes are in place for the recording, collation, processing and reporting of the data used in the measure: confidence grade A.

The data are collected automatically by Network Rail's Measurement Trains and reviewed at Route and CaRRT level for anomalies: confidence grade A.

The Periodic and Annual Return outputs are reviewed by the Routes and challenged and amended where (unusually) necessary: confidence grade A.

The overall confidence grade for this measure is therefore A.

4.3 Rail breaks and immediate action defects per 100km

No measure definition document is available for the Immediate Action Defects element of this measure (other than what is presented in the 2014/15 Annual Return), and there appears to be some uncertainty within Network Rail about its nature, although the process used for the preparation of the measure is well-documented: confidence grade C.

Rail breaks data are compared with Control Log records, suspect Immediate Action Defects are verified on site, and multiple, documented checks are undertaken in the course of collating, processing and reporting the data: confidence grade A.

The Periodic and Annual Return outputs are reviewed by the Routes and challenged and amended where necessary: confidence grade A.

The overall confidence grade for this measure is therefore C.

4.4 Service-affecting failures

Because they are based on a single data source and are generated by the same processes (see section 3.4), a single confidence rating has been applied to all six service-affecting failure measures, covering Track, Signalling, Points, Telecoms, DC traction power and Non-traction operational power supply.

Measure definition documents are available for all six measures, and the source data in TRUST is rigorously prepared, reviewed and, where necessary, challenged and amended. The data collation, processing and reporting activities are documented and, where possible, automated. However, there is significant dependence upon a single individual for understanding of some of the underlying processes: confidence grade B.

As indicated above, a robust process is in place for identifying and correcting erroneous source data: confidence grade A.

Given the rigour of the delay attribution and review processes, and the nature of the data collation, processing and reporting process, the final reported measures are unlikely to contain errors; the review and assurance of the final reported outputs are nonetheless robust: confidence grade A.

The overall confidence grade for this measure is therefore B.

4.5 Buildings – Re-active faults (2 & 24)

Clear, documented processes are in place for the recording, collation, processing and reporting of the data used in the measure, and the values reported in the Annual Return have been verified as consistent with the collated data: confidence grade A.

Erroneous data are generally filtered out by the OPHD, and any misallocated records tend to be identified and corrected by the Routes: confidence grade A.

The Periodic and Annual Return outputs are reviewed by the Routes and challenged and amended where (unusually) necessary: confidence grade A.

The overall confidence grade for this measure is therefore A.

4.6 Structures – Number of open work items with a risk score ⩾ 12

Clear, documented processes are in place for the recording, collation, processing and reporting of the data used in the measure, and the values reported in the Annual Return have been verified as consistent with the collated data: confidence grade A.

Risk scores are derived from well-defined and –understood structural inspection and risk assessment processes, and any ambiguous records tend to be identified and corrected by the Routes prior to data collation: confidence grade A.

The Periodic and Annual Return outputs are reviewed by the Routes and challenged and amended where necessary: confidence grade A.

The overall confidence grade for this measure is therefore A.

4.7 Summary of Results

The confidence gradings for the measures are summarised in Table 4.1.

Table 4.1: Summary of Confidence Gradings by Measure

Measure	Clarity of Evaluation Processes	Robustness of Source Data Correction Process	Review and Assurance of Final Outputs	Overall Grade
Immediate action geometry faults per 100km	C	A	B	C
L2 exceedances	A	A	A	A
Rail breaks and immediate action defects per 100km	C	A	A	C
Track failures (service affecting)	B	A	A	B
Signalling failures (service affecting)	B	A	A	B
Points failures (service affecting)	B	A	A	B
Telecoms failures (service affecting)	B	A	A	B
DC traction power failures (service affecting)	B	A	A	B

Measure	Clarity of Evaluation Processes	Robustness of Source Data Correction Process	Review and Assurance of Final Outputs	Overall Grade
Non-traction operational power supply failures (service affecting)	B	A	A	B
Buildings – Re-active faults (2 & 24)	A	A	A	A
Structures – Number of open work items with a risk score >=12	A	A	A	A

The results of the comparison of the national network total numbers reported in the 2014/15 Annual Return with Network Rail's pre-evaluation datasets are shown in Table 4.2. As noted in the preceding text, the numbers are 100% consistent throughout.

Table 4.2: Comparison of numbers reported in 2014/15 Annual Return with pre-evaluation datasets (national network totals)

Measure	2014/15 Annual Return	Network Rail system-produced value	Percentage difference
Immediate action geometry faults per 100km	0.9	0.9	0
L2 Exceedances	10,442	10,442	0
Rail breaks and immediate action defects per 100km	2.72	2.72	0
Track failures (service affecting)	5,493	5,493	0
Signalling failures (service affecting)	16,228	16,228	0
Points failures (service affecting)	4,008	4,008	0
Telecoms failures (service affecting)	3,957	3,957	0
DC traction power failures (service affecting)	283	283	0
Non-traction operational power supply failures (service affecting)	263	263	0
Buildings – Re-active faults (2 & 24)	5,835	5,835	0
Structures – Number of open work items with a risk score ≥ 12	1,834	1,834	0

5 Conclusions and Recommendations

The conclusions and recommendations arising from the work undertaken are set out below, followed by a list of more general observations/suggestions for increasing the usefulness of the measures and a short list of the lessons learned from the review.

5.1 Conclusions

The key requirements for reliable measure data processing and reporting are documentation, process automation (where possible) and avoidance of reliance on single members of staff. The findings described above indicate that data collation, processing and reporting for the measures under review are generally robust.

However, some gaps do remain in the measure definition and process documentation, and there is some confusion within Network Rail about the details of the Track Geometry and Immediate Action Defects measures. There is limited documentation of e.g. RACI arrangements and training needs and attainments at the Route level, and of the processes for reviewing, approving or challenging measure outputs, but this does not seem to cause any significant problems, and the review and challenge process appears to work well on the basis of ‘organised informality’.

Effective use is made of visualisation boards to monitor and review the measures on the Routes, as part of Network Rail’s Lean initiative, and this is just one of the means used on the Routes to monitor the measure outputs from Network Rail Centre, and to identify and challenge and questionable results. In some cases, ‘parallel accounts’ are maintained for measures on the Routes, so they can anticipate and know what to expect from the Centre, and check and challenge any discrepancies as necessary, rather than undertaking reactive checks of Centre outputs. In addition to these routine Periodic checks, the Annual Return outputs for the measures are passed by the Regulatory Compliance Team (RCT) to Network Rail’s Chief Engineers for review and sign-off. For the measures including in the Composite Reliability Index (CRI), i.e. all except the two Track Geometry measures, checks are also made for consistency between the CRI and the Annual Return outputs.

There remains some scope for further automation and, in parallel with this, the introduction of technology to facilitate the interrogation and interpretation of data to obtain more useful information and enable increasingly proactive asset management: examples include the implementation of the ORBIS programme and the introduction of AIRS.

The documentation and automation of processes has helped to reduce dependency on individuals, and has generally been complemented by ensuring that multiple members of staff are available and trained to undertake these processes and to cover holidays, sickness and other absences. However, in the case of the service-affecting failure measures, there remains an excessive reliance on the Systems Reliability Improvement Manager’s detailed understanding of the underlying methods.

5.2 Recommendations and Observations/Suggestions

Based on the preceding text, a list of SMART recommendations, including the potential measure confidence grades on completion (where applicable), is set out in Table 5.1, followed by a list of more general observations/suggestions in Table 5.2.

Table 5.1: Recommendations

Reference	Recommendation	Benefit	Report Ref	Owner	Suggested completion date	Potential Confidence Grade on Completion
2016AM01	Prepare a measure definition document for 'Immediate Action Geometry Faults per 100km'	Improve transparency and reduce risk of reporting error	Section 3.1.2	Network Rail	January 2017	A
2016AM02	Update the Track Geometry Work Instruction document to explicitly cover 'Immediate Action Geometry Faults per 100km'	Reduce reporting errors	Section 3.1.2	Network Rail	January 2017	A
2016AM03	Update the Rail Breaks measure definition document to explicitly cover Immediate Action Defects per 100km	Improve transparency and reduce risk of reporting error	Section 3,3	Network Rail	January 2017	A
2016AM04	Provide further documentation and knowledge-sharing of the processes used to generate the service-affecting failure measures	Reduced reliance on a small number of individuals and improved business continuity	Section 3.4.2	Network Rail	July 2017	A
2016AM05	Review the measurement of 2- and 24-hour performance and the setting of targets, with a view to reducing the apparent tendency on Routes to under-report 2-hour incidents, and thus ensuring that the measures are reported accurately	Improved monitoring, reporting and understanding of Buildings asset condition	Section 3.5.4	Network Rail	July 2017	N/A

Table 5.2: Observations/Suggestions for Improving the Usefulness of the Measures

Reference	Observation/Suggestion	Benefit	Report Ref	Owner	Suggested completion date	Potential Confidence Grade on Completion
2016AMObs01	Consider including complex S&C and terminal track geometry in a (perhaps additional) measure	Provide more comprehensive asset information	Section 3.1.2	Network Rail	N/A	N/A
2016AMObs02	Investigate issue of time lags between Measurement Train data collection and issue to Routes	Enable timely interventions	Section 3.1.3	Network Rail	N/A	N/A
2016AMObs03	Consider disaggregation of aggregate measures and aggregation of disaggregate ones, to facilitate root cause investigation and trend analysis respectively	Improved information provision	Sections 3.1.2, 3.2.4	Network Rail	N/A	N/A
2016AMObs04	Review make-up and contents of the 'Immediate Action Defects per 100km' measure with a view to increasing its usefulness to the Routes	Improved information provision and asset management	Section 3.3.3	Network Rail	N/A	N/A
2016AMObs05	Consider the potential benefits of providing additional detail to accompany the service-affecting failure measures, to provide a 'richer picture' to the data users and assist with performance improvement	Improved understanding of failure root causes and potential performance benefits	Section 3.4.4	Network Rail	N/A	N/A
2016AMObs06	Review contents of the 'Structures – Number of open work items with a risk score $\geqslant$ 12' measure with a view to increasing its usefulness to the Routes	Improved information provision, asset management and comparison between Routes	Section 3.6.4	Network Rail	N/A	N/A
2016AMObs07	Provide further documentation and knowledge-sharing of the relationships between Immediate Action Defects and wider performance issues	Reduced reliance on a small number of individuals and improved business continuity	Section 3.4.2	Network Rail	N/A	N/A
2016AMObs08	Identify and apply consistent and accurate measure(s) of total network length for normalisation and reporting purposes, taking account of the inclusion or exclusion of complex S&C and terminal tracks as necessary	Improved accuracy and consistency of reporting	Section 3.1.2	Network Rail	N/A	N/A

5.3 Lessons Learned

This was the first piece of work undertaken as the Lot 3 Independent Reporter in CP5, and some lessons were learned from the exercise, as set out below.

5.3.1 Templates/Questionnaires

The use of standard templates/questionnaires (see Appendix) B for the data collection/review, collation and processing reporting meetings was beneficial and successful. Their prior circulation helped to set the agenda for meetings, and ensured consistency of approach and information collection between meetings and across measures.

It was particularly helpful when the questionnaires were completed and returned prior to meetings, and adopting this approach consistently in the future could help to improve both the quality and quantity of information gathered. We feel that the agenda questionnaires worked well in that they provided a consistent framework for reviewing all measures.

5.3.2 Route meetings

Obtaining contact details for and arranging meetings with some of the Data Champions was more challenging and time-consuming than anticipated, as was identifying the appropriate contacts on the Routes and arranging meetings with them, to the extent that most of the discussions with the Route representatives were conducted by telephone (this worked reasonably well, although the meetings were conducted by a single member of the Independent Reporter team as a result, rather than by two, as is usual).

Having a single point of contact within Network Rail to identify contacts and coordinate and arrange the meetings (as was the case during similar CP4 mandates and the recent Renewal Volumes mandate) would have been very helpful and more efficient.

Appendix A

Mandate

INDEPENDENT REPORTERS: TEMPLATE MANDATE

Mandate for Independent Reporter Lot 3

Title	Asset Measures – Data processing and evaluation review
Unique Mandate Reference Number	L3 AR 002
Date	24th February 2016
ORR Lot Lead	Peter Moran
ORR lead for this inquiry	Mark Proctor
Network Rail Lot Lead	Jon Haskins
Network Rail lead for this inquiry	Jane Simpson

Document last updated: 19/08/2016 16:26

Background

As part of its Delivery Plan for CP5, Network Rail has established asset management indicators[1] to demonstrate its management of its asset base. These indicators reflect the robustness (reliability) and condition (sustainability) that the assets have achieved based on the application of its asset policies and delivery of the anticipated renewal and maintenance plans.

This also aligns with Network Rail's licence, which under condition 1.20 states that *'The licence holder shall maintain appropriate, accurate and readily accessible information about the relevant assets, including their condition, capability and capacity'.*

There is a requirement to review the reporting of the robustness and sustainability measures adopted by Network Rail in CP5 to determine a confidence grade for the system reliability of reporting these measures.

This work will be split over a number of tranches with the initial focus being the robustness measures (relating to asset performance) that have been introduced formally in the CP5 determination. The Reporter will also review any continuing CP4 measures which either had not been assessed or were previously noted as weak.

Purpose

The Office of Rail and Road (ORR) wishes to verify the consistency and accuracy of Network Rail's reporting processes, procedures and associated governance, to assure that the measures identified are being correctly reported.

The review will include an assessment of the processes associated with each measure and will be summarised using the system reliability confidence grading outlined in Appendix 2.

ORR also wishes to compare the aggregated input data produced by NR (prior to their evaluation process) with the final numbers reported to ORR in the Annual Return (see Appendix 4).

This mandate will review the following measures[2]

[1] See Table 24 and Table 25 of Network Rails Delivery Plan for Control Period 5

[2] These measures are detailed in Network Rails Asset Reporting Manual which are referenced in Appendix 3

INDEPENDENT REPORTERS: TEMPLATE MANDATE

Measure	Principal Asset	Metric Type	Coverage	CP4 Reference	CP4 Confidence Grading	Notes	Rationale	Data Provider
Immediate action geometry faults per 100km	Track	Robustness	National	N/A	N/A	New measure for CP5	New measure for CP5	CaRRT
L2 Exceedances	Track	Robustness	National	None	None	Has been included in previous annual return/ICR information	Existing measure without confidence grading	CaRRT
Rail breaks and immediate action defects per 100km	Track	Robustness	National + Route	None	None	Has been included in previous annual return	Existing measure without confidence grading	CaRRT
Track failures (service affecting)	Track	Robustness	National + Route	None	None	Has been included in previous annual return	Existing measure without confidence grading	Net Ops (Nigel Salmon)
Signalling failures (service affecting)	Signalling	Robustness	National + Route	M9	None		Existing measure without confidence grading	Net Ops (Nigel Salmon)
Points failures (service affecting)	Signalling	Robustness	National + Route	None	None	Scope of this measure may have increased in CP5	Existing measure without confidence grading	Net Ops (Nigel Salmon)
Telecoms failures (service affecting)	Telecoms	Robustness	National + Route	None	None	Has been included in previous annual return	Existing measure without confidence grading	Net Ops (Nigel Salmon)
DC traction power failures (service affecting)	EP	Robustness	National + Route	M12	BX	the bench marking for inclusion of incidents in these numbers may have changed	Existing Measure with weak confidence grading	Net Ops (Nigel Salmon)
Non-traction operational power supply failures (service affecting)	EP	Robustness	National + Route	N/A	N/A	New measure for CP5	New measure for CP5	Net Ops (Nigel Salmon)
Buildings – Re-active faults (2 & 24)	Buildings	Robustness	National + Route	N/A	N/A	New measure for CP5	New measure for CP5	Marianne Watt
Structures – Number of open work items with a risk score >= 12	Structures	Robustness	National + Route	None	None	Has been included in previous SHEP reporting	Existing measure without confidence grading	AMA (Patrick Chandler)

INDEPENDENT REPORTERS: TEMPLATE MANDATE

Scope

The review will focus on the processes used in the transition from the system produced aggregated national dataset, through the evaluation process, to the subsequent reporting of the selected measures to ORR to produce a system reliability confidence grade. Please note that the scope of this review does not include the validation and traceability of the reported number to ORR.

For the purposes of this mandate, the process review will look at the data reported to ORR within the 2014/15 Annual Return.

This review will consider the following aspects when determining the confidence grade for each of the measures:

System Reliability

- Whether clear evaluation processes are established for each measure
- The robustness of the process for correcting erroneous data in the source data
- The process for review and assurance of the final reported outputs

The Independent Reporter will also report on the differences between the final reported number to ORR and the system produced, pre-evaluation dataset in the format:

Measure	2014/15 Annual Return	NR system produced value	Percentage difference
Immediate action geometry faults per 100km			
L2 Exceedances			
Rail breaks and immediate action defects per 100km			
Track failures (service affecting)			
Signalling failures (service affecting)			
Points failures (service affecting)			
Telecoms failures (service affecting)			
DC traction power failures (service affecting)			
Non-traction operational power supply failures (service affecting)			
Buildings – Re-active faults (2 & 24)			
Structures – Number of open work items with a risk score >= 12			

Methodology

To enable the clear interpretation of the results of this study, each reported measure should be process mapped to:

- highlight the source of the data utilised for the relevant measure; and
- the steps undertaken to process this data from systems to produce the final reporting measure.

In general terms the method for this review shall include:

- Desktop review of the published processes for data evaluation, analysis and reporting
- Assessment of the system reliability for the processes from data extraction, evaluation and reporting.
- Work with Network Rail and ORR to identify and agree appropriate tolerances for assessing the accuracy of reporting
- Computational analysis of the tools/models used
- Interviews with NR employees involved in the process from data extraction, evaluation and reporting.
- Review of assurance activities for the data processing, verification and reporting

Having agreed appropriate tolerances, the Reporter shall determine a grading score[3] for the system reliability of the processes for the reported metrics based on the 2014/15 Annual Return submitted to ORR.

Note:
The Reporter will not be required to carry out any site verification work; this review will be conducted wholly as a desktop exercise.

Timescales and deliverables

- Initiation tripartite meeting – March 2016
- Central team meetings – March 2016
- Route meetings – April 2016
- Draft findings shared – April 2016
- Draft report – April 2016
- Tripartite meeting to discuss report – May 2016
- Final report – May 2016

Related work

Previous independent reporter studies have been undertaken that cover some aspects of this mandate and should be referred to:

- Review of Performance Measures – ARUP – July 2013
- PR13 M&R Review – AMCL – May 2013
- Review of Fault Management System – AMCL – August 2012

Independent Reporter Proposal

The Reporter shall prepare a proposal for review by the ORR and Network Rail on the basis of this mandate. ORR and Network Rail will review the proposal with reference to the criteria for selection – see attached guidance document.

The final approved proposal will form part of the mandate and shall be attached to this document.

[3] See Appendix 2 – Confidence Grading Methodology

The proposal will detail methodology, tasks, programme, deliverables, resources and costs.

The Reporter shall provide qualified personnel with direct experience in the respective disciplines to be approved by the ORR and Network Rail. The contractor is asked to submit details of the previous experience and qualifications of such personnel as part of their proposal.

Appendix 1 – Joint ORR and Network Rail Guidance to Reporters

1. The purpose of this document is to describe the trilateral relationship between ORR, Network Rail and each Reporter. It sets out in a practical context what both ORR and Network Rail expect from Reporters, and seeks to encourage best practice. This will help Reporters to deliver work in a way which meets these expectations and requirements. These requirements will be taken into account as part of the Reporter Framework (as provided to Reporters).

2. This guidance is owned and updated as necessary jointly by ORR and Network Rail. In the event of any discrepancy between this document and the Reporter contract, the latter will prevail. This guidance does not provide an exhaustive list of responsibilities and should Reporters wish to discuss these guidelines further they should contact the following for a trilateral discussion:

    - Andy Lewis for ORR; and
    - Jonathan Haskins for Network Rail.

The trilateral relationship

3. Licence Condition 13 (LC13) of Network Rail network licence states:

    - "The role of the Reporter is to provide ORR with independent, professional opinions and advice relating to Network Rail's provision or contemplated provision of railway services, with a view to ORR relying on those opinions or advice in the discharge by ORR of its functions under, or in consequence of, the Act. Where appropriate, ORR shall give the licence holder an opportunity to make representations on those opinions or advice before relying on them."

4. Reporters should be familiar with the obligations as set out in LC13 and the terms of the contract.

5. For the avoidance of doubt, in delivering this role, ORR and Network Rail expect that Reporters will also add value to Network Rail in helping it to improve its performance and business as provider of railway services, wherever possible. However, it is recognised that this is not the primary purpose of the Reporter under the License and that this may not always be possible to deliver each mandate.

Role & duties of the reporters

6. Reporters must provide an independent view and remain impartial throughout the review.

    For example:

    - Information should be shared equally and at the same time with both clients. Any correspondence or clarifications sought by Reporters should also be dealt with in the same way; and
    - communication between all three parties should be open e.g. both ORR and Network Rail should be invited to or made aware of meetings or discussions even if the meeting is more appropriate with only one client.

Identifying Reporter work

7. ORR will identify instances where there is a requirement to engage a Reporter. In practical terms, this is likely to arise from on-going discussions with Network Rail and in most cases (except urgent or exceptional cases) the potential for engagement of Reporters will have been identified in advance.

Mandates – Reporter Proposals

8. Clause 4 of the contract sets out the key requirements around provision of services. Requirements for reporter work normally arise from the day to day discussion of issues between ORR and Network Rail.

9. ORR will prepare a draft mandate for each piece of work and will in most cases agree this with Network Rail.

10. Mandates will be presented in a standard format for consistency and will clearly set out:

    - the purpose;
    - the scope;
    - why the review is necessary;
    - what it will achieve;
    - the expected outputs; and
    - timescales for providing reports.

11. Once agreed with Network Rail, ORR will email the mandate to the relevant Reporter(s), asking for comments and a proposal for the work, which should include costs and CVs for the proposed Reporter team. The Reporter has seven working days to respond with a proposal or such other timescale as determined by ORR. Every proposal must include:

    - costs;
    - resources;
    - CVs of the proposed mandate team – when providing proposals, Reporters should make the most efficient use of their resources including the most appropriate make-up of the review team;
    - methodology for delivering the aims of the mandate;
    - timescales;
    - framework of meetings, including a tripartite findings meeting before issue of the draft report;
    - expected deliverables and a concise explanation of how the aims of the mandate will be met; and
    - for larger scale reporter studies, the project management approach and project plans should be made explicit

12. Where there are multiple Reporters on a Lot, the ORR and Network Rail will use the following criteria to determine which Reporter they will select to conduct the work:

Procedure for Call Off under the Framework Agreements

Where more than one Contractor has been selected for any particular lot, ORR and Network Rail will allocate mandates on the basis of the following criteria:

1. The expertise required is only available from one source. This may be due to ownership of exclusive design rights or patents.
2. Where the mandate constitutes follow up work, which is directly related to a recently completed study.
3. The Contractor which demonstrates the greatest expertise in the subject matter of the mandate or the approach required.
4. The Contractor's performance against the performance framework
5. An overall assessment of value for money based on cost and complexity of work.

If the ORR and Network Rail cannot determine the most appropriate Contractor for a mandate using the above criteria, ORR and Network Rail will conduct a mini-tender with the Contractors who have been awarded the relevant lot using the following criteria in order to determine the most economically advantageous proposal:

1. The Contractor demonstrates sufficient knowledge of subject matter and possesses the technical skills, resource and competencies required for the work.
2. Contractor Costs.
3. The Contractor demonstrates innovation and value for money in its proposal.
4. The Contractor's performance against the performance framework.

13. Prior to conducting such a mini-tender, ORR and Network Rail will inform Contractors of the relative weighting of the above criteria and of any additional sub-criteria applicable in the context of a particular mandate.
14. ORR and Network Rail will endeavour to discuss the proposals received and to confirm by e-mail within **five working days** that the proposal is acceptable (or otherwise). There may be circumstances where ORR and Network Rail need longer to respond.
15. ORR will then formally instruct the reporter to start work, and the reporter will arrange a start-up meeting with key representatives from both ORR and Network Rail.

Mandates – During Delivery

16. The following sets out some key points regarding conduct of any inquiry. Reporters must provide an independent view and remain impartial throughout the inquiry. They should expect to discuss their progress and findings trilaterally with ORR and Network Rail and for some challenge to be given – particularly in relation to the factual accuracy of the findings.

Costs and expenses

17. If additional funds are required to deliver a mandate beyond those agreed at the outset, a timely proposal and justification must be given to ORR and Network Rail (as soon as the issue arises).

The Reporter should notify ORR and Network Rail who will discuss and respond in a reasonable timescale. Additional work (and cost) must not proceed without approval.

18. Any reasonably incurred expenses will be reimbursed by Network Rail. Only expenses that have been incurred in accordance with Network Rail's expenses policy will be paid.

19. All invoices should be sent to Matthew Blackwell (Matthew.Blackwell@networkrail.co.uk) at Network Rail prior to being sent to Network Rail Accounts Payable.

Amendment to mandates

20. For practical reasons it may be necessary for a mandate to be revised once work has commenced or awarded. For the avoidance of doubt this will not lead to the ORR and Network Rail seeking to re-run the award of the mandate unless ORR and Network Rail agree that the revision constitutes a material change to the original mandate.

Meetings

21. Unless otherwise directed, all key meetings must be trilateral and both parties should be made aware of any other meetings taking place.

22. The Reporter should take minutes of meetings, which should be provided to all parties within 7 working days.

Issues or concerns

23. Should a situation arise whereby either ORR or Network Rail is dissatisfied with the quality of a piece of work, we will explain clearly our reasons, gain approval from the other client and then, if we deem appropriate, may request the Reporter to re-do that part of work at no additional cost.

24. Should the Reporter encounter any issues with an inquiry (review) the Reporter should notify:

    - Andy Lewis for ORR
    - Jonathan Haskins for Network Rail

Reports

The report document

25. **All** Reports must include an 'Executive Summary' which should be written clearly, concisely and highlight key findings and key recommendations.

26. The full reports should also be written concisely in plain English, and should provide a brief 'Introduction' outlining the aims of the mandate and how these have been met. They should provide further detail on what is mentioned in the Executive Summary and there should not be any material points raised in the main report which have not already been mentioned in the Executive Summary.

27. Where there is commercially sensitive information in the report, the Executive Summary will be published on ORR's website, with any necessary redactions, instead of the full report. Otherwise, usually the full report will be published unless any redactions are appropriate due to a Freedom of Information Act exemption.

Recommendations

28. A recommendation is a specific action that the Reporter considers, following its analysis, should be undertaken by either Network Rail, or any other party. While the majority of recommendations are likely to be for Network Rail, not all need to be.

29. Reporters should make all recommendations SMART (Specific, Measureable, Achievable, Realistic and Time bound). The Reporter should:

    - provide a clear description of the recommendation and the benefit that implementation will deliver;
    - outline the evidence which is required in order for the recommendation to be closed out; and
    - discuss and agree a target date for completion of the recommendation with ORR and Network Rail.

30. Recommendations should only be included in the report if they actually add value to either ORR or Network Rail or another industry party and the benefits are sufficient to justify implementation. It is acceptable for a report not to include recommendations, as long as key requirements of the mandate have been met (e.g. if an inquiry finds that Network Rail is fully compliant with its requirements). A smaller number of well-targeted and SMART recommendations which will deliver tangible improvements are preferable to a large number of general recommendations.

31. In order to add further value, the report may also include observations on areas for improvement which do not need to be captured in a formal Recommendation if they are not central to delivery of the mandate requirements.

32. Recommendations will be tracked by the Reporter which generated them.

Payment

33. Reporters must include the purchase order number, and unique mandate reference (UMR) number for work when invoicing Network Rail for payment.

34. The clients can query invoices and have the right to check timesheets (and expenses) and investigate work before payment is agreed.

Post-mandate review

35. The clients will provide feedback on the work carried out, having assessed performance using the Performance Framework on a per mandate basis. This will reflect any issues or concerns raised with the Reporter during delivery of the mandate.

36. The clients will also hold formal feedback sessions with each Reporter every six months to review progress.

Appendix 2 – Confidence Grading Methodology

System reliability grading system

System reliability band	Description
A	Sound textual records, procedures, investigations or analysis properly documented and recognised as the best method of assessment.
B	As A but with minor shortcomings. Examples include old assessment, some missing documentation, some reliance on unconfirmed reports, some use of extrapolation.
C	Extrapolation from limited sample for which Grade A or B data is available.
D	Unconfirmed verbal reports, cursory inspections or analysis.

Notes:

1. System reliability is a measure of the overall reliability, quality, robustness and integrity of the system that produces the data.

2. Some examples of the potential shortcomings include old assessment, missing documentation, insufficient internal verification and undocumented reliance on third-party data.

Appendix 3 – Asset Reporting Manual References

Measure	Asset Reporting Manual Reference
Immediate Action Geometry Faults per 100km	TBA
L2 Exceedances	M5DF
Rail breaks and immediate action defects per 100km	M1DF
Track failures (service affecting)	M20DF
Signalling failures (service affecting)	M9DF
Points failures (service affecting)	M47DF
Telecoms failures (service affecting)	M69DF
DC traction power failures (service affecting)	M12DF
Non-traction operational power supply failures (service affecting)	M61DF
Buildings – Re-active faults (2 & 24)	M40DF
Structures – Number of open work items with a risk score >= 12	M44DF

Appendix 4 – 2014/15 Annual Return (as reported to ORR)

Measure	2014/15 Annual Return National Reported Value
Immediate Action Geometry Faults per 100km	0.90 per 100km
L2 Exceedances	10,442
Rail breaks and immediate action defects per 100km	2.72 per 100km
Track failures (service affecting)	5,493
Signalling failures (service affecting)	16,228
Points failures (service affecting)	4,008
Telecoms failures (service affecting)	3,957
DC traction power failures (service affecting)	283
Non-traction operational power supply failures (service affecting)	263
Buildings – Re-active faults (2 & 24)	5,835
Structures – Number of open work items with a risk score >= 12	1,744

Appendix B

Meetings Schedule

B1 Meetings

Measure	Element	Location	Date	Attendees
Immediate action geometry faults per 100km	Data Collation (Centre)	Milton Keynes	16th May 2016	CaRRT Manager, CaRRT Senior Analyst, Analysts x 2
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow	15th June 2016	RAM (Track)
	Route (Wessex)	By telephone	12th July 2016	Engineering Data Analyst (Track)
	Route (Western)	By telephone	12th July 2016	RAM (Track), Engineering Data Analyst (Track)
L2 Exceedances	Data Collation (Centre)	Milton Keynes	16th May 2016	CaRRT Manager, CaRRT Senior Analyst, Analysts x 2
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow	15th June 2016	RAM (Track)
	Route (Wessex)	By telephone	12th July 2016	Engineering Data Analyst (Track)
	Route (Western)	By telephone	12th July 2016	RAM (Track), Engineering Data Analyst (Track)
Rail breaks and immediate action defects per 100km	Data Collation (Centre)	Milton Keynes	16th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow	15th June 2016	RAM (Track)
	Route (Wessex)	By telephone	12th July 2016	Engineering Data Analyst (Track)
	Route (Western)	By telephone	12th July 2016	RAM (Track), Engineering Data Analyst (Track)

Measure	Element	Location	Date	Attendees
Service-Affecting Failures (x 6)	Data Collation (Centre)	Milton Keynes	17th May 2016	Systems Reliability Improvement Manager
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow	15th June 2016	Performance Data Quality Manager
	Route (Wessex)	By telephone	14th July 2016	Performance Data Quality Manager
	Route (Western)	By telephone	12th July 2016	Head of Performance
Buildings – Re-active faults (2 & 24)	Data Collation (Centre)	Glasgow	15th June 2016	National Performance and Support Manager – Buildings and Civils
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow By telephone	15th June 2016 6th July 2016	Acting RAM (Buildings) Senior Asset Engineer
	Route (Wessex)	By telephone	25th July 2016	Acting RPM (Buildings and Civils)
	Route (Western)	By telephone	12th July 2016	Acting RAM (Buildings)
Structures – Number of open work items with a risk score ≥ 12	Data Collation (Centre)	Milton Keynes	16th May 2016	Asset Management Analyst
	Data Processing and Reporting (Centre)	Milton Keynes	17th May 2016	CaRRT Manager, CaRRT Senior Analyst
	Route (Scotland)	Glasgow	15th June 2016	Asset Engineer
	Route (Wessex)	By telephone	18th July 2016	RAM (Structures)
	Route (Western)	By telephone	21st July 2016	RAM (Structures)

Appendix C

Meeting
Templates/Questionnaires

C1 Routes Meeting Template

Mandate L3 AR 002: Review of Asset Measures Data Processing and Evaluation

Questionnaire/template 1: Data Collection on Routes

KPI under review: Service-Affecting Failures

Number	Process Element	Criteria to be Met	Evidence Sought	Supplementary Information
1	Use of KPI	A clear understanding of how the KPI is used within the route to manage assets	e.g. KPI included in management report / dashboard	Any views on how the KPI could be improved to make it more useful
2	Limitations of KPI	A clear understanding on any limitations from the source data or data processing	Documentation	Any other data/KPIs used as benchmarks or to add a richer picture
3	Management of source data	Systematic checks of the data (perhaps prompted by KPI), over a defined period of time	Documented guidance	We want to understand if data can change after the production of the KPI
4	Data provision to Centre for calculation of KPI (if needed) - means and frequency	Description of how the data is provided (by e-mail, upload, shared data directory), how often, and when	Documentation - printed or hard copy of online material	
5	Data provision (if needed) - data format(s) and expected values	Definition and description of the format(s) in which the data are to be provided, and the expected range (if any) of values	Documentation - printed or hard copy of online material	
6	Data provision (if needed) - quality	Definition and description of the required data quality, to ensure that the data provided is necessary, sufficient and sufficiently accurate to monitor asset robustness	Documentation - printed or hard copy of online material	What procedures are in place to monitor and ensure ongoing data quality?
7	Validation of KPI by Route prior to reporting to ORR	Formal process for checking the accuracy and timeliness of the KPI, with data champion and/or reporting team	Documented evidence of checks carried out and under what timescales	How many errors are picked up? Have they led to improvements and fewer repeat errors?
8	Process for Route to initiate an update to the KPI report	A clear process for the Route to initiate an update to the KPI, e.g. from correcting source data	Documentation	
9	RACI	A clear understanding of the role of the Route in producing the KPI, with specific names (both in Route and HQ)	Documentation - printed or hard copy of online material (including contact details)	
10	Route staff training & resourcing	What training is needed to provide data (if needed) and to validate the KPI? Who is trained?	Documentation - printed or hard copy of online material (including contact details)	Is there enough cover for holidays and sickness etc.?

C2 Data Collation Template

Mandate L3 AR 002: Review of Asset Measures Data Processing and Evaluation

Questionnaire/template 1: Data Collation

Measure under review: Immediate action geometry faults per 100km

Number	Process Element	Criteria to be Met	Evidence Sought	Supplementary Information
1	Objectives	The Management System should clearly and unambiguously describe the purpose and objectives of collecting and collating the data	Documentation - printed or hard copy of online material	
2	Requirements	The Management System should clearly and unambiguously describe the standards required for the data and its collation, in order to meet the Management System objectives	Documentation - printed or hard copy of online material	
3	RACI	The Management System should clearly indicate those Responsible for, Accountable for, Consulted about and Informed about the measure	Documentation - printed or hard copy of online material (including contact details)	
4	Source(s)	Description of who or what (system) provides the data	Documentation - printed or hard copy of online material (including contact details, where applicable)	
5	Means and frequency of data provision	Description of how the data is provided (by e-mail, upload, shared data directory), how often, and when	Documentation - printed or hard copy of online material	What procedure is followed if the data is not provided as and when needed?
6	Data format(s) and expected values	Definition and description of the format(s) in which the data are to be supplied, and the expected range (if any) of values	Documentation - printed or hard copy of online material	What procedure is followed if the data is not provided to the specified format, or if the values are outside the expected range?
7	Data quality	Definition and description of the required data quality from Routes, to ensure that the data provided is necessary, sufficient and sufficiently accurate to monitor asset robustness	Documentation - printed or hard copy of online material	What procedures are in place to monitor and ensure ongoing data quality?
8	Data processing (if required) and collation	Documentation and description of the processes to be used to prepare and collate the data for subsequent use - should be sufficiently clear to guide new users through the processes used	Documentation - printed or hard copy of online material	Demonstration at the meeting of processes used for comparison with the available documentation
9	Staff training	Sufficient availability of trained staff to maintain data and process quality and continuity in the event of unavailability through illness, retirement or resignation	Documentation of numbers of trained staff, training required, and training received	
10	Checking: identification and handling of non-compliant data	Description of criteria for identifying data that may contain errors or fails to meet the system requirements, and procedures for dealing with non-compliances, including error-checking built in to processes and tools, and procedure(s) for referring queries back to data source and timescales to be allowed for response. Description of measures in place for trend analysis	Documentation - printed or hard copy of online material (including contact details, where applicable)	Demonstration at the meeting of 'error-trapping' facilities provided in tools and processes used
11	Data collation and presentation for subsequent evaluation by CaRRT	Description of required data formats, methods and frequencies and/or dates of provision (who should get what, and when)	Documentation - printed or hard copy of online material (including contact details, where applicable)	
12	Process for dealing with data-related queries from CaRRT	Description of procedures and timescales to be followed in response to queries from CaRRT, including requirements for referral back to data source(s) (see 10, above); records of numbers of queries and outcomes, analysis of trends	Documentation - printed or hard copy of online material (including contact details, where applicable). Evidence of correspondence, including records of numbers of queries, distinguishing between errors and clarifications	
13	Examples of processes used, referencing corresponding documentation	'Talking through' of processes followed for the processing and collation of data	Process demonstration, linked to suporting documentation	
14	Copies of tools (if e.g. spreadsheets) used for aggregation and checking	Provision of copies of tools used (where they are 'portable', i.e. not part of e.g. Business Objects), and demonstration of non-portable tools, for comparison with process documentation	Verification that tools work and are used as described in the process documentation	
15	Internal checking and audit procedures	Description of internal checking and audit requirements, processes and frequencies; evidence that these are being met	Documentation of requirements and procedures - printed or hard copy of online material; records sof audit activities, findngs and responses	

C3 Data Processing Template

Mandate L3 AR 002: Review of Asset Measures Data Processing and Evaluation

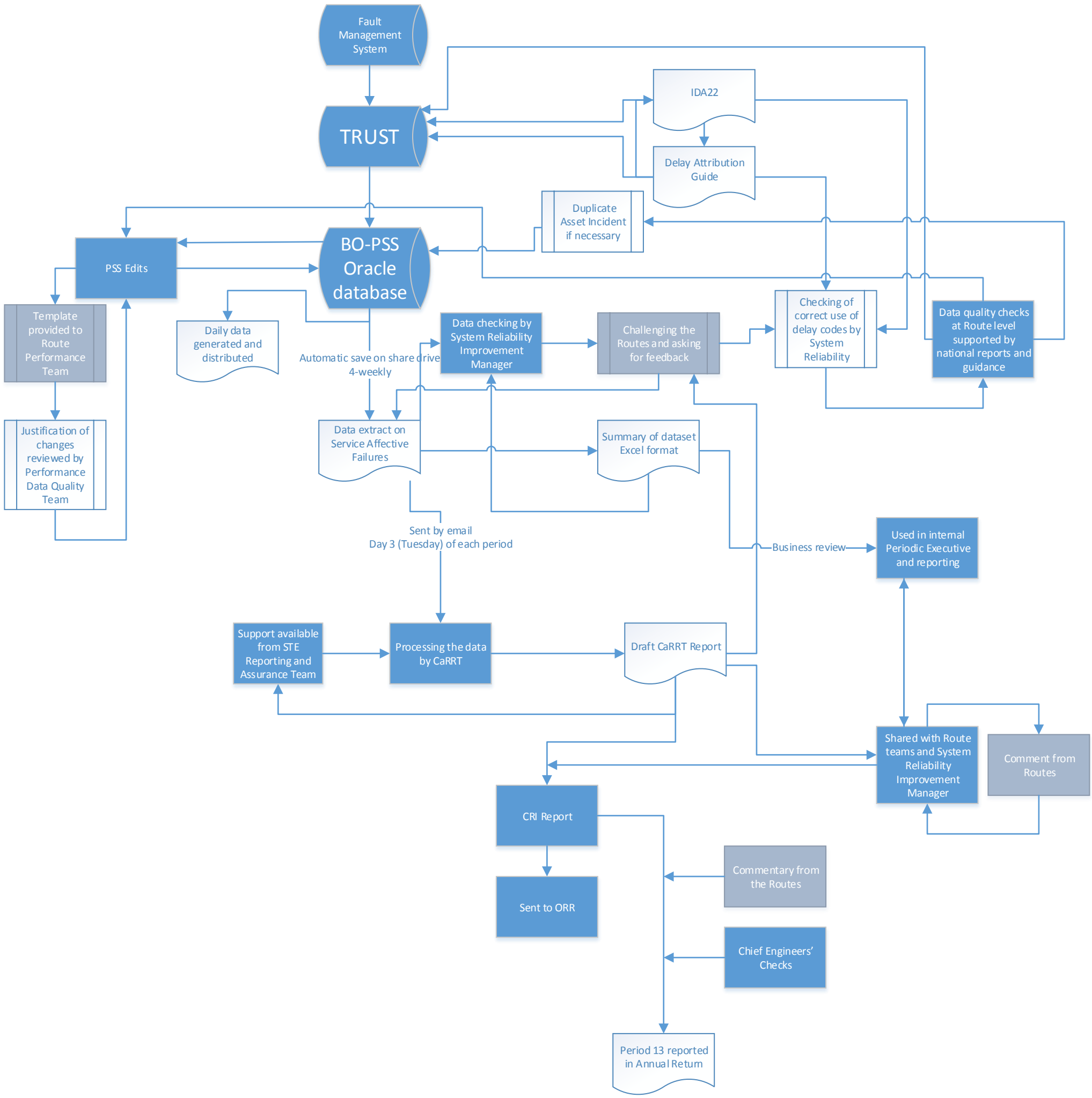
Questionnaire/template 2: Data Processing by CaRRT

Measure under review: Immediate action geometry faults per 100km

Number	Process Element	Criteria to be Met	Evidence Sought	Supplementary Information
1	Objectives	The Management System should clearly and unambiguously describe the purpose and objectives of collecting and collating the data	Documentation - printed or hard copy of online material	
2	Requirements	The Management System should clearly and unambiguously describe the standards required for the data and its collation, in order to meet the Management System objectives	Documentation - printed or hard copy of online material	
3	RACI	The Management System should clearly indicate those Responsible for, Accountable for, Consulted about and Informed about the measure	Documentation - printed or hard copy of online material (including contact details)	
4	Fitness for Purpose	The measure and data used should be reviewed on a regular basis to ensure that they are necessary, sufficient and fit for purpose for monitoring and ensuring asset robustness, and that they take account of any changes (improvements) to data quality and availability	Documentation - printed or hard copy of online material	
5	Source(s)	Description of who or what (system) provides the data	Documentation - printed or hard copy of online material (including contact details, where applicable)	
6	Means and frequency of data provision	Description of how the data is provided (e.g. by e-mail, upload, shared data directory), how often, and when	Documentation - printed or hard copy of online material	What procedure is followed if the data is not provided as and when needed?
7	Data format(s) and expected values	Definition and description of the format(s) in which the data are to be supplied, and the expected range (if any) of values	Documentation - printed or hard copy of online material	What procedure is followed if the data is not provided to the specified format, or if the values are outside the expected range?
8	Data quality	Definition and description of the required data quality from Routes and collators, to ensure that the data provided is necessary, sufficient and sufficiently accurate to monitor asset robustness	Documentation - printed or hard copy of online material	What procedures are in place to monitor and ensure ongoing data quality? Is Route data quality monitored by CaRRT, or delegated to the collators?
9	Data processing and reporting	Documentation and description of the processes to be used to process the data for subsequent reporting - should be sufficiently clear to guide new users through the processes used	Documentation - printed or hard copy of online material	Demonstration of processes used for comparison with the available documentation
10	Identification and handling of non-compliant data	Description of criteria for identifying data that may contain errors or fails to meet the system requirements, and procedures for dealing with non-compliances, including error-checking built in to processes and tools, and procedure(s) for referring queries back to data source and timescales to be allowed for response. Description of measures in place for trend analysis	Documentation - printed or hard copy of online material (including contact details, where applicable)	Are procedures in place for amending (reducing) tolerance values as data and processes improve? Are all queries directed to/via the data collators, or is there any direct communication with the Routes, bypassing the collators?
11	Examples of processes used, referencing corresponding documentation	Talking through' of processes followed for the processing and collation of data	Process demonstration, linked to suporting documentation	
12	Copies of tools (if e.g. spreadsheets) used for aggregation and checking	Provision of copies of tools used (where they are 'portable', i.e. not part of e.g. Business Objects) for review and checking	Verification that tools work as intended, testing of sensitivity to inputs outside expected formats or ranges	
13	Internal review and audit procedures	Description of internal review and audit requirements, processes and frequencies; evidence that these are being met	Documentation of requirements and procedures - printed or hard copy of online material; records of audit activities, findngs and responses	
14	Process for dealing with data- and reporting-related queries from ORR	Description of procedures and timescales to be followed in response to queries from ORR; records of numbers of queries and outcomes, analysis of trends	Documentation - printed or hard copy of online material (including contact details, where applicable). Evidence of correspondence, including records of numbers of queries, distinguishing between errors and clarifications	

Appendix D

Enlarged Process Map for
Service-Affecting Failures


Fault Management System
TRUST
IDA22
Delay Attribution Guide
Duplicate Asset Incident if necessary
BO-PSS Oracle database
PSS Edits
Template provided to Route Performance Team
Justification of changes reviewed by Performance Data Quality Team
Daily data generated and distributed
Automatic save on share drive 4-weekly
Data checking by System Reliability Improvement Manager
Challenging the Routes and asking for feedback
Checking of correct use of delay codes by System Reliability
Data quality checks at Route level supported by national reports and guidance
Data extract on Service Affective Failures
Summary of dataset Excel format
Sent by email
Day 3 (Tuesday) of each period
Business review
Used in internal Periodic Executive and reporting
Support available from STE Reporting and Assurance Team
Processing the data by CaRRT
Draft CaRRT Report
Shared with Route teams and System Reliability Improvement Manager
Comment from Routes
CRI Report
Sent to ORR
Commentary from the Routes
Chief Engineers' Checks
Period 13 reported in Annual Return