Office for Rail and Road and Network Rail

#25525 Accuracy of maintenance reporting volumes

Final Report

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ARUP

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1 Executive Summary

1.1 Purpose of Study

Maintenance volumes are a key metric used by Network Rail to track their delivery against their Delivery Plan and for the Office of Rail and Road (ORR) to perform its duties in holding Network Rail to account for delivery under the Network Licence.

Network Rail and the ORR have commissioned Arup and Winder Phillips Associates (WPA) to review the reliability of maintenance volumes reporting in their role as one of Network Rail's Independent Reporters.

This study is focussed on reviewing the system reliability[1] of the processes for reporting maintenance work volumes, assessing the following assets at the network-wide level: Track, Off Track (lineside, drainage), Signalling, Telecoms, Overhead Line Electrification and Plant and Distribution. Checking / assessment of data accuracy was outside the scope of this review.

1.2 Overview

Network Rail is run through devolved regional businesses that operate, maintain, and renew infrastructure to deliver a safe and reliable railway for passengers and freight customers. The Regions support the Routes with a focus on operations to help improve train performance. There are 5 Regions, 14 Routes[2] and 38 Maintenance Delivery Units (MDUs) within them. It was agreed that this study would cover maintenance volume data management at a sample of 14 MDUs selected by Network Rail and ORR from across the 5 Regions and 13 Routes. The sample included at least one MDU in each of the 13 Routes.

Maintenance Volumes are a measure of work done against the asset register stored within its asset database, Ellipse. For each asset type tasks are specified and a volume unit, for example tamping is measured in yards or a simple count of one for a signal inspection. Volumes are vital to enable Network Rail to plan its workload for future years and monitoring them enables them to understand progress against the plan as well as providing assurance that the assets are being maintained in accordance with standards.

Our review of the maintenance volumes was based on evidence collated through documentation review (where available) and engagements with the selected MDUs and Network Rail HQ representatives.

Network Rail issues about 4.2 million[3] maintenance work orders annually. Typically, this means each MDU deals with between 80,000 and 150,000 work

[1] System reliability is a measure of the overall reliability, quality, robustness and integrity of the system that produces the data (see SoW in Appendix A)
[2] For this study Network Rail High Speed Route (HS1) was outside scope – i.e. MDUs at 13 of the 14 Routes were sampled.
[3] Estimate based on 3.52 million work orders in Ellipse for periods 1-11 in 2021/22

orders per year, or up to 3,000 per week. Each work order is assigned to a job code, and there are several thousand job codes although around 600 job codes cover 90% of work orders.

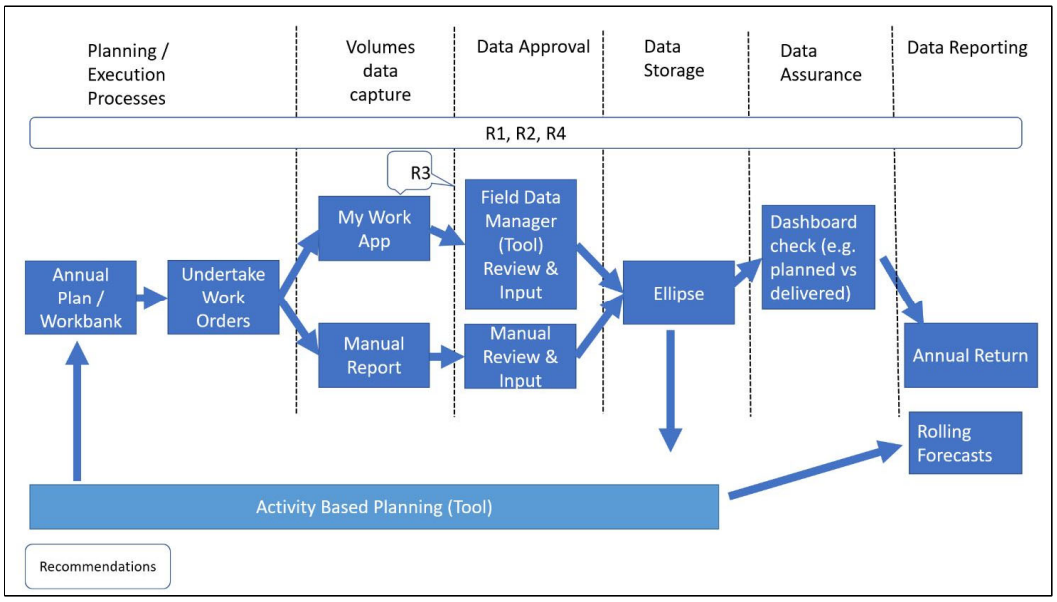
1.3 Summary of process and assurance

There are high level processes that MDUs follow to record, report, and assure data relating to maintenance volumes, which seek to enable Network Rail to plan their forward workload, verify the resources required to undertake this workload, and provide assurance to ORR of reported maintenance volumes information.

These activities depend on accurate and assured data. For this review we have summarised Network Rail's system as a simplified data flow depicted in Figure 1 below where data moves through a series of 'stages' from planning through to final reporting and application.

The planning processes used by Network Rail for maintenance volumes are an important facet of the quality assurance elements of data management, and much of the checking of accuracy of volumes data is actually a bi-product of Network Rail's arrangements for monitoring the delivery of their planned maintenance.

Figure 1: Simplified Representation of Data Flows through stages



The key stages are:

Volumes Data Capture – the majority of maintenance tasks are commissioned by work orders, around 85% of which are issued electronically to hand-held mobile devices used by relevant maintenance staff, Supervisors and Managers. The tasks not supported by an MDU work order relate to work not commissioned by the MDU, some high-value tasks completed by strategic plant (ballast cleaning, stone blowing, tamping etc), some works undertaken by contractors, and some reactive tasks undertaken on call-out. Most of these works will be recorded manually, with paper copy submitted to the MDU.

The IT platform used for issuing work orders and completing the 'Work Undertaken' section of the order is an application called My Work. The order will specify the work to be undertaken, where, on what asset, the nature of the task and the relevant volume to be recorded. Many of these tasks are Maintenance Scheduled Tasks (MSTs) – routine, cyclical activities, including asset inspections where the recorded volume will be 'zero' (if not carried out for some reason) or 'one' (if undertaken).

The work undertaken and volume recorded will usually be entered in real time by the work Supervisor, during or at the end of the shift, and the volume recorded will usually be as specified on the order. The order will then be submitted online by the Supervisor. The Supervisor may vary the volume recorded as undertaken – often in 'Off Track' situations where fencing repairs or vegetation clearance require more or less work than specified – and the Supervisor may qualify his work undertaken with comments recorded on the work order.

The My Work App is used by up to about 300 staff in each MDU. It has few inbuilt checks on the accuracy of input data although a recent development highlights variations between the delivered and planned volumes on a work order of greater than 25%. This was welcomed by the MDUs and some suggested further intelligent checks would be beneficial. Network Rail is planning further developments of the My Work App in 2022 and 2023.

Data Approval – work orders submitted in My Work App are transferred into a system called Field Data Manager (FDM) and reside there until opened for review, checked for accuracy, and any variances from specified activity or volume are clarified and cleared, and any comments responded to.

This assurance is usually a daily task for Section Planner/Managers, or occasionally MDU Data Specialists. Many routine work orders and tasks can be 'bulk approved' for entry into the asset management database Ellipse, where the data and volume are as specified, there are no variations between planned / specified and actual, and there are no comments on the order. Where this is not the case, bulk sign-off and approval is not permitted, and each such order has to be reviewed and approved individually before entry into Ellipse.

Data Storage – once data has been transferred into Ellipse, there is a further stage of assurance in the MDU maintenance team's Plan Do Review (PDR) meeting to review and plan maintenance interventions. There is no laid-down process requirement for this meeting to review the maintenance data quality in Ellipse, but most MDUs undertake these opportunities to fix outliers in the PDR weekly meeting chaired by the Maintenance Engineer or Section Manager. In most cases, this is the final element of the volumes review process at the MDU to improve volume data quality at the work order level, with the Maintenance Delivery Manager (MDM) 'signing off' on all the elements of work.

Data Assurance - the MDUs, Routes and in some cases Regions have developed bespoke tools and dashboards to assist in this assurance. Many aggregate work orders into standard jobs which it makes it more difficult to identify individual work order volume errors. Any errors that are identified are corrected in Ellipse.

In addition, Network Rail HQ have produced a Power BI dashboard that is issued to about 320 users across the MDUs / Routes and Regions every period. This has a recent development to drill down into work orders. The HQ team has now started monitoring the dashboard usage. Since the start of January 2022, this HQ Power BI dashboard has had a total of 88 viewers who made a total of 1,399 views.

As part of the final data reporting for the Annual Return and Rolling Forecasts, Network Rail undertakes further data assurance and checking. This is outlined below.

Data Reporting – as well as being used for producing Network Rail's dashboards, the maintenance volumes data in Ellipse is used for other internal and external reporting purposes.

Network Rail report the annual volumes delivered against those planned in its Annual Return to ORR for 73 standard jobs. This is produced by the central Business Planning, Analysis and Reporting team. The process for compiling and assuring the data starts in period 12 of the reporting year and completes in period 2 of the following year. The team prepare figures in the reporting template from data in Ellipse and send to the Regions who need to check actual versus planned figures, make any corrections to the Ellipse dataset so the figures can be updated or provide commentary on the reasons for any variation. In this way, the reported volumes reflect the data in Ellipse.

Network Rail also produce Rolling Forecasts in periods 4, 8 and 11 as part of the Activity Based Planning process, presenting work undertaken to date and forecasts for the remaining years in Control Period 6. The MDUs are responsible for producing the figures with assurance provided at Route, Region and National levels. The figures are presented as volumes, hours and costs by discipline in a dashboard. Maintenance "work arising" volumes are uncertain by their nature and Network Rail forecast future levels by analysing historic "work arising" volumes; we were informed this process can result in errors being identified in the historic data which are then corrected in the Ellipse dataset.

1.4 Key Findings and Conclusions

1.4.1 National Level Findings

The broad process described above is followed for each asset type. There are minor variations in how the data is captured, whether manually or by the My Work App, but variations are more driven by MDU local practices than they are by the standard process; for example, some MDUs/Routes manually input tamping volumes because more planning of the on-track machinery is required often involving third parties who do not have access to My Work App.

We interviewed a sample of 14 MDUs and we found significant process and procedure differences between Routes. These differences at Route MDU level in the sample make it difficult to identify overall trends that can be 'aggregated' up to Region level. Further interviews with the MDUs (both those in the current sample and the remaining MDUs) are recommended if such a view is required.

A high-level analysis using the national Power BI dashboard suggests that the number of work order volumes corrected in Ellipse is relatively small, perhaps about 2,000 per period (0.62% of work orders). Further, 99.25% of work orders input for periods 1 to 11 have matching planned and delivered volumes (which is the main check carried out).

Our review has not identified a Network Rail wide approach to systemically capturing inaccurate reporting of maintenance volumes at National, Regional, Route or MDU levels.

The reliability of the system for recording and reporting maintenance volumes depends to a large extent on the experience of key staff in the MDUs and Routes. Whilst the processes for planning, recording and reporting volumes are understood at a high level, there is an absence of detailed documentation. This presents a risk to training new staff as well as to consistent application of the arrangements which assure data accuracy.

A number of dashboards and reports have been produced that are tailored to local use in MDUs, Routes and some Regions for assurance of the data stored in Ellipse. There is a potential to share best practice to upskill assurance practice nationally.

The national dashboard is provided every period – providing documented guidelines in its use would help users target its use most effectively, for example to remove (the very few) negative volumes. It might also be helpful to track corrections made in Ellipse to help identify where additional training might be required in the Data Capture and Approval stages.

The checking/assurance processes of the volumes data at all stages of the process are primarily focussed on ‘Plan versus Actual’ and not on the accuracy of the volume data against what was actually delivered on site. We found no evidence of internal auditing to check this accuracy.

Additional assurance is undertaken by Network Rail at the data reporting stage – for example the Annual Return assurance focuses on the planned versus actual volumes and can result in changes to records in Ellipse. A review of the log of ORR queries and subsequent investigation by Network Rail found a few instances of mis-coding of jobs in the figures submitted in the Annual Return.

We would expect that errors should be picked up most efficiently in the ‘Volumes Data Capture’ and ‘Data Approval’ stages prior to data storage in Ellipse. Areas for improvement in these two stages could be:

- Updating training material for the 3,000 users of My Work App (we understand this is being planned by Network Rail);
- Adding additional ‘intelligent’ checks to the My Work App to highlight potential coding errors;
- Adding tools and intelligence checks to help identify ‘at risk’ work orders for manual checking in FDM and help track and analyse causes of errors in data capture.

There is scope to improve the recording of Work Arising volumes so it clearly distinguishes between preventative maintenance and reactive fault fixing. This would provide greater understanding of the asset performance and help future planning.

1.4.2 Region Level Findings

In addition to the national level findings and conclusions set out above we have summarised the identified Region-specific findings (where appropriate), in table 1 below:

Table 1: Regional Level Findings

Region	Specific Additional Findings / Comments
Eastern	No significant Region-led assurance of volumes data identified. However, some Route-led assurance including: daily Ellipse data quality checks and weekly Power BI tools of Plan versus Actual volumes in East Coast South Route as examples of good practice; and East Midlands Route starting to write step-by-step process guides; sharing of SSM resource across MDUs within some Eastern Routes
North West & Central	No significant Region-led assurance of volumes data identified. West Coast Route South Route-led support team provide MDU documentation on the ABP process and have implemented a Power BI tool to monitor progress of volumes delivery against the plan
Scotland's Railway	Route and Region is the same in this case. The Scotland Region has implemented regular checks with their MDUs, proactively checking the completeness of asset inspections in order to reduce asset-related safety risks and improve maintenance volume data quality. They have developed a report of missing planned inspections for MDUs.
Southern	Southern Region have developed a resourced asset data management programme with clear accountabilities and responsibilities. It has developed various assurance reports including compliance of inspections carried out against asset policy standards and other KPIs. There is also an asset data community where issues can be logged and prioritised.
Wales and Western	MDUs make use of Network Rail HQ's national dashboard. Some assurance is provided by Route.

1.5 Confidence Grading and Recommendations

Given all the asset types we reviewed follow the same process for recording and reporting maintenance volumes, we have assessed all as having the same confidence grade for system reliability. The A to D confidence grading provided to us and defined in Appendix B is generic. We therefore have considered a number of requirements of system reliability and graded each one separately

according to the following guidelines which are broadly consistent with Appendix B:

A – fully meets requirement
B – mostly meets requirement with few exceptions
C – partially meets requirement but risk of any exceptions is considered to be limited
D – largely / fully fails to meet requirement with significant risk of exceptions

Based on this assessment, we have assessed the system reliability for the recording and reporting of delivered maintenance volumes at the network-wide level as 'C'. With regards to the reliability of the annual network-wide maintenance volumes reported within the 2020-21 Annual Return, we note these figures are derived from those recorded in Ellipse. There are additional assurance activities in producing the reported figures but they are undocumented. We therefore consider a reliability rating of C is also appropriate for the production of the network-wide maintenance volumes in the 2020/21 Annual Return.

To improve system reliability, we have made four recommendations shown in table 2 below. In our opinion, the most important is the first one: to produce a national framework for maintenance data management and reporting in order to promote consistency, best practice across all MDUs, Route and Regions and continuous improvement. This could be based on the Southern Region Data Improvement Plan and take best practice from elsewhere.

This framework would seem to fit in well with Network Rail's existing Governance Risk Assurance Improvement (GRAI) programme which is aiming to:

- Produce a robust framework for a complex, devolved business
- Put in place systems and processes to help manage work effectively, and
- Share learning to improve efficiency and safety

Maintenance will be looked at this year within the programme. Of particular relevance to maintenance volumes is the process "Develop, deploy and manage maintenance productivity systems and processes" which is due to be developed and published in June this year.

Table 2: Recommendations

Reference Number	Recommendation Theme	Recommendation	Benefits	Evidence of Implementation	Location in Text	Owner
SOW25525-1	National framework for maintenance data management and reporting	Put in place a network wide framework led by the Centre with clear responsibilities, and documentation of definitions, standards and processes. This could be based on the Southern Region Asset Data Management plan[4]. As described in section 8.2, this should set out as a minimum: • Purpose of reporting • Clear definitions of each metric • RACI ○ Clarity on responsibilities at Centre, Region, Route, MDU • Planning Process • Data processing arrangements at each stage	Consistent standards and reliability across all Regions, Routes and MDUs	Programme put in place to develop framework with clear delivery plan; regularly reviewed on its effectiveness and updated accordingly	8.2	Network Rail

[4] Southern Region Data Improvement Plan, Network Rail, 06/01/22

		○ Standardised training requirements • Quality assurance requirements including use of standardised reports • Reporting arrangements ○ External ○ Internal				
SOW25525-2	Best practice forum	Share best practice and lessons learned on data processing and assurance. Include consideration of good practice tools listed in Appendix D.	Sharing of tools and experience to improve data quality and a forum to feedback suggestions and requirements within the overall framework programme. Use of technology (e.g. Microsoft Teams) makes this an efficient process. Success to be measured by wider use of best practice tools which are continually improved	Managed forum set up and operational	8.2	Network Rail
SOW25525-3	Intelligent systems checks	Within the overall systems assurance process for managing maintenance volumes data, incorporate simple checks in the various tools e.g. My Work App to filter out / query unexpected input data	Reducing errors in the processes for data capture and data approval	Collection of recommendations from MDUs; completion of recommendation implementation; review success with users and ideas for continued improvement	7	Network Rail

SOW25525-4	Reporting of maintenance volumes	Implement changes to the recording of all volumes data to improve the ability to distinguish between planned volumes for preventative maintenance and faulting volumes	Ability to separate the volume data will better allow the root cause of any discrepancies to be determined and provide more granularity for intelligent interrogation. E.g. if most volumes for an asset are fault volumes and not planned maintenance, this may have a detrimental impact on the condition/performance of assets.	Development of reports of separate volumes	3.2.7	Network Rail

1.6 Acknowledgements

The Independent Reporter Team would like to thank both ORR and Network Rail staff for their assistance with this study. We are particularly grateful to staff involved in the MDU meetings who made time available at short notice in the busy run-up to Christmas.

2 Introduction

2.1 Background

Maintenance volumes are a key metric used by Network Rail to track their delivery against their Delivery Plan and for the Office of Rail and Road (ORR) to perform its duties in holding Network Rail to account for delivery under the Network Licence.

Network Rail and the ORR have commissioned Arup and Winder Phillips Associates (WPA) to review the reliability of maintenance volumes reporting in their role as one of Network Rail's Independent Reporters.

This study is focussed on reviewing the system reliability[5] of the processes for reporting maintenance work volumes, assessing the following assets at the network-wide level: Track, Off Track (lineside, drainage), Signalling, Telecoms, Overhead Line Electrification and Plant and Distribution. Checking / assessment of data accuracy was outside the scope of this review.

2.2 Mandate Aims and Requirements

The objectives of this review were to:

- Review and comment on the processes and procedures by which Network Rail captures and assures data (including the effectiveness of Regions' own assurance regimes);
- Review all relevant documentation and systems and comment on their fitness for purpose;
- Review and comment on the reliability, quality, consistency and completeness of reported data;
- Present a confidence grading for the system reliability for each metric under review based on the end of year dataset (2020-21); and
- Make prioritised recommendations addressing how the existing process might be improved (recommendations should be cognisant of the inflight improvement programmes).

Specifically, the recommendations should:

- Review the application of the existing data governance processes and policies; understand how Network Rail systemically captures inaccurate reporting and provide recommendations on how Network Rail can improve capture of inaccurate reporting across the maintenance information management system (not limited to Ellipse); and

[5] System reliability is a measure of the overall reliability, quality, robustness and integrity of the system that produces the data (see SoW in Appendix A)

- Provide feedback and recommendations on how Network Rail can structure its maintenance information processes, documentation, and governance into an information management system.

2.3 Our Approach

The approach that we adopted for this study was designed to provide an assessment of Network Rail's reporting processes, procedures, and governance. Our approach is summarised in Figure 2.

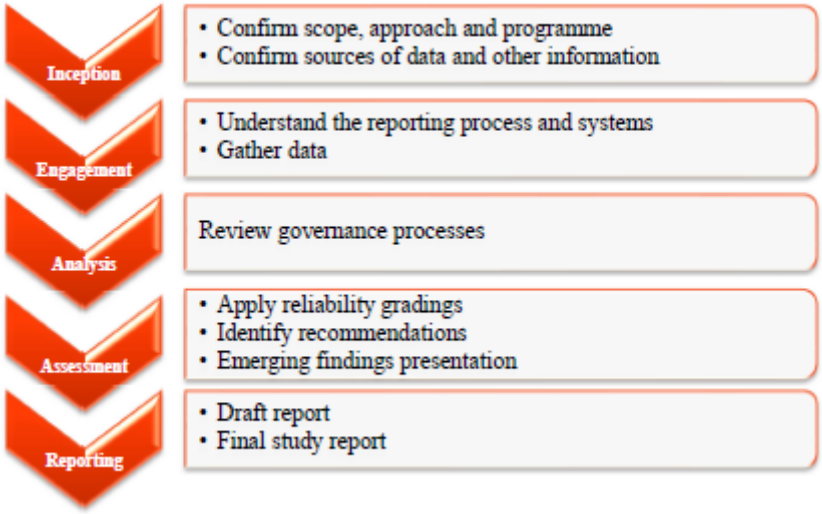


Figure 2: Summary of Review Approach

Most of Network Rail's maintenance activity is carried out by 38 Maintenance Delivery Units (MDUs) located across the network. Each MDU is part of a Route and each Route is part of a Region.

In the inception phase we agreed with Network Rail and ORR to review 14 MDUs. ORR and Network Rail selected these as being representative of all Regions and covering all asset types. They are shown in table 3 below. Each review took the form of a meeting with MDU, Route and Region representatives and followed a structured agenda covering the processes, documentation, and assurance of the maintenance volumes data.

Table 3: MDUs selected for review

Region	Route	Delivery Unit	Selected
Eastern	Anglia	IMDM Ipswich	
Eastern	Anglia	IMDM Romford	
Eastern	Anglia	IMDM Tottenham	✓
Eastern	East Coast	IMDM EC North Darlington	
Eastern	East Coast	IMDM EC North Newcastle	
Eastern	East Coast	IMDM EC South Doncaster	✓
Eastern	East Coast	IMDM EC South Kings Cross	✓
Eastern	East Coast	IMDM EC South Peterborough	
Eastern	East Midlands	IMDM Bedford	
Eastern	East Midlands	IMDM Derby	✓
Eastern	North East	IMDM N&E Central Leeds	
Eastern	North East	IMDM N&E Central Sheffield	
Eastern	North East	IMDM N&E North Middlesbrough	
Eastern	North East	IMDM N&E North York	✓
North West and Central	Central	IMDM Saltley	✓
North West and Central	Central	IMDM Sandwell & Dudley	
North West and Central	North West	IMDM Lancs and Cumbria	
North West and Central	North West	IMDM Liverpool	
North West and Central	North West	IMDM Manchester	✓
North West and Central	WCML South	IMDM Bletchley	✓
North West and Central	WCML South	IMDM London Euston	
North West and Central	WCML South	IMDM Stafford	
Scotland's Railway	Scotland	IMDM Edinburgh	
Scotland's Railway	Scotland	IMDM Glasgow	✓
Scotland's Railway	Scotland	IMDM Motherwell	
Scotland's Railway	Scotland	IMDM Perth	
Southern	Kent	IMDM Ashford	✓
Southern	Kent	IMDM London Bridge	
Southern	Kent	IMDM Orpington	
Southern	Sussex	IMDM Brighton	
Southern	Sussex	IMDM Croydon	✓
Southern	Wessex	IMDM Wessex Inner	
Southern	Wessex	IMDM Wessex Outer	✓
Wales and Western	Wales	IMDM Cardiff	✓
Wales and Western	Wales	IMDM Shrewsbury	
Wales and Western	Western	IMDM Western Central	
Wales and Western	Western	IMDM Western East	
Wales and Western	Western	IMDM Western West	✓

Given this was the first time that this data had been reviewed by an Independent Reporter, the first two MDUs were treated as a pilot exercise to trial and set the agenda for the remaining MDUs. Most meetings took place virtually via Microsoft Teams. The full list of meetings, including with ORR and Network Rail HQ, are listed in table 4 below.

Table 4: Meetings held during the review

Date	Purpose	Who
18/10/21	Inception Meeting	Core NR-ORR team and project team
21/10/21	Follow-on meeting with ORR	Core ORR team and project team
27/10/21	Follow-on meeting with NR	Core NR team and project team
10/11/21	IMDM EC South Doncaster Engagement	MDU representatives and project team
19/11/21	IMDM Cardiff Engagement	MDU representatives and project team
30/11/21	IMDM Glasgow Engagement	MDU representatives and project team
03/12/21	IMDM N&E North York Engagement	MDU representatives and project team
07/12/21	IMDM Derby Engagement	MDU representatives and project team
07/12/21	IMDM Bletchley Engagement	MDU representatives and project team
07/12/21	IMDM Western West Engagement	MDU representatives and project team
10/12/21	IMDM Ashford Engagement	MDU & Regional Asset Management representatives, and project team
13/12/21	IMDM Croydon Engagement	MDU & Regional Asset Management representatives and project team
15/12/21	IMDM Tottenham Engagement	MDU representatives and project team
15/12/21	IMDM Saltley Engagement	MDU representatives and project team
1512/21	IMDM EC South Kings Cross Engagement	MDU representatives and project team
16/12/21	IMDM Wessex Outer Engagement	MDU & Regional Asset Management representatives and project team
17/12/21	IMDM Manchester Engagement	MDU representatives and project team
Multiple	Bi-weekly progress meetings	Core NR-ORR team and project team
13/01/22	Clarification meeting with NR	Core NR team and project team
20/01/22	Emerging Findings meeting	Core NR-ORR team, MDU representatives and project team
25/02/22	Review HQ reports	Core NR-ORR team and project team
01/03/22	Review HQ reports and Annual Return	Core NR team and project team

03/03/22	Review Governance Risk Assurance Improvement (GRAI)	Core NR team and project team

Following the engagement meetings, the Reporter Team were supplied with data and information from which to undertake our review. A full list of files supplied is included in Appendix C.

2.4 Context to Maintenance Volumes Reporting

In this report we describe how volumes of maintenance work and inspections are recorded in Network Rail. Here we provide some context.

Each MDU is responsible for the maintenance and inspection of the assets on the sections of Route and types of assets it covers. For example, the East Coast South Route has three MDUs, each of which is responsible for the assets shown in table 5.

Table 5 Assets at each MDU (East Coast South)

MDU	Number of assets
Doncaster	33,002
Kings Cross	30,227
Peterborough	21,342
Total for Route	**84,571**

Each maintenance and inspection task to be carried out is set out in a work order. Typically, there can be between 80,000 and 150,000 individual work orders per year in an MDU, or up to 3,000 per week. Last year some of the tasks were cancelled due to Covid-19. This is illustrated in table 6 below by the lower numbers of work orders in 2020/21 at each of the three MDUs on East Coast South.

Table 6: Number of Work Orders in 2020/21 at each MDU (East Coast South)

MDU	Number of work orders
Doncaster	62,467
Kings Cross	44,318
Peterborough	27,736
Total for Route	**134,521**

Most work orders are processed electronically on site by Network Rail using a data capture tool called 'My Work App'. There are about 8,000 users of My Work App nationally with each depot having up to 300 users. Again, using the three MDUs on East Coast South as an example, the number of users is shown in table 7.

Table 7: Number of My Work App users

MDU	Number of My Work App users
Doncaster	239
Kings Cross	250
Peterborough	143
Total for Route	**632**

Work orders cover planned inspections and maintenance as well as fixing faults. There are several thousand Standard Job Codes to which tasks have to be assigned. However, of these about 600 are in regular use and 73 are reported each year in the Annual Return[6] as shown in table 8 below.

[6] Volumes for the 2021 Annual Return can be found in table 39: Network-Rail-Infrastructure-Limited-annual-return-data-tables-2021.xlsx (live.com)

Table 8: Maintenance Volumes for 2020/21, taken from Annual Return, table 39

Coverage	Standard Job No. and description (Unit of measurement)	2020/21
Network-wide	001436 - INSTALL CABLE IN TROUGHING (Yards)	5,927
Network-wide	001444 - OLG - CAB PATROL INSP (Each)	1,933
Network-wide	001445 - OLG - E01 FOOT PATROL (Each)	10,453
Network-wide	001560 - CON RAIL-REPLACE INSULATOR (Each)	29,483
Network-wide	001782 - S/GEN C EXAM [M] (No.)	6,986
Network-wide	002663 - INVESTIGATE / TEST-PLANT-FAULT FOUND (Hours)	9,352
Network-wide	003177 - OLG- PRE ISOLATION RISK ASSESSMENT (Each)	3,410
Network-wide	004204 - OLG-ISOL FOR MTCE ACTIVITIES (Each)	9,976
Network-wide	004205 - OLG-ISOL FOR 3RD PARTIES-INC EMERG SVC'S (Each)	4,055
Network-wide	004508 - OLG-ISOL FOR OTHER NETWORK RAIL PROJECTS (Each)	123
Network-wide	004714 - OLG-INSP-PRE WORK FAMILIARISATION (Each)	2,369
Network-wide	005026 - DISTRIBUTION-WORK ARISING-REPAIR (Hours)	27,450
Network-wide	005101 - S&T ATTENDANCE FOR ENGINEERING WORK (Hours)	28,927
Network-wide	006000 - FPL TEST (CLAMP LOCK) (Point End)	50,000
Network-wide	006004 - FPL TEST (MACHINE) (Point End)	41,985
Network-wide	006335 - TRACKSIDE APPARATUS CASE (Service)	119,272
Network-wide	006336 - TRACKSIDE APPARATUS CASE (Service)	55,985
Network-wide	006374 - CLAMP LOCK HYDRAULIC POINTS (Service)	29,959
Network-wide	006377 - POINT MACHINE - HW STYLE (Service)	26,979
Network-wide	006393 - POINTS SUPPLEM'RY DRIVE - MECHANICAL (Service)	47,562
Network-wide	006395 - POINTS - SWITCH ROLLERS (Service)	45,622
Network-wide	006687 - POINT INSPECTION (Service)	79,589
Network-wide	006849 - POINT FITTINGS - MAINTAIN [C] (Service)	83,172
Network-wide	006989 - PSB TECH MISC WORK (Hours)	92,926
Network-wide	009001 - TEF3015. PATROL TRACK ON FOOT (Miles)	376,453
Network-wide	009050 - TEF3041. RECORD TRACK GEOMETRY MANUALLY (Yards)	4,216,963
Network-wide	009059 - LUBRICATE JOINTS USING SMALL PLANT (Rail joints)	218,059
Network-wide	009062 - TEF3010. STRESS WELDED RAILS (Track yards)	429,938
Network-wide	009065 - TEF3006. WELD STANDARD RAIL GAP (Each)	17,697
Network-wide	009076 - REPLACE DEFECTIVE WELDED RAIL (Rail yards)	109,336
Network-wide	009112 - TEF3071. TAMP TRACK USING OTM (Miles)	6,288
Network-wide	009113 - TEF3071. STONEBLOW TRACK USING OTM (Miles)	3,884
Network-wide	009116 - LIFT PACK WELDED TRACK USING HAND TOOLS (Track yards)	172,774
Network-wide	009119 - UNLOAD BALLAST USING TRAIN (Tonnes)	213,121
Network-wide	009121 - REGULATE BALLAST USING HANDTOOLS (Rail yards)	1,520,836
Network-wide	009128 - TEF3071. TAMP S&C USING OTM (Point End)	2,944
Network-wide	009138 - LUBRICATE SLIDE CHAIRS USING HANDTOOLS (Point End)	257,931
Network-wide	009200 - AUTHORISED ACCESS POINT - MAINTAIN (Each)	51,324
Network-wide	009215 - INSTALL ESR/TSR EQUIPMENT (Each)	12,427
Network-wide	009216 - REMOVE ESR/TSR EQUIPMENT (Each)	12,391
Network-wide	009225 - TRANSPORT MATERIALS USING TROLLEY (Hours)	62,960
Network-wide	009236 - CHAMBER MAINTAIN MANUAL (Each)	15,513
Network-wide	009276 - BOUNDARY - ROUTINE INSPECTION (22 - 220 yards (1/8th mile))	235,909
Network-wide	009280 - BOUNDARY - MAINTAIN POST & WIRE (Yards)	604,820
Network-wide	009287 - BOUNDARY - MAINTAIN VERTICAL BAR 1 (Yards)	28,903
Network-wide	009308 - LIFT PACK WELDED TRACK WITH SMALL PLANT (Track yards)	307,606
Network-wide	009309 - MEASURE SHOVEL PACK CWR TRACK (Track yards)	339,361
Network-wide	009319 - CULVERT MAINTAIN MECHANICAL (Yards)	21,877
Network-wide	009322 - PIPE MAINTAIN MECHANICAL (Yards)	217,223
Network-wide	009323 - PIPE MAINTAIN MANUAL (Yards)	81,323
Network-wide	009326 - CHAMBER MAINTAIN MECHANICAL (Each)	7,254
Network-wide	009328 - UNLINED CHANNEL MAINTAIN MANUAL (Yards)	211,813
Network-wide	009425 - STONEBLOW S&C USING OTM (Point End)	242
Network-wide	009579 - REGULATE TAMPED BALLAST (Track yards)	414,558
Network-wide	009616 - DRAINAGE SYSTEM CONDITION INSPECTION (Miles)	7,322
Network-wide	009636 - LIFT PACK WELDED TRACK WITH SMALL PLANT (Track yards)	164,586
Network-wide	009656 - VEG CHAINSAW FELL & PROCESS TREE (Square metres)	4,358,050
Network-wide	009663 - VEG MANUAL STRIM/BRUSHCUT (Square metres)	8,666,871
Network-wide	009664 - VEG HIGH PRUNER (Square metres)	2,043,255
Network-wide	009667 - VEG SIGNAL SIGHTING (Square metres)	1,956,143
Network-wide	009668 - VEG LEVEL CROSSING SIGHTING (Square metres)	6,053,710
Network-wide	010000 - BS7671: ELECTRICAL INSTALLATION TEST (Each)	5,746
Network-wide	010006 - SW HTR-STRIP F EXAM (Each)	13,696
Network-wide	010007 - SW HTR-STRIP C1 EXAM & TEST (SEASONAL) (Each)	31,693
Network-wide	010010 - SW HTR- 110V INSUL RES TEST (Each)	10,425
Network-wide	010126 - UNOCCUPIED BUILDING MAINTENANCE D EXAM (Each)	10,224
Network-wide	010199 - OLG-HEIGHT AND STAGGER RECORDING (Span)	39,854
Network-wide	010200 - High Level Intrusive Insp All Types OLA (Span)	44,468
Network-wide	010217 - SERVICE A M001 (Each)	8,755
Network-wide	010218 - SERVICE B M001 (Each)	7,859
Network-wide	010232 - INT CABLE SERVICE - M005 (Each)	179
Network-wide	012100 - OLG-APPLY-CANCEL ISOLATION (Each)	28,217
Network-wide	012186 - CLEAR VEGETATION ENCROACHING OLE (Yards)	165,996

2.5 Report Structure

The rest of this report is structured to address each of the aims in the mandate before presenting the Reporter team's conclusions and recommendations.

- Section 3 outlines the processes and procedures adopted in the reporting of maintenance volumes
- Section 4 reviews the documentation and systems in place for the recording of the maintenance volumes
- Section 5 reviews the reliability, quality, consistency and completeness of reported data;
- Section 6 presents a confidence grading for the system reliability for reporting maintenance volumes;
- Section 7 describes areas for improvement, those planned by Network Rail, suggestions made to us by the MDUs, and our own observations; and
- Section 8 describes our conclusions and recommendations from the review.

2.6 Glossary of Terms

Table 9 below provides a description of the standard rail industry acronyms and abbreviations that are used in this report.

Table 9: Glossary of Terms

Abbreviation	Description
ABP	Activity Based Planning
CP6	Control Period 6
FDM	Field Data Manager
IBJ	Insulated Block Joints
IMDM	Infrastructure Maintenance Delivery Manager
IME	Infrastructure Maintenance Engineer
IRJ	Insulated Rail Joints
MDM	Maintenance Delivery Manager
MDU	Maintenance Delivery Unit
MST	Maintenance Scheduled Tasks
NR	Network Rail
ORR	Office of Rail and Road
PLPR	Plain Line Pattern Recognition
RACI	Responsible, Accountable, Consulted, and Informed
RAMs	Route Asset Manager
SSM	Systems Support Manager
TAR	Train Accident Reduction
WAIF	Work Arising Information Forms
WPA	Winder Phillips Associates

3 Review of process and procedures

3.1 Overview

Based on the meetings with the Maintenance Delivery Units and Network Rail HQ teams, the Reporter Team has developed an understanding of the high-level process broadly followed for the management and reporting of maintenance volumes. This is summarised below.

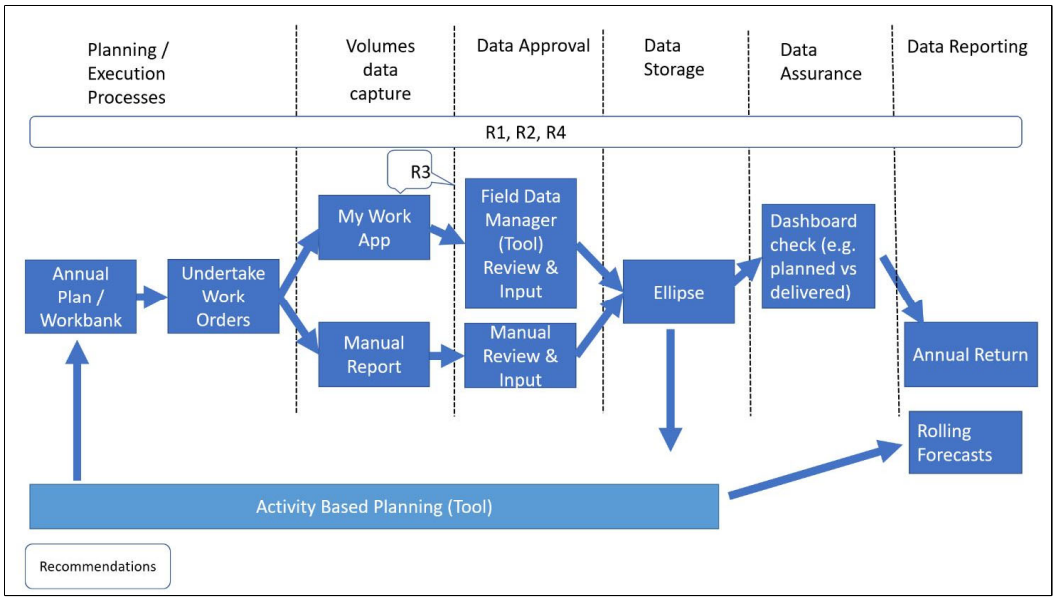


Figure 3: Process for management of maintenance volumes data

There are five main stages to the processing of volumes data starting from data capture through data approval, data storage, data assurance and data reporting. These stages are described in this section. We describe the assurance activities carried out, many of which focus on checking the delivered volumes against those that have been planned. As such, the reporting and assurance of delivered volumes data is closely linked to the Activity Based Planning (ABP) activities which are described at a high level.

Key Roles in Volumes Process

There are a number of key roles involved in the management of maintenance volumes data. The following is a brief description of the main roles, many of which are summarised in the Maintenance Planning Handbook NR/L2/MTC/PL0175 – Module 1.

Infrastructure Maintenance Delivery Manager (IMDM) – heads up the MDU team with overall accountability for delivery of maintenance work. This involves signing off the annual maintenance plan and managing delivery.

Infrastructure Maintenance Engineer (IME) – works with the engineering disciplines to develop the annual plan and accountable for creating the work plan for delivery. Reviews delivery of the planned volumes.

MDU Engineers – key role to ensure the maintenance volume data integrity, developing the annual delivery plans based on the relevant engineering requirements and monitoring delivery.

Section Managers – key role approving maintenance volume data, responsible for the delivery of volumes and sign off the work completed within Field Data Manager (FDM).

Section Planners – key role approving maintenance volume data, undertaking detailed work planning based on the cyclic, remedial and reactive requirements. Sign off actual volumes in FDM and enter manual volumes directly into Ellipse.

Frontline Workforces – responsible for the delivery of actual work and closing the work order using My Work App. This is one of the key roles for capturing maintenance data.

System Support Managers – key role in the monitoring of volumes delivery and producing reports to support IME/MDU Engineers and Section Managers on progress. The role in some places sits at Route level and works across a number of MDUs (eg on East Coast South it covers three MDUs), whilst in some places the role is specific to a MDU.

Finance Controller/Finance Partner – Responsible for reviewing affordability of maintenance plans and monitoring delivery costs.

Asset Data Governance Function in Route or Region – Regional or Route team to oversee the data governance and coordinate the data quality improvement activities.

To understand what specific interactions with volume data apply across the sample MDUs, a template was completed to capture the various roles involved within the process and the frequency with which they handle the volumes related data. This was carried out at 12 of the MDUs and is presented in the table 10 below.

Table 10: Roles involved in volumes process

Delivery Unit	Section Planner	Section Manager	Systems Support Manager	Maintenance Engineer	Infrastructure Maintenance Service Manager	Infrastructure Maintenance Engineer	Infrastructure Maintenance Delivery Manager	Head of Asset (Route)	Area Service Manager	Infrastructure Director (Head of Maintenance)	Route Director	Asset Engineer (Asset Management)	Route Asset Manager (Asset Strategy Manager)	Route Asset Data and Analysis Manager	Head of Asset Management	Regional Asset Engineer	Director of Asset Management	Director of Engineering and Asset Management	Finance Partner	Head of Reporting and Analysis	Route Finance Director	Regional Finance Director	HQ
IMDM 01	W	W	D	W	P	W	RF		P	RF	RF	P	P	AH			P	P	W		RF	RF	RF
IMDM 02	D	D	AH	W	P	P	P			P		P	P						A	P			RF
IMDM 03	W	W	W	W	P	W	A						P						P				RF
IMDM 04	W	D	D	D		D	P				P								P	P	P		RF
IMDM 05	W	W	P	P		P	P		RF	RF	RF		P						RF		RF	RF	RF
IMDM 06	D	D	W	W	W	W	P		P	P	P	P	P						W		P		RF
IMDM 07	W	W	P	W	W	W	P	RF	W	RF	P	W	P						P		RF	RF	RF
IMDM 08	D	D	D	W	W	P	P			P		RF	RF	P					RF		RF		RF
IMDM 09	D	D/W	A	W		W/P	P												AH				RF
IMDM 10	D	D	W/P	W/P		P	P	AH			P	P							P				RF
IMDM 11	D	D	W	W	W	W	P			P		RF	RF						RF		RF		RF
IMDM 12	W	W	W	P	P	P	P		RF	RF			P	P					P		P		RF

D = Daily, W = Weekly, P = Periodic, RF = Rolling Forecast Process

This shows that whilst there are consistent themes, there are differences in the way tasks are carried out and the periodicity followed. For example, at IMDM 01, the System Support Manager typically handles the volume data daily whereas at IMDM 06 the System Support Manager does so on a weekly basis. There is also variation in the way that the management of the data is undertaken which is discussed further below.

3.2 Description of process

3.2.1 Volumes Planning

The planning of maintenance volumes is an important element of the management of the delivered volumes data and is a precursor to the five key stages in the volumes data processes. Firstly, the process of planning itself involves producing forecasts for some maintenance activities which relies on accurate historic volumes. If errors are identified in the historic data during this process, then we were informed they are corrected in Ellipse. Secondly, the planned volumes then become the main benchmark against which delivered volumes are compared in the assurance activities for accuracy and completeness, so it is important the planned volumes are accurately recorded and reported to enable this assurance.

There are high level processes that MDUs need to follow on creating the plan for maintenance volumes, including the phasing of work and taking account of seasonal factors. However the detailed implementation varies by MDU or those within a shared Route.

The maintenance volumes plan is an annual process which seeks to quantify the amount of work the MDU will be required to deliver in a fiscal year and is aligned to the financial and resource budgeting arrangements. This aggregates all the Maintenance Scheduled Tasks (MSTs) for all the assets which are typically

inspections, factors in any backlog which has to be recovered and makes an allowance for unscheduled work ('Work Arising') based on previous years' experience.

The Activity Based Planning (ABP) tool supports the development of the volume plan. The plan is iterated between MDUs and Route/Region teams, considering factors such as risk assessments. There is an 'affordability' assessment which is undertaken by the Finance related roles within the Route and Region that validates the plan against the budget through a focus on planned time and resources for maintenance activities. This is usually undertaken by the Finance Partner (who in many cases are based within the MDU) and overseen by the Route or Regional Finance Director.

The make-up of work types does vary across the different asset types. Typically signalling is 90 to 95% MST based and generally very predictable in nature. In contrast, track is 60% MST based with a greater degree of volumes coming from Work Arising in the form of preventative maintenance and fixing faults. Off-track is similar with the workload being less scheduled / more reactive.

The annual planning cycle timings varied across the Routes but generally ran from late autumn with the process aiming to complete by the end of February to enable the planned volume of work for the new financial year to be established at the beginning of April.

3.2.2 Volumes Data Capture

The MDUs generate the maintenance workbank from the Maintenance Scheduled Tasks and Work Arising activities that are identified through inspection. This workbank will be scheduled to match the volumes committed to in the annual plan and will include any volumes not delivered in previous plans but still required (the backlog). The MDU planning team will align this with track access requests to produce the necessary work orders and set out the work required for each of the teams within the MDU and ensure the necessary materials and plant are produced.

The majority of work orders are generated to the relevant technical teams in My Work App, which is also used to record work done volumes. My Work App was created to replace paper-based recording of work orders and work done reporting. This practical mobile solution provides a simple overview of all the jobs a gang needs to complete during the shift with the associated work order details. On completion of the jobs, data is entered into the mobile user interface to confirm the volume and /or details of the relevant work completed.

MDUs typically report approximately 85%-90% of completed maintenance volumes through My Work App. The remainder are recorded using a paper-based process where it is impractical to record using the App. There are also some cases such as on-track machines which are recorded separately.

Scenarios where paper-based reporting is used generally occur with:

- tamping/rail grinding related activities in some MDUs given the amount of planning involved; and

- work carried out by contractors where they may not have access to the My Work App, for example vegetation clearance or some other off-track maintenance activities that are outsourced.

3.2.3 Data Approval

All information in the My Work App is linked to the FDM system. This system is used to support the checking of work undertaken and allows interrogation and closure of the data entered into My Work App before it is uploaded to Ellipse.

FDM is used on a daily, weekly and periodic basis by the MDU management teams to manage the closure of work orders and faulting work done. We observed a variety of different processes for managing the sign off process at the MDUs we visited. Commonly MST volumes are signed off in bulk without the Section Manager or Section Planner validating individual items. However, if the actual volume and the planned volume do not match or the technician has put comments into My Work App, the bulk upload facility is automatically disabled for that item forcing the reviewer to look at it individually.

Paper-based work orders are usually signed off by the site supervisor and validated by the Section Manager of Section Planner.

3.2.4 Data Storage

Once work is signed off in FDM the volumes are electronically transferred to Ellipse; the paper-based work orders, once signed off, are input manually. Ellipse is an integrated asset management system which has an associated set of processes that facilitates work management activities performed on assets, and which maintains a log of work performed and asset condition over the lifetime of the asset.

A number of reports are produced from this data to monitor delivery of the plan and produce forecasts for future work volumes.

3.2.5 Data Assurance

The MDUs, Routes and in some cases Regions have developed bespoke tools and dashboards to assist in this assurance. Many aggregate work orders into standard jobs which makes it more difficult to identify individual work order volume errors.

In addition, Network Rail HQ have produced a Power BI dashboard that is issued to about 320 users across the MDUs / Routes and Regions every period. This has a recent development to drill down into work orders. There is no mandated use of this dashboard nor documented guidelines in its use. The HQ team have just started monitoring its use. Since the start of January 2022 there have been 88 users who have made a total of 1,399 views, although at the time of writing this report it is unclear who the users are and how they are using the tool.

These local and national tools are described more fully under assurance in section 3.3. It is important to note that the assurance processes focus on plan versus actual

monitoring, not on the accuracy of volumes data itself. Discovery of incorrect volumes data is usually a bi-product of these checks as opposed to being the primary focus.

3.2.6 Reporting

There are two types of reporting of maintenance volumes that all are derived from figures in Ellipse.

Rolling Forecasts (RF)

These are produced for planning within Network Rail as well as for reporting to ORR at periods 4, 8 and 11. Since RF8 in 2021/22, the following reports are produced and sent to ORR:

- ABP Consolidated Volumes
- ABP Consolidated Plant
- ABP Consolidated Total Costs

They forecast maintenance volumes, costs and headcount for each financial year remaining in Control Period 6 compared with actual figures for the earlier years in the control period. Figures for the current year are made up of actuals and forecasts – so, for example, the current year figures reported in RF11 will consist of periods 1 to 11 delivered plus a forecast for the remaining two periods.

The Consolidated Volumes report presents figures by discipline which are aggregated from standard jobs. An example is shown below, taken from the 2021/22 RF11 Consolidated Volumes report[7].

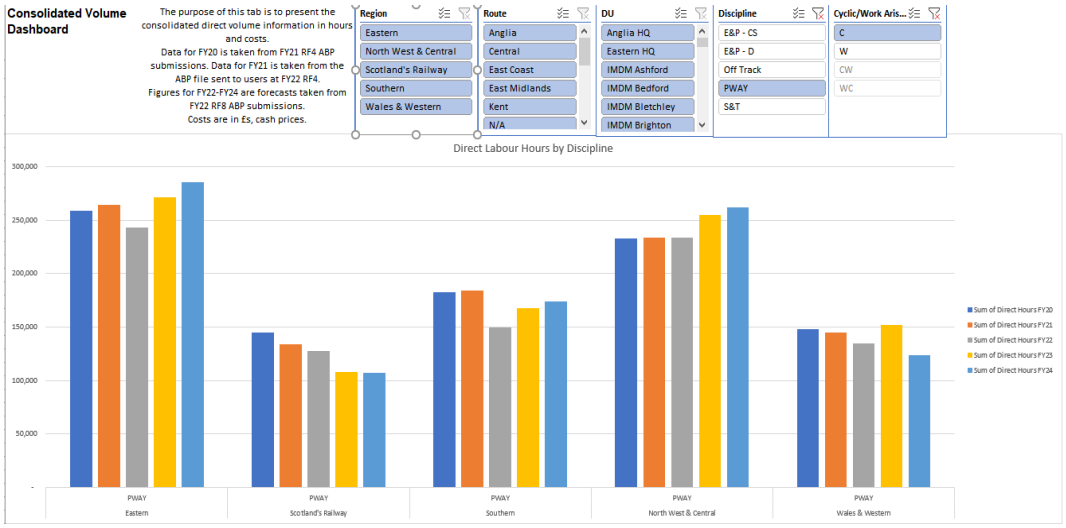


Figure 4: Consolidated Volume Dashboard (showing Cyclic "C" direct labour hours for PWay discipline)

[7] ABP FY22 Consolidated Volumes Final.xlsx

The figures are derived from the ABP planning process which takes delivered volumes from Ellipse and forecast volumes for the future, and converts both into hours and costs by applying standard rates for each activity.

The Consolidated Plant report presents historic and forecast shifts, volumes and costs for on-track machine activities. The Consolidated Costs report presents total historic and forecast costs by discipline.

Of relevance to this mandate to review reported delivered volumes, forecasts for work arising tasks are based on historic volumes recorded in Ellipse. The ABP assurance activities will check the historic trends of such tasks to spot outlier volumes recorded in Ellipse. In such cases, we were informed that corrections are made in Ellipse to correct the forecast.

Annual Return

Network Rail reports the delivered maintenance volumes compared to those volumes that were planned each year in the Annual Return. Network Rail does so for 73 standard jobs that have been agreed with ORR.

The process for compiling the Annual Return is owned by the Business Planning, Analysis and Reporting team. It is not documented but involves the following activities:

- The team populates a template for the 73 standard jobs that compares planned and delivered volumes for the year, using data from Ellipse. This is initially undertaken in period 12 of the reported year.
- It is sent to the Regions for review. They are requested to check all standard jobs that do not have matching planned and delivered volumes and either correct any errors in Ellipse so they do match or provide commentary to the team to explain the differences.
- This is an iterative process with the team in dialogue with the Regions to provide the final reported figures in period 2 of the following year. The Regions are not required to formally sign off their final figures or commentary.

3.2.7 Comments on process

The process of data capture, approval and storage was observed to be the same for each asset and across the MDUs. There are variations in how data is captured, driven by MDU local practices. For example, some MDUs manually input tamping volumes rather than using My Work App.

There is the question of whether My Work App could be made more widely available to third party contractors instead of using paper-based reporting. This would have the benefit of the automatic checks of My Work App but would need to consider lack of familiarity and possible infrequent use by contractors. The impact on raising any queries on the recorded volumes afterwards with the contractors would also need to be considered.

There are a wide variety of reports / dashboards produced by the MDUs, Routes, Regions and nationally. They are tailored to local use but there may be scope to share best practice and this is considered further in the next section on quality assurance.

An ever-increasing constraint on work planning is track access and a number of MDUs talked of the importance of managing the requirements and pressures created by the ban on Red Zone working. The increased use of remote technologies such as Plain Line Pattern Recognition (PLPR) on train monitoring eased the requirements on track walking but was leading to an increase in work arising as a result of issues found. The move to more remote monitoring generally is leading to changes in work distribution.

Some standard job codes that are classified as Work Arising, for example tamping activities, cover both preventative maintenance and reactive fault fixing. Distinguishing between these two types of Work Arising would, in our opinion, provide greater understanding of the asset performance and help future planning.

3.3 Description of Quality Assurance activities

3.3.1 Overview

In this section we describe the assurance activities carried out in each of the main stages of the process for managing the maintenance volumes data.

All MDUs understood clearly the importance of accurate volume data. It is used as the basis for developing the future year's planned volumes. In particular historic data is used to forecast the faulting maintenance volumes for each asset but it is also used as a starting point for all volumes data types such as MSTs. The volumes data is also used to manage the work of contractors. A number of those interviewed suggested there is an opportunity to reinforce its value to the business.

It was noted (for example by Doncaster MDU) that automatic collection of inspection data has improved the quality of data previously collected manually. For example, where track inspection data collected by train inspection PLPR has replaced manual inspections this had improved on the previous reports which could be less accurate at the end of a track walker's shift.

Based on the interviews, it was clear that the assurance of volumes data rests almost entirely within the MDUs themselves. The systems currently in place make it difficult to identify errors once the data is confirmed in Ellipse for the vast majority of tasks. The reports we were shown that interrogate the data in Ellipse in BI tools aggregate the volumes data by (sub) asset type making individual errors more difficult to identify.

This follows from many MSTs being simple counts of one (e.g. Insulated Block Joint (IBJ) inspections) and therefore identifying mistakes is almost impossible when they are aggregated given the small error possibility in a large overall count.

In the case of more complex maintenance items like tamping or ballast cleaning, errors through misinterpretation of unit descriptions (for example, miles vs yards) are found as they show up as spikes on the plan versus actual comparisons.

3.3.2 Data Capture

The widespread use of My Work App has provided a level of consistency in the way that volumes are initially recorded, although as noted in Section 4 there are limited inbuilt checks to the data entered (noting the recent 25% limit compared against the plan).

There is, though, no up-to-date training in the use of My Work App. We understand that new users learn how to use the App on the job from more experienced users. There are embedded training videos, but these were repeatedly described as 'out of date'. Given the importance of getting the data as accurate as possible at the data entry point, we would recommend more inbuilt checks and production of updated training for the App.

3.3.3 Data Approval

In all 14 MDUs, the level of checks carried out on the volumes data in FDM before upload to Ellipse was broadly similar but varied on some points. The automatic checks in FDM prevent bulk uploads if planned and actual volumes failed to match for MSTs, if zero hours were recorded on a work order, or if comments were added to the work order. These work orders have to be manually approved and actioned if necessary, by the Section Manager uploading to Ellipse.

3.3.4 Data Assurance – MDU

Using the data in Ellipse, all the MDUs produce reports of work delivered compared against that planned annual plan to manage future workload actively. These themselves can serve as additional assurance checks on the volume data, but the asset engineers tend to focus on any divergence from the volumes planned and the reasons for this. Errors are sometimes spotted through this, but at this point the volumes are aggregated and not all are reviewed as closely as others.

All have some form of focus on their priority assets, for example York focus on their top 20 assets judged from risk and financial perspectives. In addition, most (for example, Doncaster) also review Train Accident Reduction volumes related to vegetation, boundary, and drainage assets. The reports are tailored to the MDU requirements and their frequency varies but generally are produced weekly.

It was explained that there may be good reasons why the planned and actual volumes might vary and not simply because of errors. One example quoted was the introduction of new repair equipment for Insulated Rail Joints (IRJ) by Doncaster which has significantly improved their reliability and hence reduced the need for repairs from what was originally planned.

We did not identify any internal audit process for volumes data and some of the MDUs said that this was the first time they had been reviewed on the volumes

data itself as distinct from compliance and delivery. Cardiff MDU was the only MDU we interviewed that keeps a record of errors found to help inform data quality; no other MDUs stated they keep such a record or carry out trend analysis to identify common errors.

3.3.5 Data Assurance - Route and Region

Assurance provided by Routes was found to be variable. The Systems Support Manager for East Coast South covers three MDUs and has developed a number of data quality reports that he produces on a daily basis. He shared a number with us: those for checking general data quality in Ellipse are:

- "Hierarchy Report" – to check assets are correctly and consistently assigned to correct engineering hierarchy; and
- "RvsG Detail" – to check all closed work orders have Protection Method and Type Recorded for tracking in other summary reports.

Those reports that focus on the accuracy of maintenance volumes data are:

- "Inactive Asset" – Open Work Orders: to check no longer planning work against obsolete assets (i.e. assets removed from the network);
- "Active MST – OR Asset Report": to ensure no active MSTs are running on obsolete assets;
- "Inactive MST – Open Work Orders": a check on any open work orders that are against inactive MSTs, normally a prompt to enquire if this could be cancelled;
- "MST with 0 Units": to ensure no MST is active with 0 units required (the system will allow this with knock on effects to work orders and future work reporting);
- "MST Work Order Data Quality Report"; to check against MST units required and units complete. Any differences are sent to the relevant for correction;
- "No Costing" – to identify any completed work order with partial or missing costing (units and Time on Tools). Any found are normally returned to the relevant section;
- "Work Order Data Download - Large Actual Hours": to check for excessive hours against a work order (150+). An example we saw was closed with 501 hours instead of one hour. It was thought this was due to an errant finger strike on the My Work App and it was suggested some slightly smarter software could catch these automatically.

In our opinion, other Routes could benefit from using some or all of these reports. In addition, East Coast South Route runs weekly reports including Plan versus Actual, Future Work looking 16 weeks in advance, Productivity, and Re-prioritisation. Similar reports were found in all other Routes but the daily Reports were unique in our review.

Business Intelligence Capability

Routes and Regions that have advanced in-house BI capability have developed Power BI reporting tools to monitor the volumes delivery on a periodical basis which have been delivered to their MDUs as a self-assurance tool. During the visits we saw a number of examples of good practice although it should be noted that given we only saw 14 MDUs, better examples may exist elsewhere

Examples of good practice can be found in Appendix D.

Based on our interviews, Southern Region has the most developed data management and assurance process. It has implemented a specific region data improvement plan which includes MST data. This is described more fully in the following section along with a description of some of their tools and reports.

3.3.6 Data Assurance - Southern Region Data Improvement Plan

Southern Region has addressed the management and assurance of asset data by establishing an asset data programme to address critical asset data improvements and raise the value of asset data, including

- **Operating Model** – To define the data governance operating model to have an escalation path and influence managing data in the Southern Region
- **Management Process** – To clarify the RACI and data management process to manage data as an asset in its own right
- **Assurance** – A data assurance dashboard to monitor the data quality improvement progress
- **Digital Solution** – A digital solution (e.g. Power BI and automated workflow) to help MDUs process data and assemble relevant information
- **Asset Data Community** – Establish a data management community to collect issues and share best practices

Operating Model

The Southern Asset Data team have established a three-layer operating model with the Region and Route team.

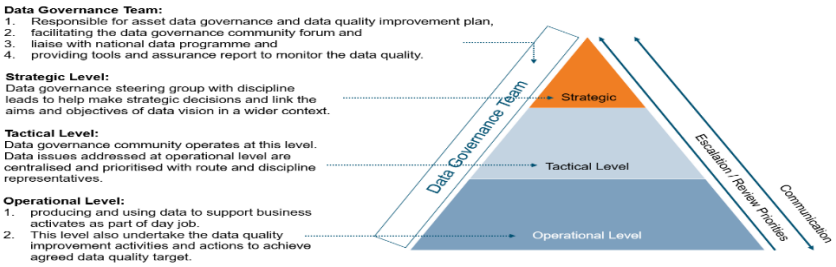


Figure 5: Southern Operating Model

The operating model aims to

1. Engage with the Route and discipline to agree and manage data quality priorities and mitigations via regular engagement and the quarterly Data Management Steering Group;
2. Provide support to MDUs via regular engagement and the periodic Route Asset Data Governance Forum;
3. Escalate issues with data governance and data management via the regular asset data community meetings.

Management Process and RACI

Southern has defined the data management RACI for asset data management as shown in figure 6 below. Based on the evidence provided to us, it is the only Region to have this clear definition of responsibilities.

RACI DETAILS	KEY CONTROL ACTIVITY	Resources								
		Asset Management					Maintenance			
		Route Asset Data & Analysis Manager	Network Data Manager	System Support Manager [Asset Management]	Asset Management Analyst	Head of Asset	Section Planner	System Support Manager [Maintenance]	Works Data Clerk	Maintenance Engineer
Process Task										
1. **Data Operations** processes focus on the factors that affect data quality and the usage of data										
1.1 **Data Architecture Management** manages the organisation wide data architecture	CENTRAL FUNCTIONS									
1.2 **Data Design** manages data standards and definitions, database and system implementation and configuration										
1.3 **Data Processing** covers activities that create, modify, update and transfer data							I	RA	R	C
2. **Data Quality Monitoring** defines a systematic approach to assess the levels of data quality										
2.1 **Data Quality Planning** sets the objectives of data quality management to align with organisational objectives		I	R			A		I		
2.2 **Data Quality Criteria Setup** sets the measures and methods to assess data quality		I	RA			C		I		
2.3 **Data Quality Measurement** is the process that utilises these data quality criteria in order to assess data quality levels			A	R	R					
3. **Data Quality Improvement** process corrects data errors detected and eliminates the root causes of data errors										
3.1 **Data Stewardship and Flow Management** is the process that analyses data flows and responsibilities and manages the stewardship of data operations		RA	R							
3.2 **Data Error Cause Analysis** is the process that identifies root causes of data errors in order to prevent them reoccurring			A	R	R					
3.3 **Data Error Correction** is the process that corrects data that does not meet standards or data quality criteria			I	R			I	RA	R	C

Figure 6: Southern Data Management RACI

Assurance Report

A number of reports have been developed that are used in periodic Region, Route and IMDM meetings. A periodical assurance report has been developed to monitor the planned versus actual maintenance volumes covering all Southern

MDUs. A number of KPIs and reports have also been developed to provide further insight to the maintenance work and the data; for example

- Compliance of inspections carried out against asset policy (MST integrity reports);
- The number of volumes remaining in FDM for upload to Ellipse (a measure of currency of volumes); and
- The number of assets with invalid hierarchy data.

Some examples of these are shown below. The MST integrity reports compare asset and MST data against pre-agreed business rules developed with the regional discipline heads and / or as documented in Network Rail standards. They provide

1. High level view of progress and completeness for each asset type in scope;
2. Visibility of weekly / monthly trends, to identify necessary data management interventions; and
3. Excel based outputs, detailing the precise changes required to the systems.

These MST integrity reports have been used on Kent and Sussex routes for some time and we were shown evidence of long term improvement in compliance. The more recent adoption on Wessex route has revealed the need for some improvements.

A Regional Asset Data and Analysis team leads local business intelligence development and data governance in the Southern Region. It is understood the team has eight posts currently. We did not identify an equivalent team in other Regions. In the past 18 months, this team developed an automated periodical maintenance volume report for all the MDUs in Southern and utilised the same datasets for business reviews at different levels from MDUs to Route directors.

Below is the screenshot of the Southern automated maintenance volume report highlighting the deliverability % between planned and actual volumes. MDUs could use this report to drill down to the section manager level by asset type, standard job numbers or delivery team. This is followed by some example KPI reports.

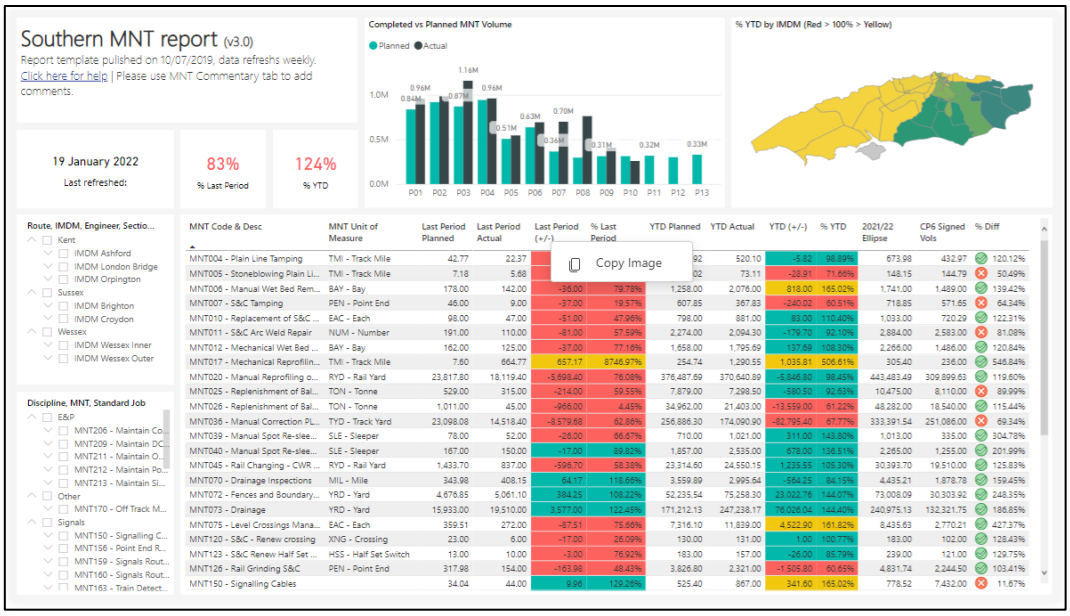


Figure 7: Southern Plan vs Actual maintenance volume report

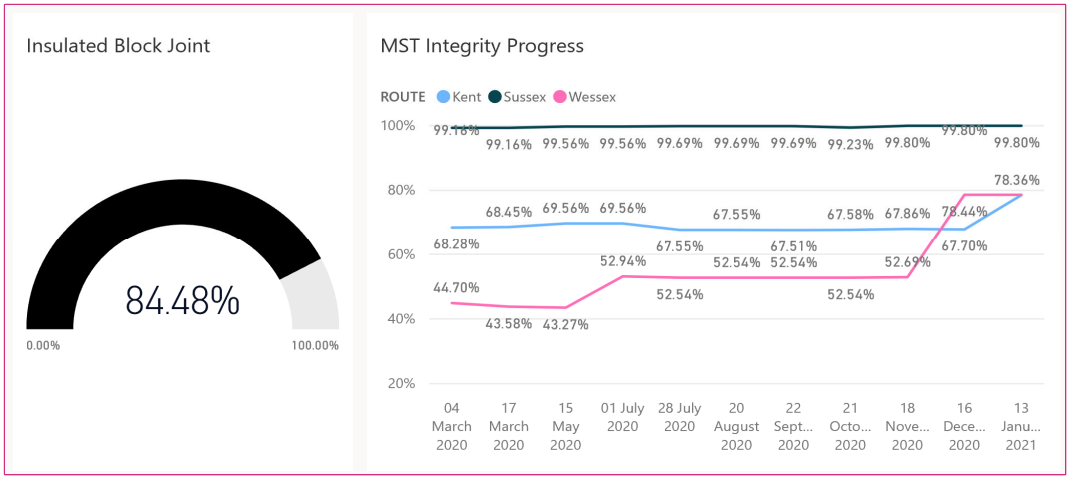


Figure 8: Data KPIs: Inspection compliance KPIs, monitoring the inspection compliance and inspection volume completeness

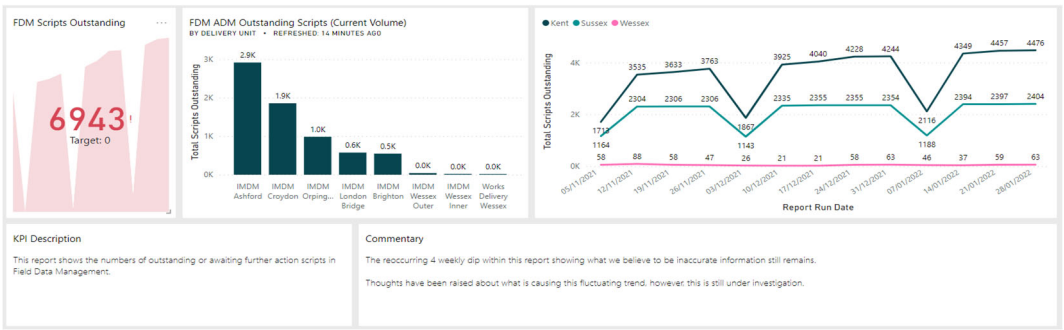


Figure 9: Data KPIs: outstanding FDM scripts, monitoring the potential volume issues in FDM

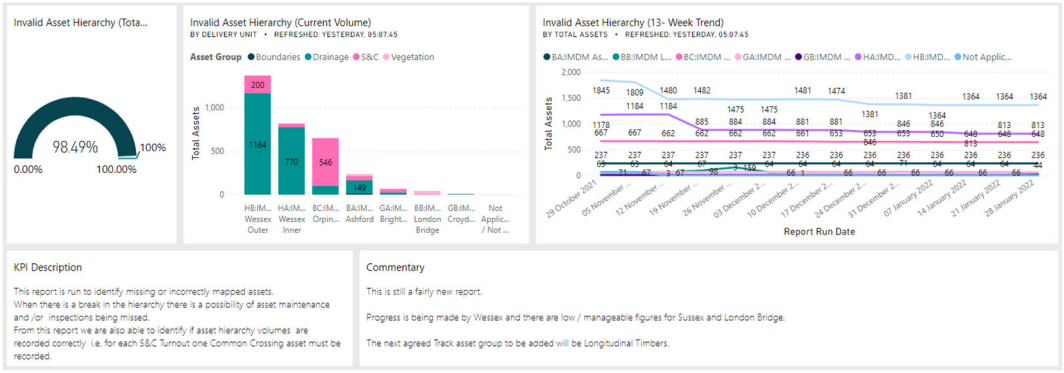


Figure 10: Data KPIs: invalid asset hierarchy, identifies the missing or incorrectly mapped assets, which improves the integrity of maintenance volume

Asset Data Community

The regional asset data management team have established an asset data community in the Region. The community can log data issues to monitor and prioritise the data improvements, as illustrated below.

Discipline	Asset Type	Category	Data Issue/Opportunity Desc	Outcome	Impact	Complexity
Track	Track Inspections	MST Data	There is no accurate mechanism to assure that these assets are being maintained and at the correct frequency as defined in the relavant standard or guidance document. (see Appendix A in Southern Region Data Improvement Plan)	1. Accurate maintenance business volumes for budgetting purposes. 2. Assurance around the application of business rules. 3. Accurate schedule of maintenance activities.	5	2
Track	Plain Line	Asset Data	Exchange of asset data following renewal of track, ballast and sleeper data does not happen due to lack of process. Incorrect volumes for 1976 rail (A2). Incorrect inspection volumes for maintenance. Prohibits the ability to correllate asset age and rail faults and defects.	1. Accurate maintenance business volumes for budgetting purposes. 2. Compliance to regulatory requirements. 3. Reliable data for engineering decision making. 4. Accurate schedule of maintenance activities.	4	1
Signalling	Signal Heads	Asset Data	The location of signal heads in the ellipse is in poor quality. Inaccurate asset location will potentially lead to safety related incidents (see Appendix B in Southern Region Data Improvement Plan)	1. Reliable data for engineering decision making. 2. Reliable data for maintenance planning purposes. 3. Formal mitigation of safety risk.	5	3
				1. Accurate maintenance business volumes for		

	Desc	1	2	3	4
Impact	business impact, following the corp risk matrix	Very low safety, financial, reputational and /or performance	Low safety, financial, reputational and /or performance	Medium safety, financial, reputational and /or performance	High safety, financial and /or perfor
Complexity	time, resource, tech and system need to develop the solution	Internal asset management resource only, solution already exists, minimal impact.	Internal asset management resource only. Simple solution required deliverable within internal team.	Internal asset management resource only. Complex solution required deliverable within internal team.	Internal solution tha significant national resource/in
Effort	time, resource requried to deploy the soultion	Less than 1 month to complete. Minimal amount of engagement with maintenance organisation required.	1 to 3 months to complete. Minimal amount of engagement with maintenance organisation required.	3 to 6 months to complete. No site visits required. Moderate engagement with maintenance organisation required.	6 months to 1 year and/or minor amour required by mai organisati

Figure 11: Southern Asset Data Issue log

3.3.7 Reporting

The Rolling forecasts are part of the ABP process and assurance is undertaken according to the ABP policy. At a high level, this is shown below which is taken from the ABP policy document[8]. The MDUs update the volume forecasts and work carried out to date in the ABP tool and this is then checked by the Routes and Regions (1st and 2nd Line Assurance). The Business Planning, Analysis and Reporting team then carry out their own checks by comparing the reported figures with those in Ellipse and provide any feedback (3rd Line Assurance). This assurance process has been set up within the last 12 months.

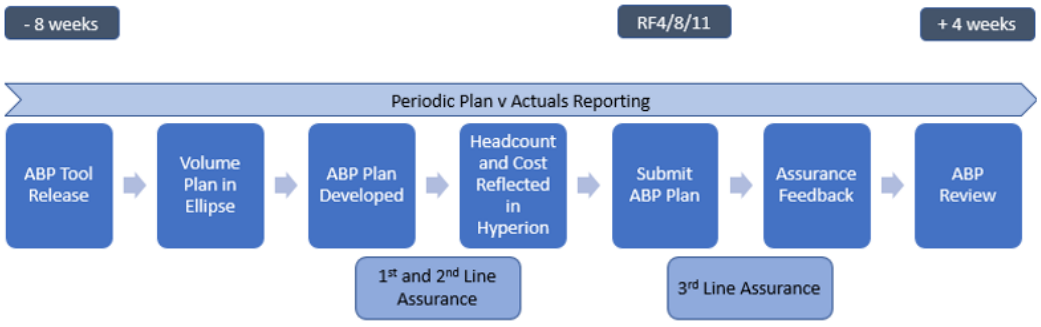


Figure 12: High level process for developing Rolling Forecasts (ABP Policy document)

The assurance process for the Annual Return is not documented but is carried out by the Business Planning, Analysis and Reporting team, again comparing the

[8] Activity Based Planning and Reporting Policy, version 0.1, March 2021

reported volumes with those in Ellipse and providing feedback to the Regions as required. The team do keep a log of correspondence between themselves and ORR on the queries relating to the quality of the figures. For the 2020/21 Annual Return, volumes for three standard jobs were questioned and subsequently found to be miscoded, or corrected from miscoding the year before, in some instances in Scotland and Eastern Regions.

3.3.8 Conclusions

Our meetings with the 14 MDUs have identified a number of examples of good data quality assurance at Region, Route and MDU levels and there is a significant opportunity to share this good practice to improve consistency.

The reliability of the system for recording asset volumes depends to a large extent on the experience of the key personnel involved, in particular the Section Managers, Section Planners and the System Support Managers in the MDUs to carry out quality assurance checks in FDM. Whilst their approach is similar, some have tools to assist in the process that are provided by their Route. All MDUs produce reports of planned versus actual volumes from Ellipse which are also useful in identifying large errors but are generally too aggregated to identify the smaller errors.

Assurance carried out by the Regions is generally limited. However, Southern have created a data improvement plan that is well structured and aimed at carrying out compliance checks of inspections against policies as well as producing some useful KPIs to assist improving data quality.

The national Business Planning, Analysis and Reporting team are playing an increasing role in assurance. Their Power BI tool now allows MDUs, Routes and Regions to carry out checks by work order at periodic intervals. It is unclear how widespread it is used and we support the team's intention to monitor its use. The provision of user documentation that describes how it can be used to identify errors would also be beneficial.

The team's assurance of the Rolling Forecasts has been put in place within the last 12 months which focuses on checking their consistency with figures in Ellipse. Their assurance of the Annual Return focuses on checking consistency with figures in Ellipse and understanding differences between planned and delivered volumes for the 73 standard jobs reported. This process is undocumented and would benefit from a formal sign off by the Regions.

4 Review of Documentation and use of systems

4.1 Overview

The review required the Reporter Team to review all relevant documentation and systems and to comment on their fitness for purpose. This included documentation that covers national processes as well as any that has been developed locally (at Regional, Route and MDU levels). The systems review covered the use the My Work App, FDM and Ellipse in the management of maintenance volumes data as well as any locally developed reporting tools.

4.2 Review of documentation

4.2.1 Overarching documentation

The two key sets of national processes are set out in the following documents:

NR/L2/MTC/PL0175 – Maintenance Planning Handbook

This is a set of high-level documents setting out the processes and systems for the planning of maintenance work activities, of which volume reporting forms a constituent part. The documents set out key requirements and responsibilities by post for the planning of maintenance work and describe in high level terms the role of Ellipse in particular as the main repository of information.

The document structure is set out below:

MAINTENANCE PLANNING HANDBOOK CONTENTS

Document Reference	Document Title	Issue	Date
NR/L2/MTC/PL0175/01	Handbook – planning introduction and guidance	3	September 2020
NR/L2/MTC/PL0175/02	Maintenance processes for planning	3	September 2020
NR/L2/MTC/PL0175/03	Weekly Section Planning Meeting (SPM)	3	September 2020
NR/L2/MTC/PL0175/04	Daily and weekly visualisation control room meetings	2	March 2018
NR/L2/MTC/PL0175/05	Planning line blockages	2	March 2018
NR/L2/MTC/PL0175/06	Guidance on safety critical roles in possessions or worksite	2	March 2018

Figure 13: Contents for the Maintenance Planning Handbook

Whilst the handbook gives a high-level overview of the planning process, it actually makes only a few references to volumes specifically and then mainly in the context of monitoring delivery of planned volumes against actuals. The processes do not make any explicit reference to the reporting of volumes, how they should be captured, quality assurance specifically for volumes data or how important is the accuracy of volumes recording and reporting.

NR/L3/MTC/MG0176 – Ellipse Management Handbook

This provides a more detailed set of processes for the use of Ellipse as the primary asset register and tool for the management of maintenance work. The contents are shown below.

5 Ellipse management handbook contents

Reference	Title	Issue	Issue date
NR/L3/MTC/MG0176/01	Purpose, Scope, Definitions and Abbreviations	4	Withdrawn March 2017
NR/L3/MTC/MG0176/02	Business rules for the use of Ellipse	5	March 2017
NR/L3/MTC/MG0176/03	Ellipse data requirements for WAIFs	4	March 2017
NR/L3/MTC/MG0176/04	Meetings framework	4	Withdrawn June 2018
NR/L3/MTC/MG0176/05	Key Performance Indicator Reports	5	September 2021
NR/L3/MTC/MG0176/06	Weekly compliance reporting	3	September 2010
NR/L3/MTC/MG0176/07	KPI Reports - Examples	2	September 2010
NR/L3/MTC/MG0176/08	Works management reporting tools	3	September 2010
NR/L3/MTC/MG0176/09	Work management reporting tools	3	September 2010
NR/L3/MTC/MG0176/10	Assets out of use records and recording	1	March 2017
NR/L3/MTC/MG0176/11	Prioritisations, reprioritisations and cancellations	1	March 2017

Figure 14: Contents for the Ellipse Management Handbook

The various sections provide instruction on a number of key elements including suggested meeting structures and report types. However, there is again little specific mention on the recording and use of volumes data. The various reports and KPIs referred to in some of the sections are all focused on the use of the data with no requirements set out on the quality assurance of the base volumes data itself.

Figure 15 below summarises the KPIs required in NR/L3/MTC/MG0176/05.

KPI Report	Local Owner (s)	Actioned by
KPI 1 - Work Order Data Quality - No Hours and Units	Section Manager	Section Planer
KPI2 - National Work Outstanding	Infrastructure Maintenance Delivery Manager (IMDM) and Infrastructure Maintenance Engineer (IME)	Section Manager
KPI5 - Work Orders Overdue by Their Cyclical Frequency	Maintenance Engineer and Section Manager	Section Manager, Section Planner and Systems Support Manager
KPI6 - Asset Status Inconsistencies	Systems Support Manager	Systems Support Manager
KPI7 - Active MST on Inactive Asset	Maintenance Engineer	Section Planner and Systems Support Manager
KPI 8 & 9 - Invalid Track ID	IME and Maintenance Engineer	Systems Support Manager
Work Cancellation (Scheduled)	IMDM, IME and Maintenance Engineer	Section Manager and Section Planner
Weekly Reprioritisation	IMDM, IME and Maintenance Engineer	Maintenance Engineer, Section Manager and Section Planner
Works Orders created more than 7 days from Defect Raised Date	Section Manager	Section Planner
Work Orders created with the same Ellipse Raised and Creation date	Section Manager	Section Planner
Productivity Report	IMDM, IME and Maintenance Engineer	Maintenance Engineer and Section Manager
Actual hours/Missing hours report (Productivity)	IMDM, IME and Maintenance Engineer	Maintenance Engineer and Section Manager

Figure 15: Key Performance Indicator reports (NR/L3/MTC/MG0176/05)

Both handbooks describe a compliance system of red for no variations allowed, amber for when variations are permitted subject to risk analysis and green for guidance where alternative solutions are allowed. However, this is not applied to many of the older procedures, so is not universally applied, and in the absence of a specified tolerance against accuracy, cannot be applied to maintenance volumes recording and reporting.

The processes Network Rail follow for reporting of data through the Annual Return are not documented currently.

During the Reporter team visits to the MDUs the teams regularly stated that there was a lack of step-by-step guidance in how to undertake planning and monitoring in line with the higher-level processes. This meant that whilst the national processes existed, the local approaches vary considerably. This was reported as a particular challenge when new entrants to key roles, particularly at MDU level, were taking up positions.

4.2.2 Local documentation

The majority of the MDUs visited had developed their own approaches to managing the processes around maintenance planning and reporting to ensure they were undertaking the high-level requirements. In the main these were unwritten and based on experience and knowledge of the individuals concerned and differences in emphasis across each of the Routes and Regions.

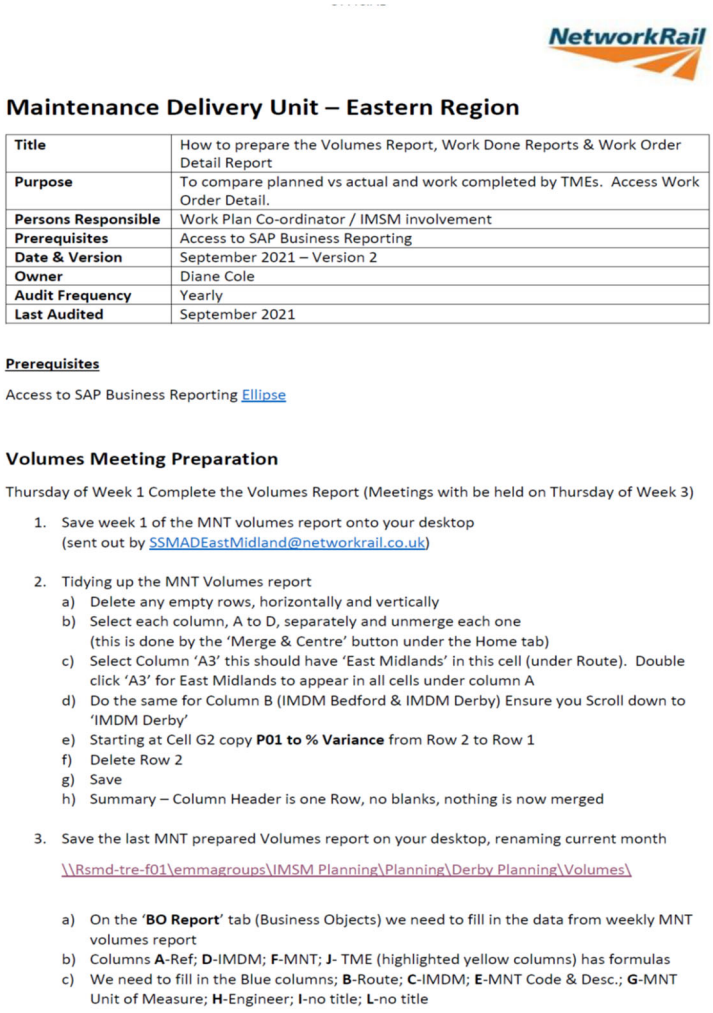
As a result, this has led to variations in the actual processes followed often with subtly different emphasis within them. Most MDUs and Route reviews, for example, had developed arrangements to review a top list of volumes but these

varied in content and number and were mainly driven by key safety issues and financial value.

All of the MDUs were aware of their reliance on experienced individuals as a result of this and in the cases where key personnel had changed, particularly the Systems Support Manager, getting access to straightforward step-by-step process guides was seen as a problem. Some of the MDUs and Route teams had recognised this as an issue and had begun to put in place procedures of their own to regularise how key tasks should be carried out.

Two examples of local documentation are included below.

Derby MDU reported that the East Midlands Route were producing a number of guides. The first of these is called "How to Prepare Volumes Report, Work Done Reports and Work Order Detail Report" – the front sheet is shown below in Figure 16. This is a well put together step-by-step set of instructions on how to use the systems available to prepare reports consistently that can be followed by any member of the team.



NetworkRail

Maintenance Delivery Unit – Eastern Region

Title	How to prepare the Volumes Report, Work Done Reports & Work Order Detail Report
Purpose	To compare planned vs actual and work completed by TMEs. Access Work Order Detail.
Persons Responsible	Work Plan Co-ordinator / IMSM involvement
Prerequisites	Access to SAP Business Reporting
Date & Version	September 2021 – Version 2
Owner	Diane Cole
Audit Frequency	Yearly
Last Audited	September 2021

Prerequisites

Access to SAP Business Reporting Ellipse

Volumes Meeting Preparation

Thursday of Week 1 Complete the Volumes Report (Meetings with be held on Thursday of Week 3)

1. Save week 1 of the MNT volumes report onto your desktop
   (sent out by SSMADEastMidland@networkrail.co.uk)

2. Tidying up the MNT Volumes report
   a) Delete any empty rows, horizontally and vertically
   b) Select each column, A to D, separately and unmerge each one
      (this is done by the 'Merge & Centre' button under the Home tab)
   c) Select Column 'A3' this should have 'East Midlands' in this cell (under Route). Double click 'A3' for East Midlands to appear in all cells under column A
   d) Do the same for Column B (IMDM Bedford & IMDM Derby) Ensure you Scroll down to 'IMDM Derby'
   e) Starting at Cell G2 copy **P01 to % Variance** from Row 2 to Row 1
   f) Delete Row 2
   g) Save
   h) Summary – Column Header is one Row, no blanks, nothing is now merged

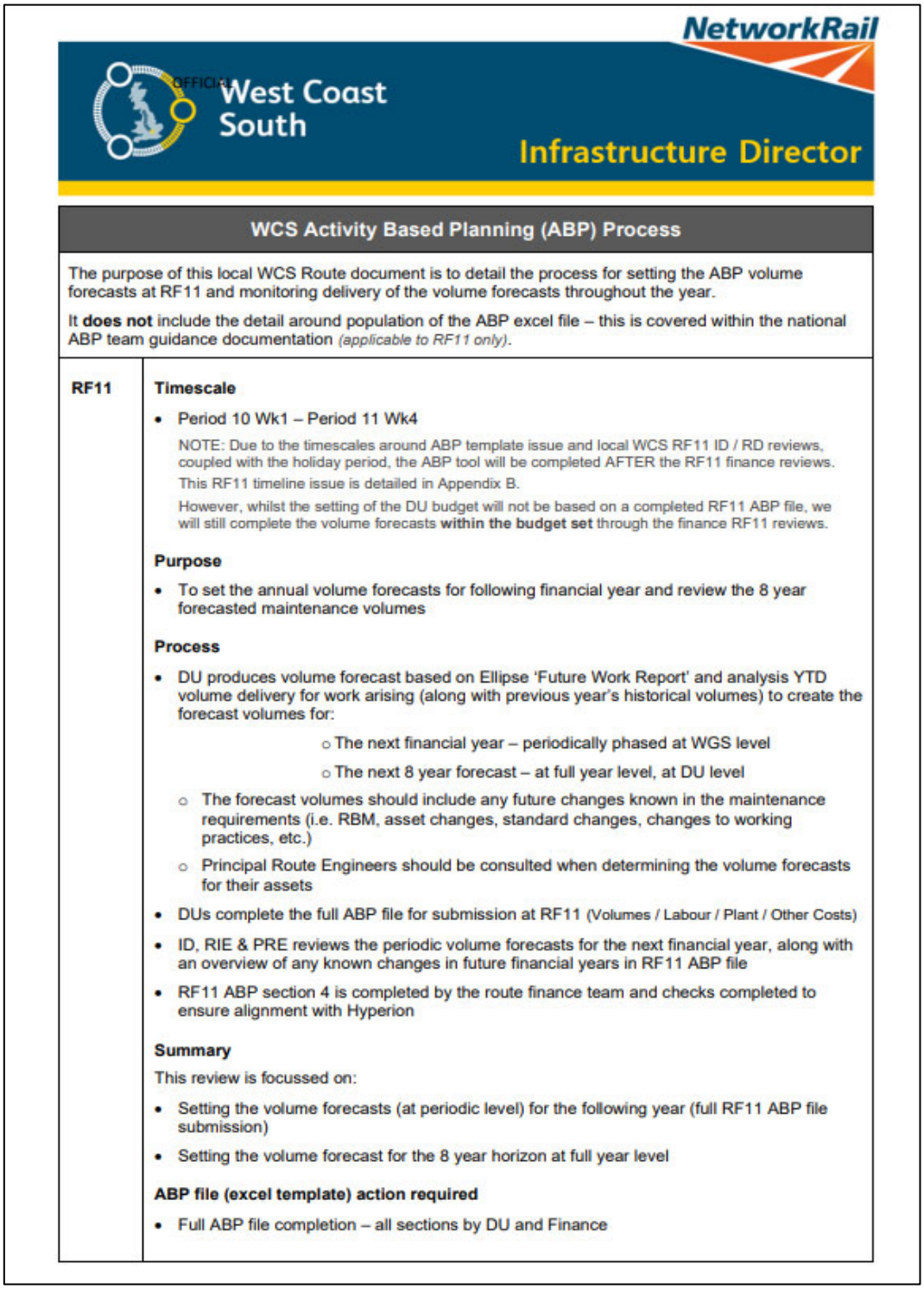
3. Save the last MNT prepared Volumes report on your desktop, renaming current month

   \\Rsmd-tre-f01\emmagroups\IMSM Planning\Planning\Derby Planning\Volumes\

   a) On the '**BO Report**' tab (Business Objects) we need to fill in the data from weekly MNT volumes report
   b) Columns **A**-Ref; **D**-IMDM; **F**-MNT; **J**- TME (highlighted yellow columns) has formulas
   c) We need to fill in the Blue columns; **B**-Route; **C**-IMDM; **E**-MNT Code & Desc.; **G**-MNT Unit of Measure; **H**-Engineer; **I**-no title; **L**-no title

Figure 16: How to guide Key Performance Indicator reports (NR/L3/MTC/MG0176/05)

West Coast South Route have developed a detailed process for setting the annual planning volumes within ABP at RF11 (Rolling Business Forecast review in Period 11) and the process of monitoring annual plan delivery. The front sheet is shown in Figure 17 and the process should help improve the consistency and quality of the plan.



NetworkRail

OFFICIAL

West Coast South

Infrastructure Director

WCS Activity Based Planning (ABP) Process

The purpose of this local WCS Route document is to detail the process for setting the ABP volume forecasts at RF11 and monitoring delivery of the volume forecasts throughout the year.

It **does not** include the detail around population of the ABP excel file – this is covered within the national ABP team guidance documentation *(applicable to RF11 only)*.

RF11

Timescale

- Period 10 Wk1 – Period 11 Wk4

  NOTE: Due to the timescales around ABP template issue and local WCS RF11 ID / RD reviews, coupled with the holiday period, the ABP tool will be completed AFTER the RF11 finance reviews.

  This RF11 timeline issue is detailed in Appendix B.

  However, whilst the setting of the DU budget will not be based on a completed RF11 ABP file, we will still complete the volume forecasts **within the budget set** through the finance RF11 reviews.

Purpose

- To set the annual volume forecasts for following financial year and review the 8 year forecasted maintenance volumes

Process

- DU produces volume forecast based on Ellipse 'Future Work Report' and analysis YTD volume delivery for work arising (along with previous year's historical volumes) to create the forecast volumes for:
  - The next financial year – periodically phased at WGS level
  - The next 8 year forecast – at full year level, at DU level
  - The forecast volumes should include any future changes known in the maintenance requirements (i.e. RBM, asset changes, standard changes, changes to working practices, etc.)
  - Principal Route Engineers should be consulted when determining the volume forecasts for their assets
- DUs complete the full ABP file for submission at RF11 (Volumes / Labour / Plant / Other Costs)
- ID, RIE & PRE reviews the periodic volume forecasts for the next financial year, along with an overview of any known changes in future financial years in RF11 ABP file
- RF11 ABP section 4 is completed by the route finance team and checks completed to ensure alignment with Hyperion

Summary

This review is focussed on:

- Setting the volume forecasts (at periodic level) for the following year (full RF11 ABP file submission)
- Setting the volume forecast for the 8 year horizon at full year level

ABP file (excel template) action required

- Full ABP file completion – all sections by DU and Finance

Figure 17: West Coast South Activity Based Planning and Monitoring Process

4.3 Review of Systems

4.3.1 My Work App

My Work App was delivered in the summer of 2014 to improve the work order management process for maintenance teams across the network. The App allows workforces to raise and close jobs for work orders and Work Arising Identification Forms (WAIFs). The Reporter team were told it is now used for about 85% of the maintenance volumes uploaded.

This method is mainly used internally within Network Rail by its maintenance staff. Each MDU has up to about 300 staff using My Work App frequently, although the precise number depends on the depot's asset population size. Maintenance staff receive their prioritised work orders, confirm the work's completion and raise any issues, for example planned and actual volume do not match, in comments made via My Work App.

Once the work is completed in My Work App and signed off by the user it is transferred to FDM. This may not happen until the user is in an area with sufficient signal strength to allow the upload to take place. The depot's Section Planner and/or Section Manager will review and approve the work order in FDM.

The review process timescales vary between MDUs and individual Section Managers with no specified time periods. Some Section Managers are responsible for approving hundreds of reports a week alongside their other tasks.

Figure 18: Example of assigned work orders in My Work App

The use of My Work App described to the Reporter team has the potential for errors in the recorded volumes, in particular:

- The system lacks intelligent checking with only a limited capability to detect input errors, although the recent introduction of an automatic check of 25% variance between planned and actual volumes has improved this;
- It is easy to enter the wrong value, or Standard Job Code, or to enter data onto the wrong Work Order;
- One of the MDUs said that if a fault team attend a reported failure, inputting No Fault Found can inadvertently cancel the volume from the system meaning the work is lost. If this is spotted they have to be manually reinstated.

Network Rail is planning to improve the user experience of the My Work App, for example enhancing the user interface design, making it easier to select the correct items.

4.3.2 Manual recording

Manual recording is used for around 15% of volume uploads. In the main this method was used by MDUs where work was carried out by contractors, such as vegetation clearance work, where they do not have access to My Work App. Some MDUs also use manual recording for On Track Machine volumes such as tamping or rail grinding. A report will be submitted to the Section Manager or Section Planner for manual input into Ellipse.

The Reporter team did not see any evidence that this process was likely to lead to higher levels of error, although some of the work typically input manually has more opportunity for error given the less precise nature of issues like vegetation clearance when compared to a routine MST.

4.3.3 Ellipse and FDM

Ellipse is a system for managing and recording asset maintenance activities, data and information. It is an integrated asset management system and associated set of processes that facilitate key planning and work management activities performed on assets. It includes a register of nominated maintenance assets and agreed data attributes.

FDM, Field Data Management system, is an interface system that oversees, reviews and approves work orders completed in the My Work App before they are uploaded into Ellipse. Network Rail has developed quality assurance controls in FDM:

1. FDM prevents bulk sign off when the planned and actual volumes do not match in any specific work order;
2. If comments are included in the work order then it must be reviewed by the Section Manager or Section Planner before signing off.

In discussion with the MDUs a number of areas were identified where system changes could improve data quality:

1. The unit of measure is not displayed on the review screen and relies on staff memory;
2. Job Codes are free form and uncontrolled in FDM; and
3. Assembling information and extracting data from Ellipse is difficult, especially for trend analysis, deep dive and assurance review activities.

4.4 Comments

The documented national procedures for planning and recording maintenance volumes are necessarily high level and there is little in the way of step-by-step guidance on how to undertake key tasks within the systems. A number of Routes and MDUs are endeavouring to fill this gap themselves through the publication of detailed procedural instructions but in many cases, the MDUs are reliant on the experience of their teams to undertake the planning and monitoring processes.

There is little in the documented processes about volumes data quality. The processes described and monitoring are generally focused on the outcomes from the data and there are no procedural requirements that we saw to monitor the accuracy of volumes data. The procedures, both national and local, focus on measuring areas such as actual volumes versus plan, to identify backlog or compliance issues, as would be expected. The identification of errors is to a large extent, a bi-product of these checks rather than a specific or overt requirement in itself. No evidence was provided of any checks that the recorded volumes were those that were actually delivered on site.

The process for reporting maintenance volumes is described at a high level in the ABP Policy document which describes the key activities and defines key roles and responsibilities. There is, though, no documentation on the process for reporting maintenance volumes in the Annual Return.

The systems used to record delivered maintenance volumes are the same for all assets at the sampled MDUs. About 85% are input via My Work App by maintenance staff with the rest being input from details recorded on paper forms submitted to the MDU data entry staff. There are some checks for errors in FDM that are led by the Section Manager or Section Planner before the volumes are input to Ellipse. There is potential for incorporating additional automated and superimposed checks into the systems.

5 Review of Reliability, Quality, Consistency and Completeness of Reported Data

The reported maintenance figures in both the Rolling Forecasts and the Annual Return are produced from Ellipse – and therefore are reliant to a large degree on the figures in Ellipse.

Using their National Power BI tool, the Business Planning, Analysis and Reporting team carried out some checks for us on maintenance volumes in Ellipse that shed some light on their reliability, quality, consistency and completeness.

5.1 Negative volumes

There should be no work orders with negative delivered volumes in Ellipse. Figure 19 below shows all those with negative volumes for periods 1-11 in 2021/22. In total there are 39 such work orders out of a total of 3.52 million (0.001%). Most relate to one MDU and specifically the Romford Off track Work Group. Training of more people in the depot to correctly input to Ellipse would avoid this happening in future.

Standard Job To Work Order - Negative Values

Work Order Number	Standard Job Number & Desc	IMDM	Work Group Set	Work Order Unit of Work Code & Desc	Units Required	Units Complete	Units Required minus Units Complete	Actual Hours
68591639	009122 - REGULATE BALLAST USING OTM	IMDM Cardiff	Newport SM(TRACK)	MI - Mile	1.70	-2,998.30	3,000.00	9.00
66376363	009122 - REGULATE BALLAST USING OTM	IMDM Cardiff	Newport SM(TRACK)	MI - Mile	1.13	-1,978.83	1,979.96	6.00
68312145	009138 - LUBRICATE SLIDE CHAIRS USING HANDTOOLS	IMDM Derby	Nottingham SM(TRACK)	PE - Point End	1.00	-898.98	899.98	900.08
67361893	009202 - AUTHORISED WALKING ROUTE - MAINTAIN	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-659.74	659.87	0.01
68031580	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68031581	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68031583	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68031587	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68210379	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68210385	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68210387	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68210411	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68557364	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68557366	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68557368	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.25
68557369	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.28
68662144	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	5.00
68825591	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68825592	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68825611	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68825676	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68825679	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68825680	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	220.00	-219.74	439.74	0.51
68885814	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	220.00	-219.74	439.74	0.51
68906865	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68906870	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	0.50
68909079	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	220.00	-219.74	439.74	0.51
68968071	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	0.13	-219.74	219.87	5.00
68662156	009616 - DRAINAGE SYSTEM CONDITION INSPECTION	IMDM Romford	Romford SM(OFFTRACK)	MI - Mile	1,320.00	-219.48	1,539.48	5.02
63733112	009183 - LC - CROSSING ANCILLARY WORKS	IMDM Western West	Exeter SM(OFFTRACK)	EA - Each	1.00	-198.00	199.00	25.00
69142086	009657 - VEG TREES - MECHANISED FELL	IMDM Bedford	Bedford VSM(OFFTRACK)	SM - Square Metre	600.00	-120.00	720.00	-1.00
65779070	009426 - VEG INSPECTION	IMDM Western West	Exeter SM(OFFTRACK)	22 - 220 yards (1/8th mile)	1.00	-118.00	119.00	35.21
67979272	002001 - LX-APPROACH-CLEAR VEGETATION	IMDM Ipswich	Norwich SM(OFFTRACK)	LO - Location	1.00	-99.00	100.00	110.00
56169989	009661 - VEG MAINTENANCE - CHEMICAL	IMDM Liverpool	Warrington SM(OFFTRACK)	SM - Square Metre	1.00	-98.00	99.00	0.16
66059105	009202 - AUTHORISED WALKING ROUTE - MAINTAIN	IMDM Saltley	Chilterns SM(OFFTRACK)	MI - Mile	0.20	-76.80	77.00	8.00
69289794	009255 - NR/L3/TRK/055/U1. TRACK RAIL HOLES	IMDM Manchester	Victoria SM(RT&L)	RM - Rail Mile	0.73	-35.98	36.71	0.50
57931652	020195 - VEGETATION CLEARANCE	IMDM Cardiff	Swansea SM(OFFTRACK)	LO - Location	1.00	-26.00	27.00	0.01
67233858	009139 - TREAT S&C COMPLETELY USING SMALL PLANT	IMDM Wessex Inner	Wimbledon SM(TRACK)	EA - Each	1.00	-21.00	22.00	16.00
62527126	009183 - LC - CROSSING ANCILLARY WORKS	IMDM Western West	Exeter SM(OFFTRACK)	EA - Each	1.00	-18.00	19.00	3.50

Figure 19: Work orders with negative maintenance volumes

The low level of negative maintenance volumes is one indication of their quality and reliability and in one sense it is reassuring most errors of this type are restricted to one MDU. This and other 'outlier' tests could usefully be developed and proactively provided to MDUs requesting they review any identified figures and address the root causes for any errors.

5.2 Corrections made in Ellipse

Network Rail compared the volumes for work orders recorded in Ellipse in period 9 with their volumes recorded in period 11. The number of these work orders with different volumes was 2,051. As a possible worst case, we can assume all these relate to corrections for work orders input in period 9 (and not earlier). With an average of 320k work orders input per period, this equates to an error correction rate of 0.62% of work orders.

Whilst this test does not measure accuracy, it does show the volumes are broadly consistent and not subject to high levels of change once they are in Ellipse.

5.3 Planned versus delivered volumes

Checking planned and delivered volumes is the primary check of accuracy that is undertaken. Network Rail analysed the period 1-11 work orders recorded in Ellipse to count how many had delivered volumes that were different to what was planned. They found that 26,553 out of 3.52 million work orders have different volumes, that is 0.75%.

A large proportion of these work orders are likely to be correct when more or less volume than planned was delivered on the day – so 0.75% is very much a worst case estimate of an error rate. That said, this is only one test and there may be work orders with matching planned and actual volumes that should instead be different.

5.4 Commentary

Both the Rolling Forecasts and Annual Return of maintenance volumes that are reported to the ORR are derived from the figures that are recorded in Ellipse. The high level analysis undertaken by the Business Planning, Analysis and Reporting team for us indicates these figures are consistent in that only a small proportion are corrected in later periods. The small number of negative volumes and the high level of planned matching delivered volumes are indicators that the delivered volumes are reliable.

The Annual Return presents one test of completeness, namely whether all planned volumes have been delivered in the year and, if not, whether the commentary adequately explains the reasons. Table 11 shows that at a network-wide level the delivery volumes were 100% or more those planned, suggesting a high degree of completeness. We note, though, that one of the investigations by Network Rail following comments by ORR on some of these figures found that some volumes may have been missing or miscoded in Ellipse on East Midlands Route for standard job “010232 Int Cable Service – M005”.

This is a high level test of completeness. A fuller test would involve checking all assets ‘on the ground’ are recorded in Ellipse and if they each have suitable maintenance data which may form part of a wider asset data integrity review for Ellipse. Note the latter check is done on Southern Region to ensure each asset in Ellipse has an allocated MST.

Table 11: Maintenance volumes reported in the 2020/21 Annual Return (figures taken from Table 39)

Coverage	Standard Job No. and description (Unit of measurement)	2020/21 Forecast	2020/21 Delivered	% Forecast that was Delivered
Network-wide	001436 - INSTALL CABLE IN TROUGHING (Yards)	5,874	5,927	101%
Network-wide	001444 - OLG - CAB PATROL INSP (Each)	1,933	1,933	100%
Network-wide	001445 - OLG - E01 FOOT PATROL (Each)	10,452	10,453	100%
Network-wide	001560 - CON RAIL-REPLACE INSULATOR (Each)	29,434	29,483	100%
Network-wide	001782 - S/GEN C EXAM [M] (No.)	6,985	6,986	100%
Network-wide	002663 - INVESTIGATE / TEST-PLANT-FAULT FOUND (Hours)	9,332	9,352	100%
Network-wide	003177 - OLG- PRE ISOLATION RISK ASSESSMENT (Each)	3,406	3,410	100%
Network-wide	004204 - OLG-ISOL FOR MTCE ACTIVITIES (Each)	9,895	9,976	101%
Network-wide	004205 - OLG-ISOL FOR 3RD PARTIES-INC EMERG SVC'S (Each)	674	4,055	602%
Network-wide	004508 - OLG-ISOL FOR OTHER NETWORK RAIL PROJECTS (Each)	123	123	100%
Network-wide	004714 - OLG-INSP-PRE WORK FAMILIARISATION (Each)	2,369	2,369	100%
Network-wide	005026 - DISTRIBUTION-WORK ARISING-REPAIR (Hours)	25,149	27,450	109%
Network-wide	005101 - S&T ATTENDANCE FOR ENGINEERING WORK (Hours)	28,771	28,927	101%
Network-wide	006000 - FPL TEST (CLAMP LOCK) (Point End)	49,953	50,000	100%
Network-wide	006004 - FPL TEST (MACHINE) (Point End)	41,963	41,985	100%
Network-wide	006335 - TRACKSIDE APPARATUS CASE (Service)	119,212	119,272	100%
Network-wide	006336 - TRACKSIDE APPARATUS CASE (Service)	55,976	55,985	100%
Network-wide	006374 - CLAMP LOCK HYDRAULIC POINTS (Service)	29,949	29,959	100%
Network-wide	006377 - POINT MACHINE - HW STYLE (Service)	26,955	26,979	100%
Network-wide	006393 - POINTS SUPPLEM'RY DRIVE - MECHANICAL (Service)	47,558	47,562	100%
Network-wide	006395 - POINTS - SWITCH ROLLERS (Service)	45,608	45,622	100%
Network-wide	006687 - POINT INSPECTION (Service)	79,575	79,589	100%
Network-wide	006849 - POINT FITTINGS - MAINTAIN [C] (Service)	83,119	83,172	100%
Network-wide	006989 - PSB TECH MISC WORK (Hours)	92,687	92,926	100%
Network-wide	009001 - TEF3015. PATROL TRACK ON FOOT (Miles)	376,247	376,453	100%
Network-wide	009050 - TEF3041. RECORD TRACK GEOMETRY MANUALLY (Yards)	4,080,120	4,216,963	103%
Network-wide	009059 - LUBRICATE JOINTS USING SMALL PLANT (Rail joints)	203,451	218,059	107%
Network-wide	009062 - TEF3010. STRESS WELDED RAILS (Track yards)	423,510	429,938	102%
Network-wide	009065 - TEF3006. WELD STANDARD RAIL GAP (Each)	17,436	17,697	101%
Network-wide	009076 - REPLACE DEFECTIVE WELDED RAIL (Rail yards)	107,178	109,336	102%
Network-wide	009112 - TEF3071. TAMP TRACK USING OTM (Miles)	5,578	6,288	113%
Network-wide	009113 - TEF3071. STONEBLOW TRACK USING OTM (Miles)	1,994	3,884	195%
Network-wide	009116 - LIFT PACK WELDED TRACK USING HAND TOOLS (Track yards)	171,748	172,774	101%
Network-wide	009119 - UNLOAD BALLAST USING TRAIN (Tonnes)	209,148	213,121	102%
Network-wide	009121 - REGULATE BALLAST USING HANDTOOLS (Rail yards)	1,502,239	1,520,836	101%
Network-wide	009128 - TEF3071. TAMP S&C USING OTM (Point End)	2,639	2,944	112%
Network-wide	009138 - LUBRICATE SLIDE CHAIRS USING HANDTOOLS (Point End)	257,604	257,931	100%
Network-wide	009200 - AUTHORISED ACCESS POINT - MAINTAIN (Each)	34,644	51,324	148%
Network-wide	009215 - INSTALL ESR/TSR EQUIPMENT (Each)	3,191	12,427	389%
Network-wide	009216 - REMOVE ESR/TSR EQUIPMENT (Each)	3,169	12,391	391%
Network-wide	009225 - TRANSPORT MATERIALS USING TROLLEY (Hours)	62,384	62,960	101%
Network-wide	009236 - CHAMBER MAINTAIN MANUAL (Each)	15,471	15,513	100%
Network-wide	009276 - BOUNDARY - ROUTINE INSPECTION (22 - 220 yards (1/8th mile))	235,084	235,909	100%
Network-wide	009280 - BOUNDARY - MAINTAIN POST & WIRE (Yards)	604,217	604,820	100%
Network-wide	009287 - BOUNDARY - MAINTAIN VERTICAL BAR 1 (Yards)	28,689	28,903	101%
Network-wide	009308 - LIFT PACK WELDED TRACK WITH SMALL PLANT (Track yards)	305,480	307,606	101%
Network-wide	009309 - MEASURE SHOVEL PACK CWR TRACK (Track yards)	338,334	339,361	100%
Network-wide	009319 - CULVERT MAINTAIN MECHANICAL (Yards)	21,877	21,877	100%
Network-wide	009322 - PIPE MAINTAIN MECHANICAL (Yards)	211,403	217,223	103%
Network-wide	009323 - PIPE MAINTAIN MANUAL (Yards)	81,159	81,323	100%
Network-wide	009326 - CHAMBER MAINTAIN MECHANICAL (Each)	7,069	7,254	103%
Network-wide	009328 - UNLINED CHANNEL MAINTAIN MANUAL (Yards)	211,802	211,813	100%
Network-wide	009425 - STONEBLOW S&C USING OTM (Point End)	240	242	101%
Network-wide	009579 - REGULATE TAMPED BALLAST (Track yards)	413,605	414,558	100%
Network-wide	009616 - DRAINAGE SYSTEM CONDITION INSPECTION (Miles)	5,167	7,322	142%
Network-wide	009636 - LIFT PACK WELDED TRACK WITH SMALL PLANT (Track yards)	163,955	164,586	100%
Network-wide	009656 - VEG CHAINSAW FELL & PROCESS TREE (Square metres)	4,355,200	4,358,050	100%
Network-wide	009663 - VEG MANUAL STRIM/BRUSHCUT (Square metres)	8,528,869	8,666,871	102%
Network-wide	009664 - VEG HIGH PRUNER (Square metres)	2,003,576	2,043,255	102%
Network-wide	009667 - VEG SIGNAL SIGHTING (Square metres)	1,953,275	1,956,143	100%
Network-wide	009668 - VEG LEVEL CROSSING SIGHTING (Square metres)	6,062,710	6,053,710	100%
Network-wide	010000 - BS7671: ELECTRICAL INSTALLATION TEST (Each)	5,574	5,746	103%
Network-wide	010006 - SW HTR-STRIP F EXAM (Each)	13,687	13,696	100%
Network-wide	010007 - SW HTR-STRIP C1 EXAM & TEST (SEASONAL) (Each)	31,654	31,693	100%
Network-wide	010010 - SW HTR- 110V INSUL RES TEST (Each)	10,403	10,425	100%
Network-wide	010126 - UNOCCUPIED BUILDING MAINTENANCE D EXAM (Each)	10,228	10,224	100%
Network-wide	010199 - OLG-HEIGHT AND STAGGER RECORDING (Span)	39,497	39,854	101%
Network-wide	010200 - High Level Intrusive Insp All Types OLA (Span)	44,048	44,468	101%
Network-wide	010217 - SERVICE A M001 (Each)	8,750	8,755	100%
Network-wide	010218 - SERVICE B M001 (Each)	7,858	7,859	100%
Network-wide	010232 - INT CABLE SERVICE - M005 (Each)	179	179	100%
Network-wide	012100 - OLG-APPLY-CANCEL ISOLATION (Each)	27,995	28,217	101%
Network-wide	012186 - CLEAR VEGETATION ENCROACHING OLE (Yards)	165,573	165,996	100%

6 Review of System Reliability

6.1 Confidence Grading – definitions

The remit for this review required a grade for system reliability only rather than the fuller process of assessing system reliability and data accuracy. Our approach has therefore been tailored to system reliability and we are unable to provide an assessment of data accuracy.

System reliability is defined in the mandate for this work as "a measure of the overall reliability, quality, robustness and integrity of the system that produces the data." The standard definitions for grading system reliability are set out in table 12:

Table 12: 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.
C	Extrapolation from limited sample for which Grade 'A' or 'B' data is available.

The grading system provides some guidance on how to apply these grades, namely "Some examples of the potential shortcomings include old assessment, missing documentation, insufficient internal verification and undocumented reliance on third-party data".

In reviewing the volumes data reliability, applying the definitions to distinguish between grades B, C and D was to a degree subjective. We have therefore broken

down our assessment to a number of requirements, described the evidence seen and then graded according to the following guidelines:

A – fully meets requirement
B – mostly meets requirement with few exceptions
C – partially meets requirement but risk of any exceptions is considered to be limited
D – largely / fully fails to meet requirement with significant risk of exceptions

6.2 Confidence Grading of System Reliability

Table 13 sets out the criteria for assessing the reliability aspect of the confidence grading for volumes data. The systems used, documentation and processes do not vary in any material way between asset types; nor did we observe any difference in their application by asset type at the MDUs we interviewed. We have therefore assessed the grading for all asset types together.

The criteria are used to assess the management of maintenance volumes data and are the same, or similar, as those we have used on other recent Independent Reporter reviews[9].

In reading the assessment it is important to understand that this is purely focussed on the recording and reporting of volumes data and not on the wider Ellipse processes which fall outside of the grading requirement. The scores reflect the limited references to the volumes data collection within the procedures, many of which can easily be rectified.

Table 13: Confidence grades

Element of Process	Criteria to be met	Grading	Evidence Provided
Objectives of metric	Clear and unambiguous description of the purpose and objectives of producing the metric	C	There is no clear definition of the volume's metric within a process or procedure for reporting purposes
Requirements	Clear and unambiguous description of the standards required for the data and its collation, in order to meet the objectives	C	The specific requirement for volumes reporting is not included in any procedures (other reported measures have clear descriptions – eg performance KPIs)
RACI	Clear identification of those **R**esponsible for, **A**ccountable for, **C**onsulted about and **I**nformed about the metric	C	Other than for Rolling Forecast reports, no RACI table provided but there is a

[9] For example, Independent Reporter Review of Environmental Sustainability Data - August 2021 (orr.gov.uk), Independent Reporter Review of Consistent Region Measure – (Passenger) Performance (CRM-P) and Freight Delivery Metric by Network Rail Region (FDM-R) (orr.gov.uk)

			good understanding in practice
Source(s)	Description of who or what (system) provides the data	B	The use of My Work App, FDM and Ellipse is understood and described in the process Handbooks (0175 and 0176)
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	B	The transfer of data from My Work App to Ellipse via FDM is used for ~85% of jobs although the frequency of authorisation of data to Ellipse does vary by depot
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	A	The volumes definition by asset types are provided
Data quality	Definition and description of the required data quality and accuracy	D	The procedures do not appear to define the expected levels of data quality and no specific checks are specified
Data processing	Documentation and description of processes, sufficiently clear for new users	C	MDU users reported that there are no clear guides on how to manage the volumes process and there is reliance on support from other MDUs
Staff Training	Sufficient availability of trained staff to maintain data and process quality and continuity in the event of unavailability through e.g. illness, retirement or resignation	C	Very little formal training available. My Work App users rely on peer training and no formal training for SMs or SSMs on the process
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	C	The processes for identifying errors vary by MDU. Safeguards in My Work App (new 25% rule) plus FDM bulk sign off rules reduce error risk but the processes at SM, SSM, IME differ by MDU. Focus of checks is not on volumes accuracy primarily but does find errors. These are generally not recorded and trends not tracked.
Data collation and presentation for subsequent evaluation	Description of required data formats, methods and frequencies and/or dates of	B	These are well understood as a function of Ellipse and other systems but not necessarily explicitly stated

	provision (who should get what, and when)		
Process for dealing with data-related queries	Description of procedures and timescales to be followed in response to queries, including requirements for referral back to data source(s); records of numbers of queries and outcomes, analysis of trends	C	No records were generally available on data queries. These being dealt with as they arose
Internal review and audit procedures	Description of internal review and audit requirements, processes and frequencies; evidence that these are being met	D	Outside of the MDUs' own processes there are no defined audit requirements, for example deep dive on specific asset types following tasks through the process to sample accuracy
Process for dealing with data and reporting related queries from ORR and other stakeholders	Description of procedures and timescales to be followed in response to queries from ORR; records of numbers of queries and outcomes, analysis of trends	B	No documented process but queries from ORR and outcome of investigations on the Annual Return are logged

Overall, we consider that a reliability rating of C is appropriate for the recording and reporting of delivered maintenance volumes.

The mandate specifically stipulated a rating for the reliability of the system that produced the annual network-wide maintenance volumes within the 2020-21 Annual Return. These figures are derived from the data captured in Ellipse and the accompanying assurance processes. We note the process for compiling the Annual Return results in additional assurance for the 73 standard jobs that are reported but it is undocumented. Overall, we therefore consider a reliability rating of C is also appropriate for the production of the maintenance volumes in the 2020/21 Annual Return.

7 Opportunities for Improvement

7.1 Ideas raised by MDUs

During the interview meetings with MDUs when discussing the processes that they follow in managing their maintenance volume data, some suggestions for improvements emerged.

These suggestions could be split into three groups: processes, training and tools.

7.1.1 Processes

The absence of more detailed step-by-step guides for undertaking the key tasks around volumes planning and recording was referenced by many of the MDUs visited. This was particularly felt to be a weakness for bringing in new team members into key roles such as the Systems Support Manager. These should cover all aspects of the process from planning to recording actual volumes and the requirements for use of My Work App and FDM and assurance of the data in Ellipse.

7.1.2 Training

More tailored training and support was felt to be needed in a number of key areas. This should cover the use of My Work App through updating the videos and ensuring that it does not just rely on peer training which can inadvertently reinforce poor practice from current users. Additionally, support and training was felt to be needed to assist new entrants to key roles such as Section Managers, Section Planners and Systems Support Managers to help them take on new roles and responsibilities in managing volumes data.

7.1.3 Tools

Several suggestions were made during the review sessions on improving user functionality of the systems. It was felt that the ABP tool could be made simpler and more intuitive. This would improve the use of the tool and the quality of the recorded data.

The My Work App was also picked up as an area for improvement in terms of functionality, specifically to allow for more intelligent reporting and data entry which would allow subtle details to be entered when condition on site may not match the work order. Instead of forcing users to respond from limited options an intelligent way to make allowances, within limits, may see an improvement in data accuracy. Another area for potential improvement was inputting No Fault Found to ensure the associated volume is not inadvertently cancelled.

Another suggestion was to update FDM to better deal with volumes that are not linked to MST activities. FDM was developed for signalling work which is predominantly MST based and at present it was reported to not work as well for managing non-MST maintenance activity. Increasing the flexibility of FDM to

deal with this data and updating the current validation workflows were identified as key areas that would improve the overall process.

These suggestions all need to be balanced with the risk of large numbers of users having a high degree of control over the data and certain functionalities may need to be limited to specific user groups who have had the correct training.

7.2 Relevant Network Rail improvement programmes

There are a number of improvement programmes currently being implemented by Network Rail.

The recent introduction of a 25% tolerance check of planned volumes vs actual volumes in My Work App is generally viewed positively by the MDUs we reviewed.

Reviewing the number of standard jobs and rationalising them is an activity that has been ongoing since 2018 but continues to happen cyclically and is wanted by all the MDUs we spoke to.

An “overhaul” of My Work App is scheduled for later this year, in which My Work will bundle jobs according to location/proximity to each other, or within booked possessions. This would enable those supervising maintenance activities to see the total work scheduled within their supervision and help them manage it more effectively.

My Work App ‘work optimiser’ is an update to the App that is promised for 2023, as the Intelligent Infrastructure project provides more tools for the workforce, to improve productivity, accuracy and timeliness of reporting. There was not much additional detail for how this would work practically, and it is anticipated that more detail about this would arise in the next year.

There is a known discrepancy with the ‘Time on Tools’ data where work is planned on the basis of incorrect estimates of the time it will take to complete. Network Rail are working to better understand labour productivity across its maintenance functions which should improve the maturity and accuracy of recording / reporting of volumes information and provide more meaningful quality assurance data for work undertaken. Better ‘time on tools’ data would have significant benefits to volumes planning and reporting.

Network Rail is developing a data dashboard via Power BI called PANDORA (Providing Accurate National Data On Rail Assets) to provide users with a simple view of their Ellipse data and allow Maintenance colleagues a “shop window” into Ellipse without having to be an expert Ellipse User. PANDORA is in development and looking to show a prototype in April / May 2022. This should help to address the comments from some MDUs about the difficulty in accessing Ellipse data easily.

Role Based Access Competency (RBAC) is being introduced for Network Rail’s applications in 2022/23 to ensure the right levels of access are held by staff based

upon their role and needs, affording tighter controls and mechanisms to assess data.

North West & Central Region have two relevant initiatives:

- To address the comments made by MDUs over the difficulty, complexity and usability of the ABP tool, the Region is developing a 'Delivery Unit Simplifier' over the coming months in readiness for RF11. We are informed that in theory the 'Simplifier' will be exclusively used by colleagues in the MDUs, the outputs of which will be uploaded into the national ABP tool.
- Training and Mentorship – West Coast Mainline South have a regular session with their teams to openly discuss and share experiences to support learning from one another. This is complemented by 'step by step' processes to support new colleagues, and Role Based Capability modules – which the section planner community are working through to identify competency requirements.

The initiatives discussed in this section go some way to indicate the continuous improvement approach that Network Rail is taking to the processes around planning and reporting maintenance activity accurately. Network Rail is also introducing a business-wide Governance Risk Assurance Improvement framework in which maintenance is being addressed.

7.2.1 Governance Risk Assurance Improvement (GRAI) framework

Network Rail is currently developing Governance, Risk, Assurance and Improvement principles into its business-wide processes with the aim of providing:

- A robust framework for a complex, devolved business;
- Systems and processes to help manage work effectively; and
- Shared learning to improve efficiency and safety.

It sets out a process model using the GRAI principles as shown in figure 20 below, as well as providing a model hierarchy and framework for defining the process.

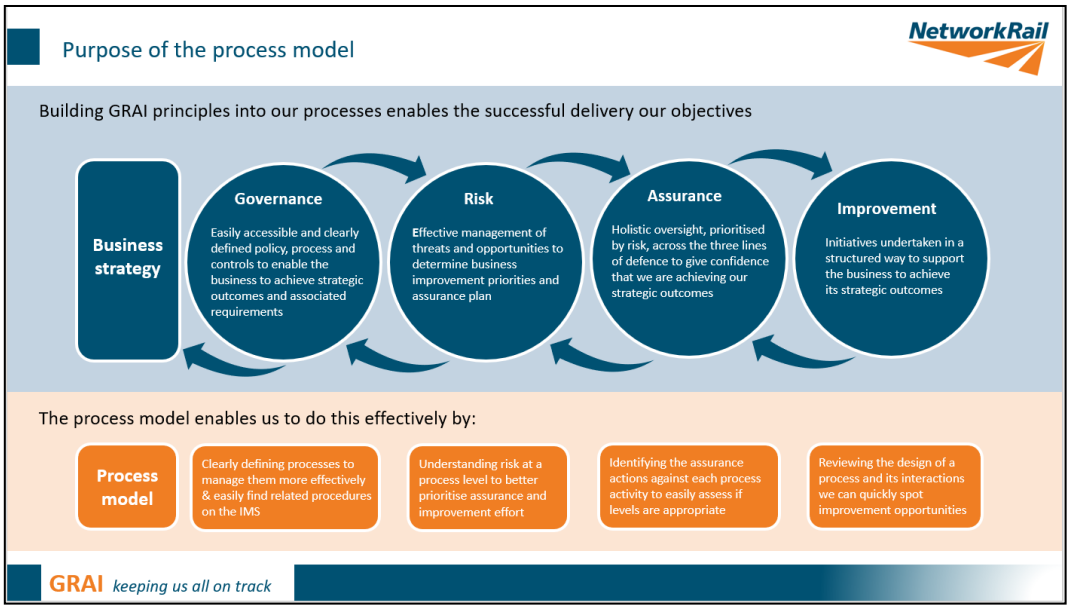


Figure 20: The process model developed under GRAI[10]

The framework is being implemented by the Quality and Business Improvement team and maintenance will be looked at this year. Of particular relevance to maintenance volumes is the process "Develop, deploy and manage maintenance productivity systems and processes" which is due to be developed and published in June this year.

7.3 Reporter observations on areas for improvement

This section provides an overview of our observations to improve the management of maintenance volume data. As a general observation, we note it becomes increasingly difficult to identify errors through the stages as the work orders become more 'remote' from those doing the work and volumes tend to be aggregated to the standard job level in the later stages. Our view, therefore, is effort should be focused on data capture and data approval.

7.3.1 Data Capture

The recent introduction of the 25% tolerance check of planned versus actual volumes should improve the accuracy of volumes recorded in My Work App. It should be sufficient to pick up incorrect units (e.g. kilometres instead of metres) although may not be sensitive enough to pick up those errors caused by selecting the wrong number on the spinner used to input values.

We note that most work orders in Ellipse (99.25% input in the periods 1 – 11 in 2021/21) have matching planned and actual volumes. For some assets, such as signalling, we would expect volumes to match closely but there may be more tolerance with others such as off track. It may therefore be worth introducing asset specific tolerances to help identify more errors. This could be based on an analysis

[10] GRAI mtce CPO intro briefing ARUP.pptx

of work orders in Ellipse and asset engineer views on the level of variability they would expect.

Any further intelligent checks on My Work App in addition to checking against planned volumes should be beneficial, such as improving the 'Time on Tools' to identify any possible errors.

Of the suggestions made by the MDUs, providing up-to-date training would appear to be a priority.

7.3.2 Data Approval

Network Rail uses FDM to review and process many work orders collected using the My Work App every day. Work order data approval is an administratively heavy task for every MDU we visited.

An area worth investigating further is introducing an intelligent reviewing system and governance process in the use of FDM to reduce the time required for reviewing work orders. This could be done by:

- Developing automatic scripts to close low risk or repetitive works automatically (or with sample manual checks automatically selected) by improving the ability to distinguish between inspection, planned maintenance and faulting volumes; and
- Building an automated analytical model to identify trends and patterns of volumes and flag outlier data for the section planner / section manager in the MDU to check such work orders prior to uploading to Ellipse and to identify root causes of errors in data capture.

7.3.3 Data Storage and Data Assurance

Network Rail uses Ellipse to store work order data. The MDUs and, to a varying degree, the Routes and Regions use locally produced reports to monitor maintenance volumes delivery against planned aggregated to the standard job level. These can be used to identify possible outliers (such as measurements in wrong units) that, on further investigation, can lead to corrections made in Ellipse.

With the variety of reports, we believe there is the potential to share best practice. We also found the implementation of data ownership and governance arrangements varied between Regions and believe that is likely to lead to varying qualities of data. The more proactive management arrangements are to be preferred.

Network Rail HQ provide a Power BI tool on the first Thursday of every period that MDUs / Routes / Regions can use to produce reports and, in a recent development, to drill down to work orders. This is useful and we have suggested the team monitors who is using it. Again, there is scope to be more proactive by showing users how to best use it and to encourage its use more widely.

On reviewing the HQ tool with the team, we noted there were a small number of negative volumes, most from one MDU. This may be confusion by a user in

updating a volume in Ellipse (or possibly FDM) inputting the change required rather than the updated value. This is an example of a smart use of the tool to identify the root cause of errors which could be usefully expanded. It could also be used to track changes made in Ellipse from period to period and identify any trends in those changes.

8 Conclusions and Recommendations

8.1 Conclusions

This review has shown that much attention is paid to the maintenance volumes data at all of the 14 MDUs we interviewed. In all cases, the data is used to actively manage maintenance work priorities and produce the annual Activity Based Programme and resource levels. The processes for recording actual volumes delivered are the same for most asset types. There are two key stages where it is easiest to identify any errors: at the point of data capture, primarily by My Work App, and in FDM where the data is approved before being uploaded to Ellipse.

In both cases, there are some simple checks already included in Network Rail processes. Network Rail is also implementing some improvements to My Work App to carry out more checks, and there may be scope for more. The SSM produces the reports for MDUs to carry out checks in Ellipse, mainly focussing on the planned versus actual comparison, some with bespoke reports developed in Power BI as no standard reports are in place. These reports are used to help identify where obvious errors have been made.

As indicated by the confidence grading on system reliability, there is an opportunity for increased national oversight on the management of maintenance data. The current national procedures do not cover the capture and use of volumes data in any detail. There is no specific purpose set out for recording volumes data, no clear definitions of the metrics, no clarity on how the data should be captured, no clear accountability for the collation of the data at all levels, and no defined processes to undertake quality assurance.

Unsurprisingly this has led to variations in the management of maintenance volumes data across the different MDUs, Routes and Regions. The most structured approach we found to data quality was in the Southern Region, which has developed an asset data management programme with a defined operating model, accountabilities and responsibilities and developed some useful KPIs to help manage the data. In addition, West Coast South has created a defined maintenance planning process that sets out how this should be undertaken, particularly the balance of budgets and engineering requirements to produce a robust plan. This builds on the national procedures and provides more supporting detail.

8.2 Introducing a data management framework for Maintenance Volume

We believe that system reliability of the maintenance volumes data would be improved by introducing an overall framework for its management network wide. This could be achieved by adopting or adapting the Southern data improvement plan alongside the West Coast South planning process. It would put in place a structured set of documentation to cover the management of the data and include

the areas of improvement we observed in section 7.3. We list key areas below that should be covered.

We recognise that the Regions and Routes may want to tailor documents and processes to their particular requirements and context under devolution, but this should be done within an overall framework that we describe here. This is vital in a devolved network where there is a need to ensure consistency of data across the whole of Network Rail to enable direct comparison between outputs at Regional, Route and MDU level.

The framework should cover the following key areas which align with table 13 used to undertake the reliability assessment in section 6.

Purpose of reporting

A clear understanding of why the data is being captured and the value of the data is vital in underpinning the processes. There are a number of reasons for capturing the data and each of these should be set out. This provides not only clarity in reporting but also helps to explain to those involved in data capture the value in what they are recording. The purposes should be developed by Network Rail, we believe they could include:

- To provide assurance on work done this year, providing reliable data to ORR through the Annual Return that key asset maintenance is being undertaken in line with the regulatory settlement
- To improve the asset reliability and sustainability
- To provide base data for use in the annual asset maintenance planning process and to support the 5-year regulatory planning cycle
- To provide base data for manpower and resource planning
- To monitor work done against plan on an ongoing basis
- To support the management of backlog work

Clearly Defined Metrics

A clearly agreed definition of the metrics and exactly what is being recorded. This should cover:

- Unit of measurement to clarify what is being measured and why for:
    - Inspection Volumes (Scheduled Inspections)
    - Planned Volumes (Preventative Maintenance Volume)
    - Faulting volumes (Reactive Maintenance Volume)
    - Backlog or undelivered volumes
- Provide an unambiguous description of the metrics (as done for other measures in Network Rail)

Requirements on reporting

A simple process description of how the data is captured through the various systems and set out the following as a minimum:

- Timescales to upload – it should set out the periodic requirements to ensure data is uploaded and available for reporting purposes;
- Accuracy requirements - set out a target for accuracy requirements based on a realistic assessment of asset types;
- Clarity on volumes being recorded and any specific issues / guidance for individual volume types if required.

RACI

Clearly set out who is responsible and accountable for reporting volumes data right through to the collation of the Annual Return. This should include who sets the overall reporting requirements to ORR and the guiding mind behind the management of maintenance volumes data. This is particularly important given the ongoing devolution processes within Network Rail. The RACI should cover:

- Overall national responsibility for setting the volume reporting requirements and collation, assurance and publication of data
- Responsibility at Route or Regional level for collation and assurance of data
- Clarity of responsibility at MDU level for collation and checking of data
    - My Work App Users
    - FDM users – Section Managers, Section Planners
    - Role of System Support Managers and other key posts
- Responsibilities and authority at MDU level to amend or correct reported volumes data
- Clarify responsibilities for follow-up procedures (if any) following amendment or correction of data

Planning Process

Adopt a defined planning process that builds more detail into the national Ellipse procedures to support the creation of a robust plan. This would provide a more consistent base on which compliance to plan could be monitored. Adapting the West Coast South procedures would provide an already proven start point.

Data processing

Provide clarity on the processes for capturing volumes data and set out step-by-step guides to support key personnel in consistently applying the high-level process requirements. These procedures should cover as a minimum:

- Use of My Work App

- The use of manual recording setting out when this can or should be used given the lack of inbuilt process checks compared to My Work App
- The use of Field Data Manager and sign off arrangements
- Training material and practical how-to guides
- Skills forum or online facility to share good practice and lessons

Quality Assurance

Set out a defined quality assurance process for monitoring volumes data itself and ensure the base data used for compliance and plan vs actual progress is within the defined accuracy requirements. This should set out as a minimum:

- Tools and methods – use a standardised and consistent approach based on best practice from the national and locally developed tools
- Defined requirements and roles at key stages:
    - My Work App
    - Manual recording
    - FDM
    - MDU checks
    - Route/regional checks
    - Central checks
- Undertake base level checks on MST compliance to ensure an appropriate planned volume covers all assets as per the Southern Region process
- Reporting of relevant KPIs to be defined and agreed with the SSMs using the Southern KPIs as a starting point;
- Record of errors identified and corrected to allow trend analysis and identification of root causes of errors at each stage of the process. This could include monitoring corrections made in Ellipse to maintenance volumes data and identifying trends (e.g. by asset type, MDU etc.)
- Identification and implementation of actions to address root cause of errors and improve accuracy
- Implement an internal data audit requirement requiring independent data sampling and escalation path. This could include assessing accuracy of volumes recorded against the actual volumes delivered on site as well as against the planned volumes. Route / Regional data or support teams could undertake this.

Reporting

Set out who will receive the data and requirements for the design and use of reports

- Requirements within Network Rail
    - Infrastructure Maintenance Delivery Manager (IMDM)
    - Route/Regional Teams
    - Central team
- Requirements to Third Parties including ORR

8.3 Recommendations

Our recommendations to improve the reliability and accuracy of maintenance volumes are shown in table 14 below. We have listed them in our view of priority order.

Table 14: Recommendations

Reference Number	Recommendation Theme	Recommendation	Benefits	Evidence of Implementation	Location in Text	Owner
SOW25525-1	National framework for maintenance data management and reporting	Put in place a network wide framework led by the Centre with clear responsibilities, and documentation of definitions, standards, and processes. This could be based on the Southern Region Asset Data Management plan[11]. As described in section 8.2, this should set out as a minimum: • Purpose of reporting • Clear definitions of each metric • RACI ○ Clarity on responsibilities at Centre, Region, Route, MDU • Planning Process • Data processing arrangements at each stage	Consistent standards and reliability across all Regions, Routes and MDUs	Programme put in place to develop framework with clear delivery plan; regularly reviewed on its effectiveness and updated accordingly	8.2	Network Rail

[11] Southern Region Data Improvement Plan, Network Rail, 06/01/22

		○ Standardised training requirements • Quality assurance requirements including use of standardised reports • Reporting arrangements ○ External ○ Internal				
SOW25525-2	Best practice forum	Share best practice and lessons learned on data processing and assurance. Include consideration of good practice tools listed in Appendix D.	Sharing of tools and experience to improve data quality and a forum to feedback suggestions and requirements within the overall framework programme. Use of technology (e.g. Microsoft Teams) makes this an efficient process. Success to be measured by wider use of best practice tools which are continually improved	Managed forum set up and operational	8.2	Network Rail
SOW25525-3	Intelligent systems check	• Within the overall systems assurance process for managing maintenance volumes data, incorporate simple checks in the various tools e.g. My Work App to filter out / query unexpected input data	Reducing errors in the processes for data capture and data approval	Collection of recommendations from MDUs; completion of recommendation implementation; review success with users and ideas for continued improvement	7	Network Rail

SOW25525-4	Reporting of maintenance volumes	Implement changes to the recording of all volumes data to improve the ability to distinguish between planned volumes for preventative maintenance and faulting volumes	Ability to separate the volume data will better allow the root cause of any discrepancies to be determined and provide more granularity for intelligent interrogation. E.g., if most volumes for an asset are fault volumes and not planned maintenance, this may have a detrimental impact on the condition/performance of assets.	Development of reports of separate volumes	3.2.7	Network Rail

Appendix A

Statement of Work for Independent Reporter Framework: #25525 Review of Maintenance Volume Data Accuracy

Independent Reporter Framework

Statement of Works

1.0 COMMISSION INFORMATION	
Project Name:	Review of Maintenance Volume Data Accuracy
Bravo Sourcing Request Number:	#25525
Network Rail Contact:	Kara Chester, Regulatory Compliance & Reporting Manager
Network Rail Department:	Planning & Regulation
SoW Number:	0012
Bravo Contact number ecm_	ecm_29133
Network Rail PO Number:	[insert NR PO# when available]
Commission Value:	£103,000 Fixed price contract, payable in milestones (set out in section 5.3)
Supplier Name:	Ove Arup & Partners Limited
Main Supplier Contact:	Ian Hood Ian.hood@arup.com Tel: 07919 220 439

This Statement of Work (SoW) is the contractual vehicle for defining, authorising and commissioning a piece of work to be undertaken under the Independent Reporter Framework. The SOW has six sections:

1 *Commission Information*
2 *Commission Overview*
3 *Scope of Services and Deliverables*
4 *Knowledge Transfer*
5 *Resource & Commercial Details*
6 *Invoicing*

This SoW is entered into under and in accordance with the terms of the Independent Reporter Framework dated 1 February 2020 between Network Rail, the Office of Rail and Road, and the Supplier and includes and incorporates any special Terms and Conditions and any other amendments captured in this SoW.

Any dispute surrounding this SoW will be resolved in accordance with the Terms and Conditions outlined in the Framework Agreement.

Ownership and use of any Intellectual Property Rights shall be in accordance with the Framework Agreement Terms and Conditions.

Change control procedures are to be applied as set out in the Terms and Conditions of the Framework Agreement.

2.0 COMMISSION OVERVIEW	
2.1 Background	Network Rail has acknowledged problems of accuracy in reporting of maintenance volumes. For example, there have been instances where metric and imperial units of distance are being used interchangeably, instances where high volumes of mileage are recorded that are impossible to achieve, etc. In recognising problems, Network Rail has introduced a Quality Assurance (QA) regime that considers work volumes which have significant variance to the reported planned versus actuals normalised in hours to enable for the first time a quantitative review across standard jobs and disciplines. The output of this QA regime is issued to the Maintenance Delivery Units (MDUs), who confirm if the variance in work volumes is correct or not and update the anomalies in Ellipse to correct the data as required. Whilst welcome, this does not assure the ORR that this or other information (i.e.volumes without significant variance) is accurate.
2.2 Business Objectives and Priorities	ORR needs to have confidence: • that Network Rail has access to reliable and accurate data to manage issues. • It can rely upon data provided by Network Rail to enable its performance of duties in holding Network Rail to account for delivery under the Network Licence. • that there are adequate improvement programmes in place to improve reporting processes.

3 .0 SCOPE OF SERVICE AND DELIVERABLES	
3.1 Key requirements	The reporter should assess the system reliability of the following maintenance work volumes, the reporter should assess each of these metrics at the network-wide level: • Track • Off Track (Lineside, Drainage) • Signalling • Telecoms • Overhead Lines Electrification • Plant and Distribution The reporter should review each of these metrics in terms of: • Review and comment on the processes and procedures by which Network Rail captures and assures data (including the effectiveness of regions own assurance regimes) • Review all relevant documentation and systems and comment on their fitness for purpose; • Review and comment on the reliability, quality, consistency and completeness of reported data; • Present a confidence grading for the system reliability for each metric under review based on the end of year dataset (2020-21); • Make prioritised recommendations addressing how the existing process might be improved (recommendations should be cognisant of the inflight improvement programmes) **Recommendation to review**

	Review application of the existing data governance processes, policies. Understand how Network Rail systemically capture inaccurate reporting and provide recommendations on how Network Rail can improve capture of inaccurate reporting across the maintenance information management system (not limited to Ellipse). IR to provide feedback and recommendations on how Network Rail can structure its maintenance information processes, documentation, and governance into an information management system.
3.2 Key skills	It is essential that the successful Bidder has the resource with the desired skills and experience for this project. Bidders will need to demonstrate how they meet the key following skills and experience: • have access to suitable tools and software in order to provide the detailed analysis • technical experience and application of data accuracy and reporting • capable of producing a reliable and efficient method for analysis and assessment • experience of assessing high-speed infrastructure interaction with the conventional network • the ability to work collaboratively with key stakeholders at all levels • the ability to draft and finalise high quality reports
3.3 Key deliverables	The required deliverables are: • two weekly progress update meetings • a confidence grading on the system reliability for each of the metrics in line with the grading system below **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. 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.
3.4 Methodology & approach	• a presentation of draft findings and any recommendations to be discussed at a meeting with Network Rail and ORR • IR to potentially remotely contact or visit (as appropriate) 14 MDUs across the five regions to testing Lv1 & Lv2 assurance. • a draft report (for comment by ORR and Network Rail) covering the issues set out in the scope section above, to be provided by the end of December 2021; and • a final report in late January 2022 that addresses comments provided by ORR and Network Rail on the draft report

Appendix B

Confidence Grading System

B1 System reliability grading system

Table 15: 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 C

List of files supplied to the Reporter Team

C1 List of files supplied to the Reporter Team

Table 17: List of files supplied to the Reporter Team

File Name	Type	From
Asset Data Steering Group Terms of Reference	PDF	Southern Region Asset Data Team (Network Rail)
Southern MNT Power BI report example	PDF	Southern Region Asset Data Team (Network Rail)
Southern MST Integrity Dashboard	PDF	Southern Region Asset Data Team (Network Rail)
Southern Region Data Improvement Plan	PDF	Southern Region Asset Data Team (Network Rail)
Data Issue and Opportunity log	Excel Workbook	Southern Region Asset Data Team (Network Rail)
Maintenance Plan vs Actual Power BI report – West Coast South Management System	Email	Bletchley MDU
ABP Process - West Coast South Management System	PDF	Bletchley MDU
CP007 COVID 19 Briefing Pack v1.3	PowerPoint	Bletchley MDU
ToR - Head of Asset steering group [Drainage]	Word Document	
GRAI mtce CPO intro briefing ARUP	Powerpoint	Quality & Business Improvement team (Network Rail)
IMS process definition template v7.0 – 11.5.3 v8 IMS process definition template v7.0 – 11.5.1 v10	Excel Workbook	Quality & Business Improvement team (Network Rail)
ABP RF11 Consolidated Plant ABP RF11 Consolidated Total Costs (Final) 20220214 FY22 RF11 Costs by Region and Discipline – Output 20220215 FY22 RF11 Headcount table v1 (output) ABP FY22 RF11 Consolidated Volumes Final	Excel Workbook	Business Planning, Analysis & Reporting (Network Rail)
Activity Based Planning and Reporting Policy 0.1	Word Document	Business Planning, Analysis & Reporting (Network Rail)
NR_L2_MTC_PL0175 (1)	PDF	Technical Authority – Network Rail
NR_L2_MTC_PL0175_01 (2)	PDF	Technical Authority – Network Rail
NR_L2_MTC_PL0175_02 (1)	PDF	Technical Authority – Network Rail
NR_L2_MTC_PL0175_03 (1)	PDF	Technical Authority – Network Rail
NR_L2_MTC_PL0175_04	PDF	Technical Authority – Network Rail
NR_L2_MTC_PL0175_05	PDF	Technical Authority – Network Rail

File Name	Type	From
NR_L3_MTC_MG0176 (1)	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_02 (2)	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_03	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_05 (1)	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_06	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_07	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_08	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_09	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_10	PDF	Technical Authority – Network Rail
NR_L3_MTC_MG0176_11	PDF	Technical Authority – Network Rail

Appendix D

Good practice tools and reports

D1 Good practice tools and reports

The following is a series of examples of good practice reports and tools seen during our visits. These are provided as representative of what was seen and it is likely that other examples could be provided for MDUs that were not visited during the review. We suggest too that the tools developed by Southern as part of their asset data programme, and described in section 3.3.6 of the report, should be considered alongside these as good practice.

Assurance reports for the delivery of the annual maintenance plan

In the West Coast South Route, the Area Support team has developed a well-documented process and advanced BI reports for their MDUs, to monitor the progress of the annual maintenance plan. The reports also allow the identification of some outliers due to data errors, for example volume delivered for an asset type being significantly more than the corresponding asset population.

The home page of the tool highlights all the critical maintenance actives with self-explanatory KPIs (Figure D-1) and gives the user the option to dive into more detail (example of drainage show in Figure D-2). It could be further developed to produce KPIs of data quality such as reporting to “Do not use” codes and automatically identifying outliers based on comparisons with average delivery rates per shift / week / period.

Figure D-1: West Coast South Power BI Report

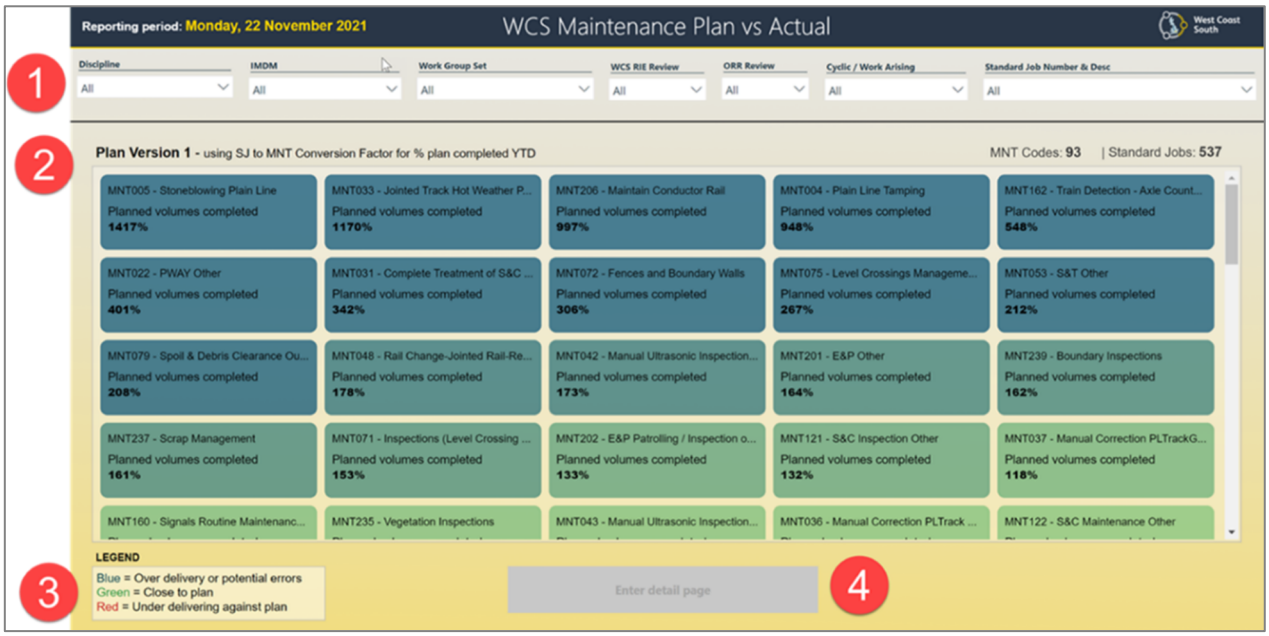
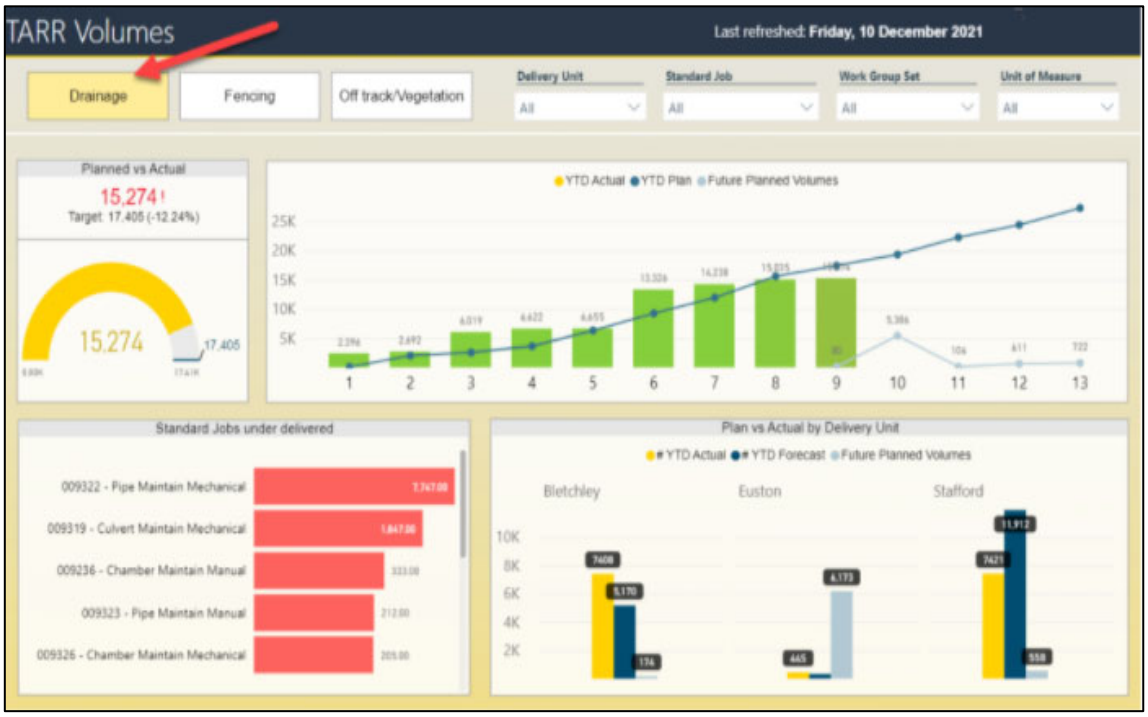


Figure D-2: West Coast South Power BI report for TARR Volumes



Another good example of a tool for monitoring the delivery of the maintenance plan was seen on the two MDUs on East Coast South (Doncaster and Kings Cross). The example below is for Doncaster MDU but is used on all of the East Coast South MDUs to compare planned and actual volumes and highlight any discrepancies. This is one of a suite of reports developed by the SSM on the route to support the MDUs in managing volumes.

Figure D-3: Doncaster MDU Power BI Report showing Plan vs Actual Report

Leading Indicator	Workstream Description	Benefit	Unit	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	YTD	FYF	%	Period Commentary	YTD Comments
No of Cyclic Top Sites	Drainage Maintenance TARR	Reduction in cyclic top and flooding sites by delivering the volume of Drainage Maintenance	Target Yards	1244	2674	1771	1689	283	4363	2490	422	2043	3084	666	1128	1482	14937	23340		Drainage lost shifts in P7, planning error contractor.	Rephased to get back X lost shifts in Ps xyz
			Actual Yards	1198	2570	1647	249	621	4232	662	511	0	0	0	0	0	21690		78.3%		
No of Cyclic Top Sites	Wet Bays Removed	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Bays	81	81	78	81	12	13	32	33	32	33	32	33	34	411	575			
			Actual Bays	22	57	37	107	30	100	74	55	0	0	0	0	0	482		117.3%		
No of 053/054 Failures	Cast Crossings Renewal	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Each	3	3	2	3	3	2	3	3	2	3	3	3	3	22	42		P13 - Suspicious Target	
			Actual Each	2	5	2	2	2	1	1	1	0	0	0	0	0	16		72.7%		
No of 053/054 Failures	1/2 Sets of Switches Renewal	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Each	2	2	1	2	2	1	2	2	1	2	2	1	1	14	21		Lost 230B1 lost shift due to lack of S&T/Covid. Replanned Xmas	Lack of S&T Support
			Actual Each	2	3	1	2	0	0	0	0	0	0	0	0	0	8		57.1%		
No of 053/054 Failures	Cast Crossings Repair	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Each	51	51	51	51	40	40	40	40	40	40	40	40	40	364	564			
			Actual Each	47	29	75	43	45	28	34	17	0	0	0	0	0	318		87.4%		
No of 053/054 Failures	1/2 Sets of Switches Repair	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Each	40	43	43	43	15	15	15	15	15	15	15	15	15	229	304		Awaiting Ellipse Update	Review std jobs/Lack Support
			Actual Each	28	23	40	16	24	9	41	19	0	0	0	0	0	200		87.3%		
No of VPE/S Reds	PL Tamping	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Miles	6	6	5	6	1	6	7	6	3	6	0	7	7	46	69			
			Actual Miles	7.05	5.82	6.58	7.43	3.73	5.78	9.16	6.23	0	0	0	0	0	51.78		112.6%		
No of VPE/S Reds	PL Stoneblowing	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Miles	3	3	2	3	0	0	3	4	0	0	0	1	4	18	23		Lost 2 Stoneblower shifts, machine failure	Lack of machines/ rep machines requested
			Actual Miles	2.01	2.04	0	0	0	0	1.47	2.13	0	0	0	0	0	7.65		42.5%		
No of VPE/S Reds	S&C Tamping	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Units	5	5	4	5	1	4	9	6	1	0	6	3	2	40	32			S&T unable to suppor
			Actual Units	5	4	5	0	2	3	11	8	0	0	0	0	0	38		95.0%		
Hot Weather Failures	IBJ's identified to repair/replace	Reduction in 104A (TSR's) and 104B (Track Faults) treating predict and prevent faults	Target Each	49	50	45	50	50	45	50	50	45	50	50	49	63	589	646		Rephase columns P7 onwards?	
			Actual Each	115	57	55	45	8	6	15	6.01	0	0	0	0	0	307.01		78.9%		
Hot Weather Failures	Ballast drops	Reduction in 104A (TSR's) treating predict and prevent faults	Target Tonnes	77	77	77	77	0	0	25	25	25	25	25	25	25	358	483			Volume caught up
			Actual Tonnes	8	10	0	0	330	0	0	60	0	0	0	0	0	408		114.0%		
Hot Weather Failures	Mechanical Regulating	Reduction in 104A (TSR's) treating predict and prevent faults	Target Mile	5	5	5	5	0	2	0	4	4	0	0	0	0	26	30		Plan to be developed	
			Actual Mile	4.88	2.42	4	0.5	2	5.69	0	0	0	0	0	0	0	19.49		75.0%		

Lagging Indicator	Workstream Description	Benefit	Unit	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	YTD	FYF	%	Period Commentary	Period Commer
101	Machine operated Points Reliability	Reduction in risk associated with facing point movements	Planned PE	47	33	28	42	33	28	42	33	28	42	33	28	39	286	456			
			Actual PE	43	35	28	40	34	30	39	23	0	0	0	0	0	272		95.1%		
101	TRK6100 Compliance	Reduction in SAPs and risk associated with Points	Planned PE	190	91	138	158	91	138	158	91	138	158	91	138	138	1055	1718			
			Actual PE	168	87	138	150	94	147	155	71	0	0	0	0	0	1010		95.7%		
101	Machine operated Points Reliability	Reduction in SAPs	Planned PE	47	33	28	42	33	28	42	33	28	42	33	28	39	286	456			
			Actual PE	43	33	28	41	30	31	41	23	0	0	0	0	0	270		94.4%		
103	Level Crossing Reliability and safety	Ensures Operational staff have clear visibility of level crossing	Planned Each	34	8	20	24	11	20	24	9	20	21	14	20	8	150	293			
			Actual Each	24	9	26	17	12	13	22	14	0	0	0	0	0	137		91.3%		

Assurance report of completeness of asset inspections

Like the Southern region, the Scotland Region has implemented regular checks with their MDUs, proactively checking the completeness of asset inspections to reduce asset-related safety risks and improve maintenance volume data quality. They have developed a report of missing planned MSTs for MDUs as illustrated below. This enables them to recognise where planned volumes are missing from the workplan and ensure that they are covered correctly, for example, an inspection may not be required. Alternatively, they may also highlight where an inspection has been carried out but not recorded in the Ellipse data.

Figure D-4: MST Configuration report developed by Scotland team highlighting missing MSTs