Network Rail and the Office of Rail Regulation

Part A Independent Reporter Mandate

Mandate AO/003:NR Annual Return MUC and CAF Audit 2009/10

FINAL| November 2010

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Glossary

CAF	Cost Analysis Framework
CP	Control Period
FRM702	Reporting of Maintenance Unit Costs – guidance document
FY	Financial Year (for Network Rail this ends on 31 March each year)
IMDM	Infrastructure Maintenance Delivery Manager
ISC	Internal Stock Control (materials ordering system)
KPI	Key Performance Indicator
LNE	London North East
MDU	Maintenance Delivery Units
MUC	Maintenance Unit Cost
MNT	Maintenance activity code
MST	Maintenance Scheduled Tasks
NDS	National Delivery Service
NROL	Materials ordering system used by NDS
ORR	Office of Rail Regulation
OTL	Oracle Time and Labour
PR08	Periodic Review 2008
P'way	Permanent Way
RAB	Regulatory Asset Base
RWI	Repeatable Work Items
S&C	Switch and Crossing
S&T	Signal and Telecoms
SSM	Systems Support Manager
UCF	Unit Cost Framework
UCM	Unit Cost Model
WAIF	Work Arising Identification Form
Z567	Z567 Unit Costs Report

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Executive Summary

Introduction

This report provides the results of a compliance and reliability audit of Network Rail's MUC and CAF unit cost outputs as reported in their 2009/10 Annual Return. The scope of the latter elements of the work, as set out in our Independent Reporter mandate of 14th June 2010 for this assignment (reproduced in Appendix F), includes:

- An audit of the unit costs in the CAF and MUC to check that they have been calculated in accordance with company's unit cost handbook; and

- An assessment of the confidence that we can have in the underlying 2009-10 data for each of the unit costs in the CAF and MUC, and assignment of a Confidence Grading for each measure.

Building on the previous Independent Reporter analysis undertaken by Arup (May 2010) which reviewed the overall robustness and suitability of Network Rail's Unit Cost Framework, this study has entailed a bottom-up review of both cost and resource elements and the key calculations from which the unit costs are derived.

The findings for each section are summarised below.

Maintenance Unit Costs

The mandate for this audit (as indicated above) included an objective to "audit the unit costs … to check that they have been calculated in accordance with company's unit cost handbook." However, as far as we are aware, no specific unit cost handbook as such exists from which to carry out this part of the audit. The nearest document identified is the standard FRM702 – Reporting of Maintenance Unit Costs - which we consider to be a guidance document describing how labour should be allocated to MNT Codes and the mapping of Standard Jobs to MNT Codes.

Therefore, in terms of auditing the calculation process for MUCs, this audit has been undertaken on the following basis:

- Investigation and documentation of the MUC process on the basis of information provided during audit interviews; and

- Assessment of consistency and clarity of the feedback received from interviewees (which included four different MDUs and the HQ Finance Team), highlighting any discrepancies.

On this basis, our audit has found that processes for the provision of data, and quality controls and checks are being engaged with on a generally consistent basis by MDU management. This should be recognised as a positive development.

Production of MUCs follows a transparent process, with multiple stages of data scrutiny. The MUC formulation process is characterized by:

- Reliance on comprehensive input data entered into the three systems at MDU level;

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- Integration of input data manually, using an Excel macro on collated data, (rather than an automated process); and

- Multi-stage controls and checks on data quality, including:

  - centrally collated summary spreadsheets and quality control reports, circulated to the MDU teams to identify quality issues;

  - iteration of the MUC formulation process over the 4-weekly reporting process, enabling MDU teams to review and correct discrepancies and errors, investigate outliers and improve overall quality within the input system data; and

  - scrutiny of the data down to a relatively detailed level, (e.g. explanations required at individual MDU level in relation to significant variances in MUC levels).

However, there appears to be no guide or written overview that formalizes the entire MUC process. We consider it should be relatively straightforward for Network Rail to produce such a handbook and implement the actions identified. At the time of writing we understand Network Rail has a number of initiatives such as the setting up of a "national MUC steering committee" to help co-ordinate and encourage best practice and consistency across the business.

With regard to the Confidence Grading, we consider that the Reliability Grading we can attribute to the MUC is a level C (some significant shortcomings in the process which require urgent attention).

Level C is the same grading that was achieved last year. We consider that with the development of written detailed processes, procedures, system maps and timelines, along with evidence that these have been communicated, rolled out and complied with nationally, an improvement in the reliability grade could be achieved by Network Rail.

With regard to the Accuracy Grading, we have restricted our review to the MUC figures reported in the Annual Return - as specified in our mandate[1]. Based on our review of sample of MUC input data, combined with our assessment of the MUC data handling processes, we consider the Accuracy Grading for MUC to be a level 4 (accuracy level outside +/-10%, but within +/-25%).

Every interviewee at MDU level has indicated that the production of central data quality reports has played a key role in their ability to identify and therefore correct data errors. Given the level of validation demonstrated during our audit sessions we considered on this basis that MUC figures were likely to be accurate at least to within ±25% (equivalent to a grade 4).

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[1] In our previous report, we noted that approximately 80% of Network Rail's maintenance costs (for 2009/10) were allocated through the MUC framework. Since then, we understand the number of MUCs has increased from 44 to 50. In the 2009/10 Annual Return, Network Rail publishes data for 22 individual MUCs (compared with 12 for the Annual Return 2008/09). This relates to 31.3% of total maintenance expenditure. The scope this audit report does not cover the value of MUC coverage *per se*. However, it is perhaps important to bear in mind that at present MUC coverage (as presented in the Annual Return) represents a limited proportion of total maintenance costs for the business.

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Our review of the sample MUC input data has confirmed that, whilst the accuracy of the data appears to be well within the ±25% level, it does not appear sufficient to achieve the higher "level 3" whereby data accuracy would be within ±10%. Our analysis found that a considerable level of manual reworking / adjustment to the original input data is necessary before this data is factored into MUC calculations. Furthermore, for the first three periods of FY 2009/10 no evidence of systematic data validation was provided to the Independent Reporter; consequently, for the purposes of this calculation it was assumed that input data from the input systems went unchecked during this period. On this basis, our assessment is that for MUC figures within the 2009/10 annual return, residual inaccuracies within the source data could lead to potential inaccuracy levels of over 10%. This confirms our initial assessment of Accuracy Grading, which identified Level 4.

In summary, progress has been made in ensuring data feeding into MUC calculations are accurate. However, the scope of adjustments and the associated potential for uncorrected inaccuracies means that the level of confidence that has been assigned to MUC figures included in the 2009/10 Network Rail Annual Return is **C4.**

Cost Analysis Framework (CAF)

As described in sections 1 and 2 of this report, the audit of Network Rail efficiency measures in the 2009/10 annual return has presented a number of challenges in terms of the processes used and the transparency of the data presented.

Understanding the basis of efficiency savings requires a detailed working knowledge of both the underlying unit cost data and the varying baselines from which efficiency is measured for each renewals category.

The scope of our audit has necessitated prioritising the assets that represent the greater proportion of costs in 2009/10 - track, structures and signalling asset categories.

Our findings in relation to the audit are as follows:

Category	Description	Comments
Coverage	CAF coverage	CAF coverage in the period was lower than anticipated at 53% compared to 60% forecast in May 2010 and significantly below Network Rail's target of 85-90%.
Track	Integrity of cost data	The review of track cost data demonstrated a detailed knowledge and understanding of the asset costs including costs at both territory level and centrally allocated costs and adjustments.
	Calculation of volume efficiency	Significant volume deferrals are declared as efficiencies in 2009/10 in line with Network Rails CP4 delivery plan. Using Network Rails methodology the true value of the efficiency gain cannot be known until the end of the Control Period.

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Category	Description	Comments
	Calculation of unit cost efficiency	The baseline against which efficiency has been measured for track assets is the Network Rail Adjusted CP4 baseline. However, other aspects of the methodology for determining unit cost efficiency require further investigation, since alternative methods for calculating efficiency exist with significant variations in outcome.
Structures	Integrity of unit costs established using the CAF process	Data integrity is verified at territory level. Margins of error between time of data capture and financial closure mean that a higher accuracy band cannot be provided at this time. Similarly, the granularity of cost data does not provide sufficient reason to award a higher reliability grade.
	Calculation of efficiency	Review of the CEM calculation for this asset category falls outside the scope of this study. We recommend that this is investigated further to understand the basis of the declared efficiencies of £28m.
Signalling	Integrity of unit costs established using the CAF process	Data integrity verified at territory level. Margins of error between time of data capture and financial closure mean that a higher accuracy band cannot be provided at this time. Similarly, the granularity of cost data does not provide sufficient reason to award a higher reliability grade.
	Calculation of efficiency	Review of the CEM calculation for this asset category falls outside the scope of this study. We recommend that this is investigated further to understand the basis of the declared efficiencies of £21m.
Other asset categories	Integrity of unit costs established using the CAF process	No unit cost or volume data presented in the annual return to undertake an assessment
	Calculation of efficiency	No unit cost or volume data presented in the annual return to undertake an assessment

In summary, our audit identified the following as key issues:

- CAF coverage;
- The reliability and accuracy of volume cost savings;
- The reliability of the calculation of unit cost efficiencies; and
- The reliability and accuracy of asset efficiencies when low unit cost coverage is evident.

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The most significant of these issues is the deferral of track volume in 2009/10. In accordance with Network Rails stated strategy in the CP4 Delivery Plan, track volume is being deferred until more efficient means of working are identified later in the Control Period. This effectively "banks" savings in 2009/10 that have yet to be demonstrably achieved.

Although the audit found no procedural failings in the use of the CAF process in the audits undertaken, variations in accuracy of +/-5% were evident.

Also, the scope of the sample included in this audit was limited to analysis of key assets and the data presented in the annual return.

Accordingly, based on the findings of the audit and the issues identified above, we assign an overall level of confidence in the efficiency measures stated in the annual return of **C3**.

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1 Introduction

Note: redacted edit (09.05.2011)

Please note that for reasons of commercial sensitivity, two tables within Section 3.2 have been redacted from this version of the report. These are marked with the symbol ✂.

1.1 Network Rail Annual Return 2009/10

1.1.1 Network Rail is required to produce the Annual Return document at the end of each financial year under the terms of Condition 12 of the Network Licence. The Annual Return reports Network Rail's performance against a range of regulatory parameters, which relate to the outputs for Control Period 4 (2009-14) specified in the ORR Periodic Review 2008.

1.1.2 ORR has asked the Part A Independent Reporter to undertake the following in relation to Network Rail's 2010 Annual Return:

- High-level reviews of the Annual Return preparation process and of the contents of the Annual Return, to check for consistency with the findings of our 2009/10 rolling programme of KPI reviews;

- An audit of the unit costs in the CAF and MUC to check that they have been calculated in accordance with company's unit cost handbook; and

- An assessment of the confidence that we can have in the underlying 2009-10 data for each of the unit costs in the CAF and MUC, and assignment of a Confidence Grading for each measure.

(Note: the general, high-level coverage is described in a separate report.)

1.1.3 Acting as Part A Independent Reporter, Arup's approach to the second and third elements of this audit has been based on audit meetings with various teams within the Network Rail organisation involved in data provision and processing of the unit costs, together with the review of selected sample data feeding into the calculations. This has included:

- Audit meetings with a number of maintenance and renewals delivery teams responsible for providing the input data that feeds into the MUC and CAF unit cost calculations. This has enabled data handling and control processes at regional level to be audited;

- Audit meetings with members of the HQ finance team responsible for formulating the unit costs. This has enabled the central data handling, integration and control and the unit cost calculation processes to be audited; and

- Sample data review and process audit of unit cost input data, calculation spreadsheets and outputs.

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1.1.4 Cost related outputs form a key component of the Annual Return, and Section 7 of that document includes commentary on the annual costs for maintenance and renewals activities. A high priority continues to be placed on unit costs by both the ORR and Network Rail as a means to drive cost efficiencies and best practice within Network Rail's day-to-day operations, as well as a key measure to support the ORR in determining performance and informing regulatory and funding decisions.

1.1.5 Building on the previous Independent Reporter analysis of the overall robustness and suitability of Network Rail's Unit Cost Framework (in our report of May 2010) this audit has attempted to review the MUC and CAF unit cost outputs in terms of both process compliance and reliability, with a bottom-up review of both the cost and resource elements and the key calculations from which the unit costs are derived.

1.2 Report Structure

1.2.1 This audit report is structured on the following basis:

- Chapter 2 presents our audit of Maintenance Unit Costs (MUCs);

- Chapter 3 presents our audit of the Cost Analysis Framework (CAF); and

- Appendices provide further details on the approach taken to this review including meetings held, documents reviewed and the information / query log used to manage the process of working with Network Rail, together with selected key reference documents used to support our audit.

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2 Maintenance Unit Cost (MUC) Audit

2.1 Approach

Network Rail reported on 22 Maintenance Unit Costs (MUCs) in the 2009/10 Annual Return, out of the 45 MUCs now defined within Network Rail's FRM702 specification document, which captures the scope of each individual MUC. These unit costs relate to Network Rail's maintenance activities, which accounted for 17.6% of Network Rail's total expenditure during CP4 (£5.02 billion). The full list of 22 MUCs published in the Annual Return is included in Appendix C to this document.

Our MUC audit is set out under the following sub-headings:

- Data process compliance: this sets out the findings of our audit of process compliance, and includes both areas of best practice identified through our audits, and areas of concern with our assessment of their potential impact;

- Confidence Grading: based on the results of our compliance audit and the accompanying analysis, we then present our assessment of the Confidence Grading applicable to the MUC data entailed within the Annual Return; and

- Recommendations: this sets out our recommendations for improving data reliability and accuracy.

When assessing the compliance of the MUC process, and undertaking an assessment of Confidence Grading, it is important to note the following:

- Firstly, the utilisation of MUC figures is a relatively new and dynamic process; MUCs were first implemented by Network Rail in FY 2006/7. The definition of MUCs in terms of the constituent Standard Jobs they are formulated from is subject to ongoing development, and the process by which the costs have been formulated has also been subject to change – these issues can be seen to have an impact in our audit findings discussed below. It is also worth referring to the Independent Reporter's review of MUCs in context of Network Rail's Unit Cost Framework, reported on earlier this year; this assessment of the robustness and appropriateness of the MUC as a key reporting metric provides a useful background to this audit; and

- Secondly, the systems used as data sources for the MUC calculations are all used as essential business systems and were implemented in order to meet a specific business need. These systems were not originally designed to produce MUC figures but have had their original processes and procedures changed in order to facilitate the production of the MUC figures.

The MUC formulation process is set out in full in Appendix A.

2.2 MUC process compliance audit

This section of the report sets out the findings of our audit of MUC process compliance under the following two sections:

- Areas of good practice identified through our audits; and

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- Areas of concern with our assessment of their impact on process compliance.

Our audit of these areas has informed our assessment of the Confidence Grading to be applied to the MUC data, set out in the next section of this report.

2.2.1 Data process compliance: areas of good practice

Our audit has identified a number of areas of good practice relevant to MUC process compliance and data quality. Many of these initiatives are still being developed or are relatively new and have been undertaken due to the increased business focus on the MUC process, the aim of which has been to increase the quality of the MUCs as a key metric to gauge costs and establish efficiencies.

Central production of reports to check data

The central production of reports has been consistently cited during audit interviews as an effective means through which data quality issues can be identified and controlled.

Whenever questioned, interviewees have been able to show examples of the reports that they have been quoting. The speed at which users have been able to navigate to these reports gives confidence that the reports are used on a regular basis. Regular production of these reports ensures the relevant parties know when they will be available and central production ensures consistency across Network Rail's organisation. Furthermore, including figures for all routes in the same report engenders peer review behaviours between routes. Transparency encourages the rectification of errors. The central production of the reports listed below can be considered good practice:

- MUC Rolling Graphs – new this financial year;
- MUC Data Quality Metrics – distributed for the first time in period 4;
- Z567 Unit Costs Report;
- Productivity Report;
- Work Order Data Quality Report;
- Macro Output; and
- OTM Work Order Errors.

Examples of these documents have been reviewed by the Independent Reporter first-hand; see Appendix E for details.

Transfer of reports to the Business Objects system

The Business Objects system is a central information portal for Network Rail staff, which has been in use for 8 months. Most of the Ellipse reports are now available in Business Objects and new reports are continuously being rolled out.

The transfer of reports to Business Objects allows individuals to run standardised reports as and when required. This represents a significant improvement in terms of visibility and providing information to users. However, care needs to be taken that users recognise the entire process, including when actions should be completed by, in order to produce meaningful reports that are not misinterpreted.

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Ellipse bulletin

The weekly Ellipse bulletin is available to all users of the system to inform them of changes that they need to be aware of. This too can be regarded as good practice, especially given the size of Network Rail.

Using MUCs to identify efficiencies

As a unitary measure MUC figures can be utilised to inform the numerical analysis of efficiencies that have been achieved. Furthermore, future examination of MUCs should be a means through which to identify whether these are true efficiencies rather than one-off savings. The use of MUCs in this way increases their importance within the Delivery Units, which is important for achieving data quality improvements. This also promotes a sense of ownership and critical thinking.

Ellipse documentation defined by Asset Type combined with measurement of compliance

This initiative has been completed for key asset types in Signalling and Track but is still being implemented for Electrification and Plant.

The Data Quality Improvement Programme and the production of Ellipse Design Documents are very important in ensuring that Ellipse is configured correctly and consistently across the country. We consider that weekly monitoring of compliance to these design standards adds an additional element of confidence that this business critical maintenance management system is being used correctly.

Production of flash report before final report

"Flash reports" produced centrally allow users to identify and correct errors with source data before the data is used for other purposes. This is an important factor when considering confidence that can be placed in data and resulting reports/measures.

Central collation of comments explaining outliers from top 6 MUCs

This activity increases understanding of the MUC process locally as well as the understanding of how the business is operating. Such questioning and scrutiny provides an incentive to ensure data are correct, strengthens the sense of ownership, and serves as a method of identifying areas where the MUC process can help to improve the business.

Change control applied to Ellipse definition documents

This is also a very important factor in the management of this business critical maintenance system. The change control process ensures that changes made to Ellipse, including Standard Jobs, are communicated to the correct people and ensures they are reflected in the MUC process.

Online discussion forums to share best practice

This also promotes the sharing of good ideas and local ownership, and is also a good method of communicating and resolving issues.

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2.2.2 Data process compliance: concerns and areas for improvement

We have developed a list of key concerns in relation to the MUC data process compliance, which are set out in full out in Appendix B of this document.

The following is a brief description of the most important concerns identified. For information on the mitigations in place to reduce the impact of these concerns, please refer to Appendix B.

Travel time is recorded against the first Work Order undertaken at that site.

If multiple Work Orders are carried out at a site on a given day, only one Work Order will carry a disproportionately large travel time cost. This raises the risk of misallocation of MUC data. For example, if a planner ensured a given Work Order covered by MNT022 (other maintenance) was always the first job undertaken at a site, travel costs would effectively be removed from all other MUC figures.

MNT Codes are defined by activity/item in NROL.

The MNT Code mapping to items for which the cost is booked through NROL cannot be changed, even though the Standard Job that the item is being used for may belong to a different MNT Code. Potentially the cost for these items will be allocated to the incorrect MNT Code. Reports detailing the cost recorded against MNT Codes generated from NROL will be different to reports generated from the General Ledger.

Difference between dates captured in ISC and the date the work is carried out.

Costs recorded in ISC for items ordered for a specific job are captured when the Purchase Order is raised, not when the items are used. This means that costs are factored into the MUC calculations at a different time to when the work is carried out.

Variation in allocation of costs associated with transport of materials.

Transport of materials is included as a cost against some Standard Jobs if it takes less than half a shift but is recorded against its own Standard Job if it takes over half a shift; (the same applies to the removal of materials from site). This results in potential confusion over the Standard Job which these costs should be assigned to, and inconsistency in the overall level of cost incurred due to factors such as where the materials are needed, rather than the type of work being undertaken.

Differences between definition of time recording in Ellipse and OTL.

Time recorded in Ellipse is the "time on tools" whereas the time recorded in OTL is the time from beginning travel to site to finishing the work. Comparisons between the two systems cannot be made. Figures for the hours booked by Standard Job will be different in OTL to those recorded in Ellipse. There is potential for misinterpretation as knowledge of the data source is required to understand what any reports/figures represent.

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Section Administrator reliance on MNT Data spreadsheet.

Section Administrators rely on a spreadsheet to check that the information contained in the General Ledger is correct. If the MNT Data spreadsheet became corrupted or contained errors this would greatly hinder the Section Administrator's ability to confirm NROL costs or MNT Code allocation.

Confusion of the high level description of Standard Jobs.

Confusion over the high-level description of Standard Jobs has resulted in the incorrect Standard Job number being recorded against work by maintainers. This could lead to costs and work being accounted for under the incorrect MNT Code.

Standard Jobs can change

This can cause confusion, resulting in incorrect Standard Jobs being recorded on WAIFs and work done being recorded in terms of the wrong unit of measure.

Data held in BMIS is recorded against MNT Codes.

If Standard Jobs changed or the mapping to MNT Codes was changed it would not be possible to apply these changes to historical cost data or assess the impact of the change on the codes that it is moving from/to.

2.3 MUC Confidence Grading

Based on the results of our compliance audit and the accompanying analysis, our assessment of MUC data entailed within the 2009/10 Annual Returns represents a Confidence Grading value of **C4.**

This compares to the Confidence Grading of C5 for the previous year, representing an improvement in terms of Accuracy Grading from the previous year[2], whilst Reliability Grading remains unchanged.

2.3.1 Reliability Grading

We set out in Table 2.1 our assessment of the Reliability Grading for MUC figures in further detail.

Reliability Band	Description	Comments
A	Sound textual records, procedures, investigations or analysis properly documented and recognised as the best method of assessment. Appropriate levels of internal verification and adequate numbers of fully trained individuals	MUC process is not properly documented. Also, there are too many points at which errors can occur to consider the current method of producing MUCs to be the best method of assessment.
B	As A, but with minor shortcomings. Examples include old assessment, some missing documentation, insufficient internal verification, undocumented reliance on third-party data.	Levels of understanding between areas have been high but without properly documented processes and procedures encompassing the use of the source systems, data

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[2] See 2008/9 Annual Return audit undertaken by Halcrow.

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Reliability Band	Description	Comments
		quality checks, the central production of reports and MUC calculations it is not possible to assume the required level of consistency is in place to ensure reliability across the company.
C	**Some significant shortcomings in the process which need urgent attention.**	**We would currently consider this to be the level at which Network Rail is operating. There has been an improvement, especially due to the centralised production of reports and levels of error checking described, but the points outlined in B would need to be addressed before we were confident in scoring higher than this level.**
D	Major shortcomings in all aspects of KPI: process unfit for purpose	Without the mitigation measures described in the concerns table we would consider this to be the case. However, the activities described give us confidence that issues are being addressed and the MUC figure produced is calculated in a consistent manner.

Table 2.1 – MUC Reliability Grading Assessment

2.3.2   Accuracy Grading

We set out in Table 2.2 our assessment of the Accuracy Grading for MUC figures in the 2009/10 Annual Return.

Accuracy Band	Description	But outside +/-
1	Calculation processes automated (to a degree commensurate with dataset size); calculations verified to be accurate and based on 100% sample of data; external data sources fully verified. KPIs expected to be accurate to within ±1%	Calculation processes are automated but there are too many opportunities for error due to manual entry of data and differences between source systems.
2	[see note below]: KPIs expected to be accurate to within ±5%	The scope of manual adjustment of input data evident from our comparison of "flash" and final data input reports would lead us to expect a margin of error greater than 5% unless proved

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Accuracy Band	Description	But outside +/-
		otherwise.
3	Shortfalls against several attributes: e.g. significant manual input to calculations or incomplete data verification or less than 100% sampling used.]: KPIs expected to be accurate to within ±10%	Our review of flash and final data input reports leads us to conclude that errors and inaccuracies of a considerable magnitude are present with the original source data, which require considerable manual reworking / adjustment, before the source data can be factored into MUC calculations.* We consider that even if a relatively low number of residual inaccuracies within the source data go unchecked, this could still lead to potential inaccuracy levels of over 10%.
4	**[see note below]: KPIs expected to be accurate to within ±25%**	**Based on the evidence received we consider that the MUCs are only accurate to within 25%. For the first three periods of FY 2009/10 no evidence of systematic data validation was provided to the Independent Reporter. For the remainder of the year, although we consider that the level of data validation in place is likely to have captured most errors, we consider it likely that the impact of even a relatively small number of residual errors will mean the accuracy of the MUC figures is potentially outside the 10% level.**
5	Calculation processes largely manual with significant errors; data inconsistently reported and unverified; KPI based on small data sample or cursory inspections and verbal reports. KPIs unlikely to be accurate to less than ±25%	The use of Ellipse, OTL and the General Ledger ensures that the MUC figures at MNT level are based on 100% of the data recorded rather than a small data sample. Although there is a large amount of manual intervention this is consistently reported, and processes are in place to correct errors before they are used for calculations.
6	No longer used	
X1	KPI is calculated on a very small sample of data	
X2	Accuracy cannot be assessed for some other reason (to be qualified in text of report)	

* - Please note: for the first three periods of FY 2009/10 no evidence of systematic data validation was provided to the Independent Reporter; consequently, for the purposes of this calculation it was assumed that input data from the input systems went unchecked during this period.

Table 2.2 – MUC Accuracy Grading Assessment

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2.4   MUC Recommendations

Table 2.3 contains a set of recommendations in respect of the MUCs. The recommendations are numbered 2010.MUC.8, 2010. MUC.9, etc. to reflect the (end of the) year 2009/10, the context of the recommendations, and to follow on from the numbering of the MUC-related recommendations made in our previous report on this area, for mandate AO/005.

No.	Recommendation to Network Rail	Location in Text	NR Data Champion	Due Date
2010.MUC.8	We recommend that a comprehensive and detailed MUC handbook is produced, that encompasses as a minimum: • A system and data process map. • A data dictionary describing the relevant fields from the source systems. • A register of documents and standards supporting both the MUC process and the source systems. • Instructions for the correct entry and processing of relevant data through the Ellipse, OTL and BMIS systems. (This should include data validation checks.) • A process overview documenting the extraction of data from source systems through to formulation of MUC figures. • A list of data validation reports, with brief details of the content and purpose of each report. • Definition of responsibilities for each action. • Timeline(s) showing when each of the above process steps should be carried out. • Change control on each of the above documents.	Section 2.1		
2010.MUC.9	As part of Network Rail's development of a business case for linkage of key MUC input systems (see note 1 below), we would recommend that time recorded in OTL is linked back to the level of individual Work Order number (as it in Ellipse). This would provide a full audit trail for labour cost booked, ensures consistency and makes the	Section 2.2.2		

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No.	Recommendation to Network Rail	Location in Text	NR Data Champion	Due Date
	correction of misallocated time easier. This also enables costs to be re-allocated if the definition or mapping of Standard Job numbers to a particular MUC changes.			
2010.M UC.10	We recommend an alteration of the data inputting fields in the NROL system (which feeds into the General Ledger) to enable the manual inputting / amendment of the MNT code allocated to a given material order (presently this is fixed for the given material type and cannot be altered by the user).	Section 2.2.2		
2010.M UC.11	We recommend reconfiguration of data fields attached to materials orders held within the NROL system, so that the Work Order that the materials are being used for is entered as a mandatory field at the point of order placement. This would enable the materials order to map directly to the Work Order and its associated MNT code, thereby avoiding the misallocation of materials costs to the incorrect MNT code in the General Ledger.	Section 2.2.2		
2010.M UC.12	Development of an IT application that enables the full range of relevant materials data from the General Ledger feeding the MUC calculations to be controlled, before the data are posted at the end of each period. This should be configured to enable Section Management to perform quality checks for the relevant data fields more robustly, and to provide an auditable record of any input adjustments / corrections made in the General Ledger following completion of the checks. This should improve the reliability and robustness of the input data entering the MUC calculations.	Section 2.2.2	John Gerrard	March 2011

Notes:

1 – In the Independent Reporter's previous report (20 May 2010), documenting the robustness of Network Rail's Unit Cost Framework, the Independent Reporter made the following recommendation with regard to MUC costs:

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"Network Rail should present a business case which demonstrates the potential costs and benefits of linking the current work allocation (Ellipse) and cost recording (Oracle) to reduce the potential for mis-coding of timesheets and to reduce the scale of the requirement for manual data processing and checking."

Network Rail indicated in its response document dated 13th August 2010 (Action Plan item M01) that it is presently working up the requirement for the development of the business case in response to this recommendation.

Table 2.3 – MUC Recommendations

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3   Cost Analysis Framework (CAF) Audit

3.1   Approach

Network Rail reports on renewals delivery using two separate processes; Primavera for track renewals and the Cost Analysis Framework (CAF) for all other renewals asset categories.

Our audit of unit costs has therefore been structured in response to these two very different methodologies as follows:

Track assets – Our approach has been to undertake a thorough analysis of the unit costs presented in the Annual Return and to determine how these costs have been adjusted to reflect the unit costs and volume efficiencies stated.

All other assets – Our approach has consisted of prioritising renewals projects in differing categories and/or territories and analysing the unit costs contributing to the data presented by Network Rail in the Annual Return. This has required a comparison of actual costs versus those recorded in the CAF records, and satisfying ourselves that unit costs are being recorded in accordance with Network Rails internal procedures.

Where appropriate we have also commented on other data presented in the Annual Return as part of our audit report.

The report concludes with an assessment and Confidence Grading for the renewals efficiency data presented within section 7 of the Annual Return.

3.2   CAF Process Compliance Audit

3.2.1   Track Asset Audit

3.2.1.1   Overview

Total spend on track renewals in 2009/10 was £698m as detailed in Table 3.1 below. This was cross checked and found to mematch the actual costs presented in Section 6.0 (Table 6.10 of the Annual Return).

Combined track asset costs 2009/10		
Item		
Plain line	489.70	70.2%
S&C	163.10	23.4%
Non-volume	43.30	
Gauging	1.60	
Total	**697.70**	

Table 3.1: Combined track asset costs 2009/10

For track assets 93.6% of actual costs were attributable to RWIs (Repeatable Work Items). The audit found that plain line RWIs accounted for 70.2% of actual costs compared to 23.4% for S&C. This compares to figures of 70.6% and 23% presented in the Annual Return.

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Non-volume costs were also reviewed and found to comprise the following items:

Non-volume costs	
Item	**Actual costs (£k)**
Non-volume costs by Territory	
LNE	4,259
LNW	6,147
SCO	1,552
SE	1,970
WEST	1,424
Cat 15a track renewals	2,747
Depot threshold payments	2,000
Maintenance non-volume costs	23,233
Total	**43,332**

Table 3.2: Non-volume related costs 2009/10

Non-volume costs by territory comprised items such as drainage and fencing whilst maintenance non-volume costs comprised elements of planned and reactive maintenance although no further breakdown was provided.

3.2.1.2   Plain line audit

The composite plain line rate for 2009/10 is £279/m, based on actual costs of £489.70m and a total volume delivered of 1,756km.

Plain line costs include £404.2m of infrastructure investment directly incurred by each territory and a further £94.7m of cost incurred by Network Rail Maintenance for plain line works (principally lower complexity Category 1 and 2 re-railing).

Territories delivered 1,353km of track with Maintenance contributing a further 403km. Plain line actual costs of £489.7m relating to volume works are shown in further detail in Table 3.3 below.

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Plain line costs 2009/10	
Item	**Actual costs (£m)**
Infrastructure investment	404.2
Ops signal box opening	2.2
Maintenance	94.7
NDS indirect costs	30.2
Engineering staff recovery	3.2
Less non-volume investments	-15.3
Less non-volume maintenance costs	-23.2
Gauging	-1.6
Cat 15a items	-2.7
Depots renewals threshold payments	-2.0
Total	**489.7**

Table 3.3 – Plain line cost analysis 2009/10

Further analysis of infrastructure investment costs was undertaken. Infrastructure investments were found to comprise actual costs incurred on a territory by territory basis incorporating savings identified by the central Network Rail team as follows:

Infrastructure investments 2009/10	
Item	**Actual costs (£m)**
LNE	113.1
LNW	96.8
SCO	29.9
SE	97.1
WEST	91.5
CEN	-24.1
Total	**404.3**

Table 3.4: Breakdown of infrastructure investment in plain line 2009/10

Actual costs by territory were explained as being an amalgam of the P3e data provided by each territory cross checked against costs in the General Ledger. Where discrepancies occurred the General Ledger data tended to take precedence.

Cost recovery items and central team costs are omitted from the infrastructure investment costs at territory level. These costs were audited and found to contain the following items:

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Central team costs and recovery items 2009/10	
Item	**Cost (£m)**
Track bed investigation	4,196
Medium output ballast cleaner	2,705
Modular plain line	242
High output demobilisation	1,892
Central admin overhead charge from Group (CAMS)	3,698
Depot threshold claims provision	2,000
MOBC	-387
Recovery of central costs	-44,600
Engineering recovery	394
Overlay	-595
Adj to territory COWD for OP-MBR variances	336
Gain share	5,979
Total	**-24,140**

Table 3.5: Central cost adjustment, plain line 2009/10

As a net adjustment, items such as track bed investigation and MOBC are taken into account in the plain line unit cost presented in the Annual Return.

The inclusion of a credit for central cost recovery implies that this is accounted for both at territory level and also in a separate cost centre, meaning an adjustment is necessary. Our audit has yet to determine how territories account for the central costs detailed.

In summary, our audit found a reasonably clear audit trail to demonstrate how plain line unit costs at territory level were collated and how adjustments were made centrally to arrive at the data presented in the Annual Return.

3.2.1.3   S&C audit

The S&C rate for 2009/10 is £569k/equivalent unit, based on actual costs of £163.10m and a total volume delivered of 319.20 equivalent units.

S&C costs include £144.20m of infrastructure investment directly incurred by each territory and a further £7.70m of cost incurred by Network Rail Maintenance.

Territories delivered 273 equivalent units with Maintenance contributing a further 46 equivalent units.

S&C actual costs of £163.20m are shown in further detail in Table 3.6 below.

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S&C costs 2009/10	
Item	**Actual costs (£m)**
Infrastructure investment	144.2
Maintenance	7.7
NDS indirect costs	10.0
Engineering staff recovery	1.3
Total	163.2

Table 3.6: S&C Cost Analysis 2009/10

No non-volume cost element was incurred in S&C costs in 2009/10.

Further analysis of infrastructure investment costs was undertaken. Infrastructure investments were found to comprise actual costs incurred on a territory by territory basis incorporating savings identified by the central Network Rail team as follows:

Infrastructure investments S&C 2009/10	
Item	**Actual costs (£m)**
LNE	43.2
LNW	37.1
SCO	17.7
SE	26.9
WEST	27.4
CEN	-8.1
Total	144.2

Table 3.7 – Breakdown of infrastructure investment in S&C 2009/10

Cost recovery items and central team costs are omitted from the infrastructure investment costs at territory level. These costs were audited and found to contain the following:

Central team costs and recovery items 2009/10	
Item	**Cost (£m)**
Central admin overhead charge from Group (CAMS)	1,168
S&C DVD	60
Recovery of central costs	-12,900
Engineering recovery	131
Overlay	1,016
Adj to territory COWD for OP-MBR variances	391
Gain share	1,993
Total	-8,141

Table 3.8 – Central cost adjustment, plain line 2009/10

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In summary, our audit found a reasonably clear audit trail to demonstrate how plain line unit costs at territory level were collated and how adjustments were made centrally to arrive at the data presented in the Annual Return.

3.2.1.4   Factors influencing track unit costs

Two factors have been identified that explain the inefficiency of 9.1% between 2008/09 and 2009/10. These are the Indirect Cost Impact (ICI) and Work Mix Impact (WMI).

Both factors are an effort by Network Rail to explain the inefficiency in track renewals in the period. The ICI factor was explained as being the measure of how inefficient Networks Rail's fixed costs were in relation to the volume of track renewals delivered in the period. Fixed costs were stated as being structured in 2009/10 to deliver a far greater volume of renewals and, on the work bank being cut, Network Rail's fixed costs were no longer proportionate and therefore inefficient. The ICI factor is shown in table 7.13 of the Annual Return and is used to explain the increase in both plain line and S&C costs in the period.

The WMI factor was explained as being the change in unit costs in the period based on the change in the work mix from 2008/09 to 2009/10. As different grades of track renewal attract different levels of cost, the WMI seeks to explain how this has affected the unit rate achieved in the period. The WMI factor is applied only to plain line costs in the period.

In summary, Network Rail has identified the cuts in renewal volumes (ICI) and the change in work mix type (WMI) as being the causes of the £46m inefficiency achieved in track renewals in 2009/10.

The calculation of each factor was found to be correct. The Work Mix Impact does raise the issue that track spend in future years will need to be measured on a like for like basis. Further fixed cost inefficiencies should not be evident in future year's reporting.

3.2.2   Structures asset audit

As structures asset renewals use the CAF process an audit was undertaken of individual projects contributing to the combined unit cost data presented in the Annual Return.

Our approach to the audit was to select and audit projects identifying any issues where costs had not been collated in accordance with the CAF process.

Table 3.9 details the results of the audit and the variances identified between the data presented in the CAF return and the demonstrated actual costs of the project.

✂ **(table redacted)**

Table 3.9 – Structures audit; CAF returns vs. audited costs

Of the 17 projects audited, all were found to comply with the CAF process albeit with varying levels of granularity. Two key issues were identified relating to:

- Allocation of design and management costs; and

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- Allocation of contractors costs when insufficient detail is provided in the contractors price (a common issue when a bill of quantities is not included in the contract documentation.

For fast turnaround projects it was found that design costs are frequently grouped into costs at a single stage in the CAF return. This tended to be the case where a contractor would provide a fee for completing the design to a certain level of completion but did not specify the cost in terms of each discreet stage of the GRIP design process. For the projects in question however, this was not considered a material issue and did not represent a deviation from the CAF methodology.

Contractors' management costs for common structures projects were found to be allocated in the CAF return on the basis of a fixed percentage. This percentage was based on the contractors' agreed fixed management charges across a portfolio of work in the period. This method was found to be robust until changes in the portfolio resulted in a smaller or larger volume of work being delivered. Examples were found where the management costs in the CAF return were based on the fixed percentage despite having been accounted for in full in prior CAF returns. Whilst not a significant deviation from the CAF process it illustrated how procurement strategy can have an effect on the quality of data entered into the CAF return.

As anticipated, the level to which contractors' costs were analysed in the CAF return varied from project to project depending on the chosen procurement route. For projects where a fixed price was agreed using an activity schedule the level of analysis was poorer than for those projects where a bill of quantities or similar pricing document had been used.

In summary, only minor issues were identified with regard to the use of the CAF process by projects in the structures audit. Adherence to the CAF process was found to be good. For projects where actual cost data varied by more than 5% from the completed CAF return it was recognised that the CAF return would be resubmitted in accordance with Network Rail's procedures.

3.2.3 Signalling asset audit

Table 3.10 details the results of the audit and the variances identified between the data presented in the CAF return and the demonstrated actual costs of the project.

✂ (table redacted)

Table 3.10 –Signalling audit; CAF returns vs. audited costs

Of the nine signalling projects audited, variances between the CAF return and the actual cost data provided ranged between 0 and 81%. This was due to the inclusion of a GRIP4 CAF return in the audit data and as such significant actual costs were yet to be incurred.

The source of the remaining variances was found to be due to the stage at which signalling CAF returns are submitted. The majority of projects sampled have yet

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to be fully closed out due to outstanding issues such as payment of retention and finalisation of final accounts.

In summary, only minor issues were identified with regard to the use of the CAF process by projects in the signalling audit. Adherence to the CAF process was found to be good. For projects where actual cost data varied by more than 5% from the completed CAF return it was recognised that the CAF return would be resubmitted in accordance with Network Rail's procedures.

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3.3   Renewals Unit Cost & Volume efficiency

Overview

Of the eight renewals asset categories the Annual Return provides detailed volume and/or unit cost efficiency measures for the following items, representing 74% of renewals spend in 2009/10:

- Track;
- Structures;
- Signalling; and
- Telecoms.

Efficiencies against the remaining asset categories of electrification, plant and machinery, IT, operational and property are generally stated or explained in the document narrative.

This has presented us with a general issue of how to report on efficiency when the Annual Return presents different methods or approaches to presenting data requiring - in many instances - a very detailed analysis of how the measures have been determined. For this reason our audit has focused on the key assets of track, structures and signalling as these assets represent the largest proportion of spend in 2009/10 and can be more readily audited using the data presented in the Annual Return.

Section 7 of the Annual Return details the efficiency achieved in the financial year for renewals projects. In 2009/10 Network Rail claims an overall cost efficiency of £160m (6.6%) as follows:

Track volume:	£117m
Track unit cost:	(£46m)*
Signalling:	£21m
Structures unit cost:	£28m
Operational property:	£16m
Telecomms:	£12m
Other:	£12m
Total:	**£160m**

*Note: * Represents inefficiency*

The most significant contribution to efficiency in the period was made by a reduction in track volume. Two reasons were provided in the Annual Return for this saving:

> *"....through the introduction of new asset management policies, focussed on managing our assets in a best whole-life value, sustainable way"*
> *(Page 212) and;*

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"Volumes have been deferred to enable development of more efficient methods of delivery providing the opportunity for driving out additional efficiencies later in CP4" (Page 213).

The saving has been achieved by calculating the reduction in track volume between the Network Rail adjusted CP4 baseline versus the actual volumes achieved as follows:

Variance in actual volume vs NR CP4 baseline				
Item	Baseline volume	Baseline rate	Actual volume	Rate
Plain line (km)	2,042	257	1,756	279
S&C (eu)	404	508	319	511
Totals	2,446		2,075	

Table 3.11 – Variance in Network Rail forecast volumes vs. adjusted CP4 baseline

The deferral of track volume in 2009/10 is in accordance with Network Rails stated strategy in the CP4 Delivery Plan of deferring track volume until more efficient means of working are identified later in the Control Period. This effectively "banks" savings in 2009/10 that have yet to be demonstrably achieved.

The Annual Return also states a total inefficiency in track renewals of £46m in 2009/10 caused by an amalgam of high indirect costs for the volume of works being delivered and variations in the complexity of work undertaken in the period compared to 2008/09.

Based on the information provided by Network Rail, the inefficiency of £46m is based on higher unit costs of £279/m for plain line and £511/equ for S&C in 2009/10 versus baseline unit cost projections of £257/m and £508/equ respectively.

The change in actual unit rates versus baseline unit rates has then been applied to Network Rail's baseline volumes. This calculation determines the total efficiency for track unit costs. In our opinion, this methodology requires further investigation as measuring unit cost variation against the baseline does not appear to give a correct view of efficiency. It may also lend itself to underestimation of baseline volume projections in future years. Our own calculations have shown that unit cost efficiency may vary between £39m and £54m depending on whether the approach is based on actual volumes delivered or year on year unit cost efficiency.

Signalling, power and communications efficiency is calculated using the CEM (Cost Efficiency Measure). This process measures:

"...periodic efficiency based on spend to date against the defined outputs in terms of volumes and is annualised across the life of the project, based on the expected final cost recorded in CAF at GRIP stage 4."

The investigation of this measure (and similarly the Structures and Buildings CEM) falls outside the scope of this audit.

In summary, unit cost and volume efficiency has been detailed within section 7 of the Annual Return to a sufficient extent to allow an analysis of track, structures,

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signalling and telecoms assets. Due to the limited scope of this audit, we have focused on an analysis of track, structures and signalling assets only.

At a macro level deferred track volume savings are reported as efficiencies before being demonstrably achieved. The levels of savings achieved in deferring track volume will not be known until later in the Control Period. We also believe that the method of calculating track unit cost efficiency requires further analysis being based solely on changes in unit costs against a notional baseline volume.

Savings against the remaining asset categories use a number of methodologies that are the subject of subsequent chapters or, for the reasons stated, fall outside the scope of this audit.

3.4 CAF Confidence Grading

As described in sections 1 and 2 of this report, the audit of Network Rail efficiency measures in the 2009/10 annual return has presented a number of challenges in terms of the processes used and the transparency of the data presented.

Understanding the basis of efficiency savings requires a detailed working knowledge of both the underlying unit cost data and the varying baselines from which efficiency is measured.

The scope of our audit has necessitated prioritising the assets that represent the greater proportion of costs in 2009/10 - track, structures and signalling asset categories.

Our findings in relation to the audit are as follows:

Category	Description	Comments
Coverage	CAF coverage	CAF coverage in the period was lower than anticipated at 53% compared to 60% forecast in May 2010 and significantly below Network Rail's target of 85-90%..
Track	Integrity of cost data	The review of track cost data demonstrated a detailed knowledge and understanding of the asset costs including costs at both territory level and centrally allocated costs and adjustments.
	Calculation of volume efficiency	Significant volume deferrals are declared as efficiencies in 2009/10 in line with Network Rails CP4 delivery plan. Using Network Rails methodology the true value of the efficiency gain cannot be known until the end of the Control Period.
	Calculation of unit cost efficiency	The baseline against which efficiency has been measured for track assets is the Network Rail Adjusted CP4 baseline. However, other aspects of the methodology for determining unit cost efficiency require further

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Category	Description	Comments
		investigation, since alternative methods for calculating efficiency exist with significant variations in outcome.
Structures	Integrity of unit costs established using the CAF process	Data integrity verified at territory level. The margin of error between time of data capture and financial closure may adversely affect data accuracy. Similarly, the granularity of cost data may affect data reliability.
	Calculation of efficiency	Further investigation is required to understand the basis of the CEM calculation and the declared efficiencies of £28m.
Signalling	Integrity of unit costs established using the CAF process	Data integrity verified at territory level. There are margins of error between time of data capture and financial closure. Similarly, the granularity of cost data does not provide sufficient reason to award a higher reliability grade.
	Calculation of efficiency	Further investigation is required to understand the basis of the CEM calculation and the declared efficiencies of £21m.
Other asset categories	Integrity of unit costs established using the CAF process	No unit cost or volume data presented in the annual return to undertake an assessment
	Calculation of efficiency	No unit cost or volume data presented in the annual return to undertake an assessment

Table 3.12 – CAF Audit Findings

In summary, our audit found the following key issues:

- CAF coverage
- The reliability and accuracy of volume cost savings
- The reliability of the calculation of unit cost efficiencies
- The reliability and accuracy of asset efficiencies when low unit cost coverage is evident

Additionally, although the audit found no procedural failings in the use of the CAF process in the audits undertaken, variations in accuracy of +/-5% were evident.

Also, the scope of the sample included in this audit was limited to analysis of key assets and the data presented in the annual return.

Accordingly, based on the findings of the audit and the issues identified above, we assign an overall level of confidence in the efficiency measures stated in the annual return of **C3**.

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3.5 CAF Recommendations

Table 3.13 contains a set of draft recommendations in respect of the CAF. The recommendations are numbered 2010.CAF.8, 2010.CAF.9, etc. to reflect the (end of the) year 2009/10, the context of the recommendations, and to follow on from the numbering of the CAF-related recommendations made in our previous report on this area, for mandate AO/005.

No.	Recommendation to Network Rail	Locations in Text	NR Data Champion	Due Date
2010.CAF.8	We recommend that the level of CAF coverage is monitored as a KPI, and that target coverage levels for forthcoming financial years are established. In addition, we consider CAF coverage should be detailed by value against Network Rail's baseline / Business Plan value for the financial year in question on an asset by asset basis, in order to establish year-on-year progress.	Section 3.4		
2010. CAF.9	We recommend that a formalised method for establishing / qualifying unit cost efficiencies for track renewals is developed. This should enable the demonstration of the proportion of track savings attributable to a) improved asset management policies and b) deferrals based on more efficient working methods yet to be developed.	Section 3.2.1		
2010. CAF.10	Network Rail should share with ORR how it intends to reliably measure financial savings and whole life cost benefits attributable to improved asset management. We would recommend that	Section 3.3		

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No.	Recommendation to Network Rail	Locations in Text	NR Data Champion	Due Date
	qualification test procedure / protocol to confirm and validate any declared efficiencies, with a record of – (a) the technical basis / reason for the declared efficiency (e.g. quantified process saving, proof of improved / better-than-expected asset condition), (b) the resulting scope of efficiency saving directly attributable. *(Note, this may have been covered in asset strategies that we understand may have recently been discussed and agreed with Network Rail)*			
2010. CAF.11	Consistent with our previous CAF recommendations (May 2010 report), we recommend that Network Rail reviews the calculation for measuring unit cost efficiency with regard to the use of baseline volumes versus actual volumes using consistent baselines based on actual volumes delivered rather than notional baselines.	Section 3.3		
2010.CAF.12	Consistent with our previous CAF recommendations (May 2010 report) with respect to declared efficiencies, we recommend that Network Rail develops a qualification test procedure / protocol to	Section 3.4		

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No.	Recommendation to Network Rail	Locations in Text	NR Data Champion	Due Date
	confirm and validate any declared efficiencies, with a record of – (a) the technical basis / reason for the declared efficiency (e.g. quantified process saving, proof of improved / better-than-expected asset condition), (b) the resulting scope of efficiency saving directly attributable.			

Table 3.13 – CAF Recommendations

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Appendix A

MUC formulation process

Appendix A   Formulation Process

MUC Process Overview

The following table sets out the three systems that feed data directly into the Maintenance Unit Cost (MUC) process – Ellipse, OTL and the General Ledger – and how these combine to form the MUC calculation.

MUC Source System	MUC Calculation
Ellipse – Ellipse is the system used for Maintenance Management. Ellipse is the source of data for the quantities of work undertaken which is fed into the MUC calculation.	The MUC figure is calculated by Network Rail's HQ Finance Team through an Excel macro contained in the MUC Macro Spreadsheet. This combined the input data from each of the source systems to produce the final MUC figures for the period.
OTL – Oracle Time & Labour (OTL) is the system used to record the amount of time worked by employees and turns this into a cost figure. OTL is the source of labour cost data which is fed into the MUC calculation.	
General Ledger the cost of Materials, Plant, Specialist Contractors, Labour Only Contractors and Other is recorded in the General Ledger and is all fed into the MUC calculation.	

Figure 1: MUC source data & calculation (source: feedback through Independent Reporter audit interviews)

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Production timescale

The reporting of MUC outputs for a given (4-week) period follows a reporting cycle, whereby the MUC value is formulated, reviewed and finalized during the following period. This process entails the elements set out in the following table:

Timescale	Process	Output to MUC
Reported period: Week 4, Friday	Section Administrators (check) complete all of the checks they need to ensure that the cost information contained in the General Ledger is correct. Journal posted to the General Ledger.	
Following period: Week 1, Monday	General Ledger closed (no further changes can be made to the data).	Oracle report is produced as a text file → input to the MUC Macro Spreadsheet.
Following period: Week 1, Tuesday	Reports generated from OTL and Ellipse showing: • time booked to activities • number of units of work undertaken during the previous period and-year-to-date.	
Following period: Weeks 1&2	Section Planners, Accountants and Administrative Assistants perform checks to identify errors with the data contained within these systems, query anomalies and correct the data in the source system.	
Following period: Week 3, Tuesday	OTL and Ellipse reports are generated for the second time as final versions.	OTL and Ellipse data fed into the MUC Macro Spreadsheet.

Figure 2: MUC production timescale (source: feedback through Independent Reporter audit interviews)

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Ellipse system: overview

As the system that contains Work Order specifications and captures actual units of work performed for the MUC calculations, Ellipse is one of the three MUC input systems. The data components from which the Ellipse outputs for MUC are constituted are set out below.
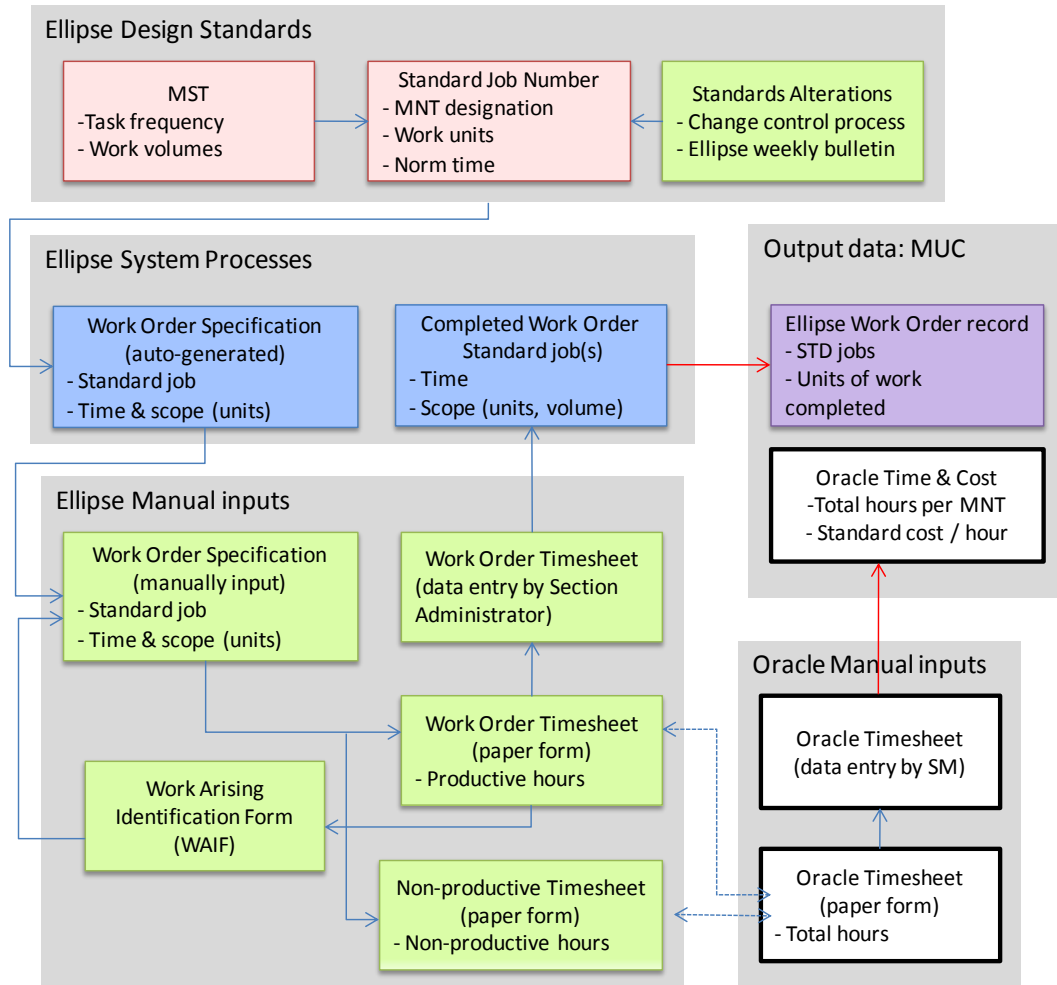
Figure 3: Ellipse and Oracle MUC inputs (source: feedback through Independent Reporter audit interviews)

Ellipse Design Elements

Standard Jobs describe work that needs to be undertaken, and include:

- Norm Time figure: this is the normal amount of time (hours worked) that the Standard Job is expected to require;

- MNT designation: Standard Jobs are mapped to MNT Codes which are used to produce the MUC figures; and

- where required, there is a code entered against the Standard Job which refers to the Network Rail Standard and which describes the required maintenance activity in more detail.

If a new Standard Job is needed or a change is required to an existing Standard Job this is subject to a strict change control process. Part of this process ensures

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that the Maintenance Improvement team can assess whether there will be an impact on the MUC figures, or in the case of a new Standard Job, ensure that is mapped to an MNT Code. Any changes made to Standard Jobs are communicated via a weekly bulletin that is sent to each Ellipse user.

Maintenance Scheduled Tasks (MSTs) are set up in Ellipse whenever cyclical maintenance activities are required and include:

- a frequency for how often the activity is required;

- a Standard Job reference, to represent the actual work performed within the MST, which includes a description of activities to be undertaken, the unit of measure that the work should be defined in;

- the quantity of work required; and

- the team that will undertake the activity.

Ellipse Work Orders

The central data component of the Ellipse system is the Work Order, which captures the full details of work performed.

Work Orders are initially set up either automatically by Ellipse via an MST or raised manually by the Section Planners. The Work Order will, amongst other things, specify:

- a description of the work required;

- a Standard Job number, which will ensure the correct unit of measure is used; and

- the quantity of work required.

Once set up, the process of logging and recording actual work performed is a work-intensive process involving a number of stages of manual inputting:

- at the start of each day, the Section Planner will print off all of the Work Orders planned for the day. These will be given to the Section Manager who will hand them out to the team leaders;

- the maintenance teams will go to site, carry out the work described on their Work Orders and record what they have done. This will include a log of the "time on tools" and the amount of work undertaken. (If, for any reason, not all of the work required was completed, a Work Arising Identification Form (WAIF) is completed to cover the remaining work; this is explained in further detail below);

- at the end of each shift the team leader gives the Section Manager the Work Orders for the day, any WAIFs and the non-productive sheet (see below). The Section Planners or Administrators will complete the recording of work units completed and time booked against Work Orders into Ellipse. They will aim to do this within 5 days of receiving the Work Orders. After 13 days the Work Order will appear as backlog. The Section Planner will ensure that all Work Orders have been returned.

Note: The above process does not apply to Signalling maintenance. The Work Orders are managed directly by Signalling maintenance staff who take handheld units to site and feedback information on site at the time the job is completed. These handheld units are then docked at the end of each shift and the information

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entered is uploaded into Ellipse each night following the Section Manager's approval.

WAIF (Work Arising Identification Form): As indicated above, maintenance staff are able to capture work requirements in Ellipse not originally programmed as Work Order during the given shift within a WAIF form. This can include:

- work not completed under the original Work Order, whereby the original Work Order is closed capturing the amount of work that was physically completed, and additional outstanding work is captured in the WAIF;

- any work that was carried out but was not planned for the day, and therefore was not covered by a Work Order that the maintainer took to site, is captured on a WAIF; and,

- any faults, defects or other work that the maintainer identifies but does not carry out is also captured on a WAIF.

The maintainer will enter the required Standard Job on the WAIF along with a description of the work, the time taken and quantity of work undertaken.

The Section Manager will review the WAIFs, ensuring that the maintainer has allocated the correct Standard Job to the work and used the correct unit of measure and raise these as Work Orders in Ellipse. If the work has already been undertaken the Work Orders will be closed straight away.

Non-productive timesheet: In addition to the Work Order specifications, each team will have a timesheet to record non-productive time for the day. This will be completed at the end by the team leader to record any time associated with equipment (loading vans, equipment checks etc.), travel, setup, stopping work for passing trains and delays due to the weather. The Planner will also enter the non-productive time into Ellipse.

Ellipse Outputs to MUC

The Work Orders within Ellipse represent the record of work units performed against MNT codes that feed into MUC calculations. Excel output files containing aggregated records of units of work completed for each MDU are run out of Ellipse for this purpose on a weekly basis. However, staff hours recorded in Ellipse against each Work Order are not included within the MUC calculations.

Oracle Time & Labour

Staff hours and cost data for the MUC calculations is derived from data recorded in the Oracle Time & Labour (OTL) system. The capturing of staff time and cost entails the manual recording and inputting of data as follows:

- Each maintainer must complete a timesheet each week. The front of the timesheet lists the hours the maintainer has worked by day, for the week. This is sent to payroll and if it is not completed the maintainer will only receive flat rate pay until adjustments are made at a later date. The back of the timesheet shows the time the maintainer has spent working against each Standard Job they have had a Work Order for during the week.

- A check is carried out by the Section Administrator when the timesheets are returned to ensure that every maintainer submits a timesheet and also to ensure the time booked on the front and back of the timesheet tallies.

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- The Section Administrator will enter the details from the back of the timesheet into OTL, together with the Cost Centre and the period for which the timesheet refers. This will pull up a list of the personnel belonging to the Cost Centre along with any entries already entered for the week.

- The Section Administrator will enter a Standard Job number against the relevant employee and the total amount of time spent on the Standard Job during the week. If more than one Standard Job is required a new row is created for the employee. The time for all employees belonging to the Cost Centre must be entered before the week can be submitted in OTL.

- A minimum of 35 hours must be booked for each employee (Assistant Section Managers must book 40 hours). If fewer hours are booked the system will return an error and will not allow the timesheet to be submitted until this is rectified.

In terms of inputs to the MUC calculations, all Standard Job numbers against which hours are booked in the Oracle system are designated to MNT codes. The hours booked are totalled up and assigned a standard unit labour cost rate for maintenance. These are collated into an Excel document which transfers the data to the MUC calculation macro.

General Ledger – system inputs

Costs factored into MUC calculations for plant, materials, specialist spares, contractors etc. are sourced through the General Ledger. There are two systems in use that account for the ordering of such items, and their associated cost. These are Internal Stock Control (ICS) and NROL.

ISC is the stores system run by DHL that is used to manage components and consumables.

If the item required is a stock item it is held in the stores, the ISC operates as follows:

- DHL will record who took the item, and the MNT Code for which the item was needed.

- At the end of each week, DHL produces a download of all of the items used during the week; items that have been "taken of a shelf" from stores are listed as "MSP_Issue".

- The costs associated with MSP Issue items are captured when the items are used.

If the item required is not a stock item but is being ordered for a specific activity, ISC operates on the following basis:

- The supervisor will order the item directly using ISC.

- On the list produced at the end of each week, items that have been ordered for a specific purpose are listed as "Planned Job", and assigned to the relevant Work Order number. The costs associated with Planned_Job items are captured when the purchase order is raised (there was some confusion here with when the PO is raised and posted on delivery), not when the item is used.

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NROL is the system used by the National Delivery Service (NDS). There are different NROL modules used to order different items (major plant, on track machines, engineering trains, S&C, subcontractors). It is notable that MNT Codes are already assigned to the items being ordered as a fixed field (i.e. there is no way to manually enter an MNT Code to a given item.

The placement of orders in NROL is overseen by the responsible Section Resource Planner who is contacted by the MDU planners to place an order. This process follows a number of stages:

- Details of the item ordered, including the MNT Code for the job that the order is required for, are recorded locally in the MNT Data spreadsheet by the Resource Planner,

- The Resource Planner will then place the order with NDS who place the order with the suppliers using NROL.

- The request is also sent to Finance who will enter it into the General Ledger as an accrual. The actual cost of the order will not show up in the General Ledger until the item has been invoiced.

At the end of the period, the Resource Planners will send through the MNT Actuals spreadsheet to the Section Administrators who check the figures recorded against the actual costs in the General Ledger. This includes a check that the correct MNT Code has been recorded against the cost. If the spreadsheet does not tally with the actual costs an error report is sent to NDS. This will be corrected in NROL in the form of a credit during the next period. The Section Administrators will then post a journal to the General Ledger, correcting any errors to ensure that the General Ledger figures are correct.

General Ledger output to MUC calculation

All items booked through the ISC and NROL systems are transferred into the General Ledger, with the relevant MNT code assigned for each entry.

The total materials volumes and costs are collated for each MNT code, and factored into the MUC calculation. The data are submitted and transferred in the form of a text file.

MUC calculation macro

The final MUC unit cost calculations are performed by the NQ Finance Team at Network Rail, utilising a macro contained in the MUC Macro Spreadsheet. The macro is run once per route and the output is entered into the Macro Output file. This file will contain the final MUC figures for the period.

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Appendix B

MUC data process compliance: concerns and areas for improvement

Appendix B   MUC data process compliance: concerns and areas for improvement

We set out in the table below our key concerns in relation to the MUC data process compliance. This includes assessment of the following for each concern listed:

- Impact (high, medium or low);
- Severity (high, moderate or minor);
- Likelihood (high, medium or low);
- Mitigation (effective mitigation, partial mitigation/inconclusive or ineffective mitigation); and
- Conclusion (high / medium or low level of risk / uncertainty).

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
1	Sometimes volumes of work are recorded incorrectly by maintainers, usually due to confusion over the unit of measure.	High The quantities of work recorded in Ellipse will be wrong.	High Depending upon the reason and unit this can be high. The most commonly quoted example was the maintainer mistaking miles for yards.	High. Evidence viewed showing that this has happened.	Effective mitigation Section Planners check for these errors each week. Centrally produced reports specifically identify such data issues, including where the amount of work required significantly differs from the amount of work done. Some planners also produce their own reports tracking such discrepancies. The unit of measure which should be applied to a Standard Job has occasionally changed. If this happens a bulletin is sent to inform users of the change and the Section Planners check that the maintainers are completing forms correctly. The Standard Jobs include the unit of measure which is automatically entered into the Work Order.	Low risk / uncertainty Each Section Planner has shown how they mitigate this issue. With any process such as this there will be a potential for error and the interviews suggest that this is being managed as well as can be expected. Before being completely satisfied that this concern is not an issue we would want to prove that each Planner is identifying errors as described in the interviews. However, we have enough confidence in the interview responses to believe that this concern is being managed effectively.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
2	Transport of materials is included as a cost against some MNT codes if it takes less than half a shift but is recorded against its own MNT code if it takes over half a shift; (the same issue exists for the removal of materials from site).	Medium Potential for confusion. Inconsistency over the allocation of these costs due to factors such as where the materials are needed rather than the type of work being undertaken.	Moderate In terms of confusion, low. In terms of inconsistency, high.	High	Partial mitigation / inconclusive Standard FRM 702 has been updated to clarify when such issues occur and where these costs should be booked to.	Medium risk / uncertainty Questioning whether this is the correct method of allocating these costs was outside the remit of this study so this has not been taken into account in this assessment. Although clarity has been given to avoid confusion we have not interviewed any maintainers to assess their understanding of this issue. Therefore we cannot have complete confidence that this concern is fully mitigated.
3	MNT Codes are pre-assigned to the items being ordered in NROL.	High If the item being ordered is for an activity different to the one automatically assigned to it in NROL there is no way to change the allocation in NROL. Therefore cost information in NROL will be booked to the incorrect MNT Code.	High	High	Partial mitigation/inconclusive Section Administrators keep local records and check the NROL figures at the end of each period. Any discrepancies are resolved and the correct MNT Code allocation is posted to the General Ledger which is what is used to calculate the MUC.	Medium risk / uncertainty The mitigation in place should be sufficient to ensure the allocation of NROL costs to the correct MNT Code is accurate. However, the manual nature of this check along with the need to keep accurate spreadsheet records and the resulting conflict between the data contained in the General Ledger and NROL give cause for concern.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
4	There is no sense check in Ellipse to warn when the work done is different to the work required.	High Errors in recording work done may exist in Ellipse. Work Orders to capture any unfinished work might not be raised.	Moderate. Errors could affect the MUC figures.	High.	Effective mitigation Section Planners check for these errors each week. Centrally produced reports specifically identify such data issues, including where the amount of work required significantly differs from the amount of work done. Some planners also produce their own reports showing such discrepancies. The unit of measure which should be applied to a Standard Job has occasionally changed. If this happens a bulletin is sent to inform users of the change and the Section Planners check that the maintainers are completing forms correctly. The Work Orders include the unit of measure that is required.	Low risk / uncertainty Each Section Planner has shown how they mitigate this issue. With any process such as this there will be a potential for error and the interviews suggest that this is being managed as well as can be expected. The sample MUC data reviewed by the Independent Reporter has provided evidence that input errors are being identified and corrected, and we have enough confidence in the interview responses to believe that this concern is being managed effectively.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
5	There are chainage marks alongside the track…do these correspond to the Ellipse units of work?	Medium Chainage marks that are in a different unit of measure to the unit of measure required on the Work Order may result in the wrong values being recorded (e.g. chains instead of yards).	Moderate Potentially high but unsure of the scale of the problem	High. Different Standard Jobs require different units of measure so this is likely to occur.	Effective mitigation Units of measure as well as the required work is listed on the Work Order.	Low risk / uncertainty No questions were asked relating to this concern. However, we would expect a maintainer to be able to adequately estimate the amount of work undertaken without needing to refer to chainage marks.
6	Data held in the General Ledger are only recorded against MNT Codes and not Standard Jobs.	Medium If Standard Jobs change or the mapping to MNT Codes was altered it would not be possible to apply these changes to historical cost data or assess the impact of the change on the MNT codes that it is moving from/to. Cost data is not available below MNT Code level.	Minor	High It is likely that activities currently recorded under code MNT022 will be shifted to other codes as the MUC calculations evolve to encompass more activities.	Partial mitigation / inconclusive Items ordered via NROL by NDS are recorded locally at Standard Job level for other reasons so it should be possible to calculate these figures if needed. However, items ordered via ISC are not recorded to Standard Job level.	Medium risk / uncertainty Ideally, the General Ledger costs would be recorded at Work Order level to enable exactly when and where the costs were incurred to be traced. This is not a significant issue in terms of the MUC figures but it could cause problems in the future and make historical comparisons difficult.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
7	MNT Codes are defined by activity/item in NROL and cannot be changed, even though the Standard Job that the item is being used for may belong to a different MNT Code.	High Potentially the cost for these items will be allocated to the incorrect MNT Code. Reports detailing the cost recorded against MNT Codes generated from NROL will be different to reports generated from the General Ledger.	Minor	High This does occur although, only one example was given during the delivery unit interviews.	Partial mitigation / inconclusive A check is made at the end of each period to ensure that items ordered using NROL match the MDU's records (MNT Data spreadsheet). This includes checking the totals at MNT Code level. If there are inconsistencies the correct value from the MNT Data sheet is used.	Medium risk / uncertainty We would expect this to be a minor issue and the level of cost associated with these items to be relatively small. Furthermore, the check before the figures are posted to the General Ledger should ensure any errors are not reflected in the MUC figures. However, this mitigation was only mentioned at one interview. Further evidence of knowledge and mitigation of this issue along with the scale of the costs in question would be required before having complete certainty that this concern was fully mitigated.
8	Reliance by Section Administrators on a spreadsheet to check that the information contained in the General Ledger is correct,	High If the MNT Data spreadsheet became corrupted or contained errors it would greatly hinder the Section Administrator's ability to confirm NROL costs or MNT Code allocation (Concern 2).	High Due to the level of reworking / adjustment to MUC input data on the basis of data contained within this spreadsheet we would consider this to be high.	Low The likelihood of this spreadsheet becoming corrupted is small.	Partial mitigation / inconclusive This process may exist, but was not covered during interviews due to time constraints. We would welcome a response from Network Rail to this point.	Low risk / uncertainty In the absence of any evidence we would assume that a certain level of backup and control was being undertaken locally on this spreadsheet. Even without this assumption, we consider the likelihood of this becoming an issue that impacts on the MUC figures to be low .

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
9	Time recorded in Ellipse is the "time on tools" whereas the time recorded in OTL is the time from the start of travel to site to the finishing of the work.	High Comparisons between the two systems cannot be made. Figures for the hours booked by Standard Job will be different in OTL to those recorded in Ellipse. There is potential for misinterpretation as knowledge of the data source is required to understand what any reports/figures represent.	Minor Entry into both Ellipse and OTL is manual so a comparison would be beneficial to gain confidence in the data. However, in terms of impact on MUC Costs this concern is minor.	Low This occurs by design.	Effective mitigation Some areas have attempted to compare these figures by uplifting the Ellipse time on tools using non-productive time figures and have achieved an adequate comparison.	Low risk / uncertainty Being able to compare time booked in Ellipse with OTL would help to identify errors but is not an essential element of MUC control. There is a wider question over which figure should be used to calculate MUCs, but this is outside the scope of this review.
10	The MUC Macro Spreadsheet contains lookup tables that need to be updated manually.	High Data could be allocated to the wrong area or MNT Code.	High	Low. These lookup tables should be relatively stable but will need to be updated whenever a new Standard Job is required or if a Standard Job is mapped to a different MNT Code. A re-organisation could have a major impact on the lookup tables.	Effective mitigation The MUC Macro Spreadsheet will return an error if a code is missing. Strict change control is applied to Standard Jobs.	Low risk / uncertainty The combination of errors being returned and change control should ensure this is not an issue. However, more evidence that these tables are checked regularly would be required in order to have full confidence that this concern is being managed fully.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
11	The macro contained in the MUC Macro Spreadsheet is run once per route.	Low Manual selection of the code could result in a route being selected twice by error.	High	Very Low	Effective mitigation Sense check of the figures	Low risk / uncertainty If this was to occur the error would be spotted as two routes would have the same data. In this case the macro would be repeated with the correct route.
12	Confusion over the high level description of Standard Jobs has resulted in the wrong Standard Job being used for Work Orders.	Medium Costs and work could be accounted for under the incorrect MNT Code.	Minor It is unlikely that this would cause a problem widespread enough to have a significant impact on the MUC figures.	Medium. Anecdotal evidence that this has occurred.	Effective mitigation Standard Jobs are well defined by the DQuIP project. Standards relating to the Standard Job are included as references on the Standard Job.	Medium risk / uncertainty There should be enough detail available to enable Section Planners to advise maintainers whenever confusion arises. However, we have not seen any evidence to suggest that areas of confusion already identified have been communicated nationally to ensure consistency.
13	There does not appear to be any code that can be used to book equipment to that may be used for more than one activity.	Low Equipment/consumables etc. may be used for more than one job, but nobody has mentioned how this should be booked in ISC. Therefore we would have to assume that these costs are assigned to the activity that the equipment / consumables were first booked for.	Minor	High	Partial mitigation / inconclusive This was not mentioned.	Low risk / uncertainty The scale of this concern is likely to make it insignificant in terms of MUCs.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
14	Costs recorded in ISC for items ordered for a specific job are captured when the Purchase Order is raised, not when the items are used.	High Costs are included in the MUC calculations at a different time to when the work is carried out.	Moderate Potentially high but unsure of the scale of the problem	High	Partial mitigation / inconclusive The only mitigation mentioned is that Network Rail cannot afford to have a large amount of spares sitting around so items are only ordered when they are needed. This means that any Purchase Orders are raised close to the time when the items are used, minimising the impact.	Medium risk / uncertainty Assuming that all items ordered in this way are used within the financial year then there will be no impact on the year end MUC figures. However, the monthly figures would tend to show a higher MUC at the start of the year as large quantities of materials are ordered and this will reduce during the year as the amount of work done increases.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
15	Section Planners are responsible for ensuring the correct unit of work is entered against MSTs.	High The incorrect unit of measure would be shown on the Work Order and in Ellipse. This can cause confusion on behalf of the individual completing the details on the Work Order who would not be used to seeing the incorrect unit of measure. The impacts would be the same as for Concern 11.	High Depending upon the reason and unit this can be high.	Low	Effective mitigation The Data Quality Improvement Programme (DQuIP) defines how assets and maintenance activities should be entered into Ellipse. Compliance to DQuIP is measured. Section Planners take ownership of the setup of the MST's and know that it is their responsibility to ensure they are set up correctly.	Medium risk / uncertainty We have not seen an example of an Ellipse Design Document in detail to be assured that the required unit of measure is defined against Standard Job and which asset types the Standard Jobs should apply to. We also have not seen what is included in the DQuIP compliance calculation or evidence that the quoted compliance score of 99.9% is correct. Also, we would like to ascertain the extent to which the Standard Jobs which are included in the MUC measures are covered by the DQuIP documents; documents covering 15 asset types were counted when viewed on the screen during the interview. Therefore we cannot be sure that this concern is fully mitigated.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
16	Work Orders are physically distributed and returned at the end of each shift.	Low There is a potential for the paper copy of the Work Order to get lost.	Minor The loss of the quantity of work logged for one shift will not have an impact on the MUC. If multiple Work Orders were going missing the severity might increase.	Medium.	Effective mitigation A check is done by the Section Planner to make sure all Work Orders are returned. If a Work Order is not closed within 13 days of it being issued it is escalated as backlog.	Low risk / uncertainty This concern is being effectively managed.
17	Hours worked are recorded in three different places; on Ellipse Work Orders, the front of the timesheet against the day and on the back of the timesheet against Standard Job.	Low Duplication along with the differing interpretation of each of the definitions of time worked could cause confusion.	Minor It is unlikely that this would cause a problem that is widespread enough that it has a significant impact on the MUC figures.	Medium.	Effective mitigation Maintainers have been trained how to complete all of these documents. Checks are made to ensure the time recorded on the front and back of the timesheet add up. The Section Manager should check the time recorded on the Work Orders and timesheets.	Medium risk / uncertainty Whilst the Section Planners have consistently described how these documents should be completed we have not questioned any maintainers therefore we cannot be fully confident that there is no confusion. Ideally the time booked against the Standard Job in Ellipse and OTL should be the same to remove the potential for confusion and provide a further data quality check.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
18	Plant, spares, materials, contractors etc. are not recorded against the Work Order for the job that they were used for.	Medium Variations between the date these items are accounted for and used may impact the MUC figures. A full audit trail between the work recorded in Ellipse and the materials used is not available. If the mapping of Standard Jobs to MNT Codes was changed it would not be possible to carry the costs associated with these items to the new MNT Code.	Minor In terms of the impact on the MUCs, low, but in terms of the potential for future problems following development of the MUC process, high.	High	Ineffective mitigation No mitigation is in place	Medium risk / uncertainty Ideally, the General Ledger costs would be recorded at Work Order level so it can be traced exactly when and where the costs were incurred. This is not a big issue in terms of the MUC figures but it could cause problems in the future and make historical comparisons difficult.
19	If an activity is not fully completed the work done is recorded, the WO closed and a new WO raised to capture the remaining work.	Low The maintainer may forget to complete a WAIF resulting in the remaining work being missed.	Minor In terms of the impact on the MUCs, low.	Low	Partial mitigation / inconclusive This was not mentioned.	Low risk / uncertainty This is unlikely to happen but even if it did it would not impact the MUC figure.
20	If a maintainer carries out an unplanned activity or any work for which they do not have a Work Order they need to know the correct Standard Job number to raise the WO with.	High Work recorded on WAIFs may be allocated to the wrong Standard Job and therefore the wrong MNT Code.	Minor	Medium	Effective mitigation The maintainers have been issued with pocket sized cards listing the Standard Jobs relevant to their skill.	Low risk / uncertainty This has been mitigated well enough that it should not be an issue.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
21	Travel time is recorded against the first Work Order undertaken at that site.	High If more than one Work Order is carried there is potential for one work to carry a disproportionately large travel time cost. If the planner ensured a Work Order covered by MNT022 (other maintenance) was always the first job undertaken at a site, travel costs would effectively be removed from all other MUC figures.	Moderate. Travel time can make up a large percentage of the cost of a job. Good maintenance planning could even make this concern worse!	Low. It is unlikely that a particular MUC category would be skewed on this basis; unless there was a conscious decision to always undertake the same job first the allocation of travel time should average out between MUCs.	Ineffective mitigation No mitigation is in place	High risk There was a consistent understanding among interviewees that travel time should be recorded against the first work order. However, no maintainers were interviewed so complete confidence that this is universally understood cannot be given. As with concern 18, questioning whether this is the correct method of allocating travel time was outside the scope of this study. However, as there was no recognition of this as a potential issue, and the fact that no mitigation is in place this should be highlighted as an area for concern.
22	Timesheets are submitted weekly but Work Orders are submitted daily.	Low If timesheets are not completed until the end of the week but Work Orders are submitted on a daily basis, the two might not match.	Minor	Low	Effective mitigation Timesheets should be completed daily along with Work Orders even though they are submitted weekly.	Low risk / uncertainty This should not impact on the MUC figures.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
23	Some personnel carry out both maintenance and Capex work.	Medium Costs can be misallocated and included in the MUC figures when they should appear in the CAF figures.	Minor Although the scale of this is unknown we would expect the quantity of work that falls into this category to be small. Even if this did occur it is unlikely that there will be a significant difference between work undertaken as Opex or Capex so there will be no resulting impact on the MUC figure.	Medium. This has occurred in the past.	Effective mitigation Routes which use the same personnel to carry out Opex and Capex activities have been briefed on the importance of allocating the correct Cost Code to any work that they do.	Low risk / uncertainty Without any evidence to suggest that this is a big issue we would expect that the presentations to stress the importance of this along with the impact on budgets of misallocating work will mitigate this concern adequately.
24	Each maintainer has been issued with a pocket book listing all Standard Job codes.	Medium Changes to Standard Jobs would cause these pocket books to become out of date.	Moderate. This could result in work recorded on WAIF's being booked to incorrect Standard Jobs.	Medium. It is unlikely that the details contained in these books would be changed in such a way as to impact the MUC. However, new Standard Jobs would be likely.	Partial mitigation / inconclusive This was not mentioned.	Medium risk / uncertainty There was no mention of how pocketbooks are kept up to date.
25	The time entered into Ellipse is not used for anything.	Low Errors in recording the time entered into Ellipse may occur. Although this data is not used now, this could affect the confidence in the data if it is used in the future.	Minor	Medium. It is likely that there will be errors with data input and if the time is not used for any purpose no checks will be carried out to identify errors.	N/A	Low risk / uncertainty This is not a concern that will impact on the MUC figures.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
26	The Productivity report is based on Norm Hours not actual hours worked.	Low This report could be misinterpreted as it is not based on actual productivity.	Minor	High. To correctly interpret this report it would be necessary to know exactly how it was calculated	N/A	Low risk / uncertainty This is not a concern that will impact on the MUC figures.
27	The Section Management team at Brighton carry out a comparison between the work done by On Track machines recorded in NROL and the work done recorded on the corresponding Work Orders in Ellipse. If errors are found it is usually the Ellipse figure that is wrong.	Medium Errors have been found with the quantities of work recorded in Ellipse that were not identified elsewhere.	Moderate	Medium	Effective mitigation Comparison between On Track machines recorded in NROL and work done recorded in Ellipse.	Medium risk / uncertainty It is not clear whether this comparison was done before or after the central reports were produced, and only one Section Management team interviewed mentioned this type of data check. We would recommend that this check is repeated alongside the centrally produced reports to ascertain whether all of the errors identified using this method are routinely captured by the existing method. If not, we would suggest that this method of error checking be rolled out to the other areas.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
28	The quantity of work required is entered onto MSTs by the planners who calculate this via diagrams.	Medium The quantities of work included against MSTs in Ellipse are estimates and may be inaccurate.	Minor	Low	Effective mitigation The Section Planners take ownership of the MSTs. If the diagrams were significantly wrong this would be highlighted by the maintainers recording a quantity of work done which was significantly different to the work required, without submitting a WAIF. This would highlight the error and enable it to be corrected.	Low risk / uncertainty This should not be a concern that will impact on the MUC figures. However, no evidence has been seen to suggest that the mitigation takes place.
29	Standard Jobs can change.	Medium This can cause confusion, result in the incorrect Standard Jobs being recorded on WAIFs and work done being recorded in terms of the wrong unit of measure.	Moderate Potentially high but unsure of the scale of the problem	Medium. Anecdotal evidence that this has occurred.	Partial mitigation Changes to Standard Jobs are subject to strict change control and are communicated via bulletins weekly. Centrally produced reports highlighting discrepancies between work required and work done would highlight any errors.	Medium risk / uncertainty It is not often that changes to Standard Jobs that would affect the MUC calculations would occur. If any such changes did occur then the Section Planner should ensure that MSTs were updated correctly, in which case the mitigation actions would be effective. Therefore, If the comments surrounding concern 12 were fully addressed then we would also consider this concern to be fully addressed.

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ID	Concern	Impact	Severity	Likelihood	Mitigation	Conclusion
30	Are the relationships between systems properly mapped and fully understood?	Medium If the relationships between the systems which feed data into the MUC process are not properly mapped and understood the consequences of not carrying out an action on time will not be fully understood.	Moderate Potentially high. Although unlikely, if the MUC Macro Spreadsheet was run in week 1 rather than week 3 the MUCs would be likely to be based on erroneous data.	Low	Partial mitigation / inconclusive A timeline has been supplied showing the inputs into the MUC Macro Spreadsheet.	Medium risk / uncertainty Audit interviewees have been consistently knowledgeable and clear regarding when they must complete their own actions but the bigger picture has not been given. The timeline provided to the Independent Reporter does not cover the actions carried out by Section level staff in enough detail to be fully confident that this issue is understood.

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Appendix C

Maintenance Unit Costs in 2009/10 annual return (regional breakdown)

Appendix C   Maintenance Unit Costs in 2009/10 annual return (regional breakdown)

ELLIPSE Ref	Activity Description	Activity Unit	Summary unit cost (2009/10)	Anglia	Kent	LNE	LNN	LNS	M&C	Scotland	Sussex	Wessex	Western
			£/unit	£s	£s	£s	£s	£s	£s	£s	£s	£s	
Pway Activities													
MNT001	Manual Ultrasonic Inspection of Rail	Rail Mile	324.9	572	377	294	403	570	129	376	403	239	263
MNT002	Rail Changing	Rail Yard	109.8	150	200	84	91	102	157	98	118	146	92
MNT003	Manual Spot Re-sleepering	No of sleepers	170.2	156	343	85	176	245	217	152	221	267	175
MNT004	Plain Line Tamping	Track Mile	4,126.6	4,812	5,852	3,068	3,824	7,333	1,989	5,110	6,361	5,016	2,828
MNT005	Stoneblowing	Track Mile	3,776.9	4,382	6,603	3,561	2,608	4,886	3,365	4,646	4,963	4,201	2,674
MNT006	Manual Wet Bed removal	No of Bays	134.6	153	166	102	152	196	135	132	205	96	131
MNT008	S&C Unit Renewal	No S&Cs Units	10,131.0	12,474	14,810	7,950	10,186	12,767	8,918	4,806	11,893	7,494	11,860
MNT010	Replacement of S&C bearers	No of S&C Bearers	210.6	393	264	149	190	273	249	278	331	189	179
MNT011	S&C weld repairs	No of Repairs (weld)	676.3	920	542	793	512	1,225	469	719	1,081	295	578
MNT013	Level 1 Track Inspections	Track Miles Inspections	82.9	68	98	92	109	92	107	61	47	66	78
MNT015	Weld Repairs of Defective Rails	No of repairs (weld)	490.2	501	269	420	411	680	300	528	725	793	516
MNT016	Installation of pre fabricated IRJs	No of joints	1,364.8	2,735	1,779	1,525	3,142	1,552	964	591	4,430	2,843	328
MNT019	Manual correction of plain line geometr	Track Yards	18.3	18	18	22	22	23	20	20	9	15	13
MNT020	Manual reprofiling of ballast	Track Yards	3.5	5	2	6	4	4	3	3	2	5	2
MNT026	Replenish Ballast Manual (train)	Tonnes	17.0	16	13	12	21	17	15	12	36	20	20
MNT027	Maintenance of Rail Lubricators	Each	209.0	206	286	187	237	223	124	88	232	196	262
MNT029	Replacement of Pads & Insulators	Sleepers	4.3	3	4	4	4	6	6	5	6	2	3
S&T Activities													
MNT050	Point End Routine Maintenance	Services	54.6	54	51	57	60	68	62	43	36	53	53
MNT051	Signals Routine Maintenance	Services	87.2	150	60	133	83	84	42	98	42	110	58
MNT052	Track Circuits / Train Detection Services	Services	52.2	44	68	50	34	66	44	53	54	68	53
Other Infrastructure													
MNT073	Drainage	Draining Yards	7.1	9	9	2	6	23	6	10	30	6	11
MNT077	Signs	Each	19.2	39	11	17	60	22	9	13	9	30	19

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Appendix D

Meetings

Appendix D   Meetings

Date	Location	Attendees name & division	Purpose of meeting
26/07/2010	NR York Way office, London	Arup: Mark Morris, Tim Ashwin Network rail: Rob Evison (HQ Strategic Planning)	Kick off meeting: audit approach, key data & meetings requirements.
04/08/2010 (a.m.)	NR Northern House office, London	Arup: Trevor Taylor, Tim Ashwin Network rail: Wendy Horne (LNE Route Finance), Scott Kennedy (HQ finance)	MUC audit meeting with LNE Route Finance to assess local compliance with MUC reporting
04/08/2010 (p.m.)	NR George Stephenson House, York	Arup: Trevor Taylor, Jonathan Yates, Tim Ashwin Network rail: Paul Bridgman (Sheffield MDU), Alex Storey (Sheffield MDU), Scott Kennedy (HQ finance)	MUC audit meeting: Sheffield MDU to assess local compliance with MUC reporting
04/08/2010	NR Kings-way offices, London	Arup: Mark Morris Network Rail: Mark Hadley	CAF audit meeting, focussing on track assets.
05/08/2010	NR London Bridge office	Arup: Trevor Taylor, Tim Ashwin Network rail: Emmaline Jennison (Route Management, Kent), Becky Mottley (Route Management, Kent), Paula Wowrow (London Bridge MDU), Ken Lambert - (HQ Maintenance Improvement)	MUC audit meeting: Kent route management & London Bridge MDU to assess local compliance with MUC reporting
05/08/2010	NR Birmingham office	Arup: Mark Morris Network Rail: Richard Fisher, David Hughes, Kate Wheatley, Steve Dent	CAF audit meeting focussing in civils assets
09/08/2010	NR Brighton office	Arup: Trevor Taylor, Tim Ashwin Network rail: Richard Langham (Sussex Route Manager), Liam Sumpter (HQ finance), Sion Pocock (Brighton MDU), Malcolm Smith (Brighton MDU), Chris Kane (Brighton MDU), Laura Feehan (Brighton MDU)	MUC audit meeting: Sussex route management & Brighton MDU to assess local compliance with MUC reporting
10/08/2010	NR Melton Street office, London	Arup: Trevor Taylor, Tim Ashwin Network rail: John Gerrard (HQ Finance), Ed Mulcahey (HQ Finance), Pablo Forteza (HQ Maintenance Improvement),	MUC audit meeting: HQ Finance to assess HQ processes to ensure MUC quality and compliance.

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Date	Location	Attendees name & division	Purpose of meeting
		Davin Crowley Sweet (HQ Maintenance Improvement)	
08/2010	Via corres-pondence	Arup: Mark Morris Network Rail: Tony Smith (LNE region)	Audit of CAF measures for signalling
08/2010	Via corres-pondence	Arup: Mark Morris Network Rail: Julian Humphrey (Western region)	Audit of CAF measures for Western Civils

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Appendix E

Documents reviewed

Appendix E   Documents reviewed

Ref	Document name	File name	Document source	Date received
1	Annual return audit – reporter instructions for efficiency, unit costs and financeability data assurance mandate	ORR-#382649-v1-Final_draft_-_reporter_instruction_annual_return_audit.DOC	Chris Fieldsend	02/06/2010
2	Network Rail Annual Return 2009-10 - DRAFT version	2010 Annual Return 1.7.10.zip	Bill Davidson	05/06/2010
3	Network Rail Annual Return 2009-10 (final version)	Network Rail Annual Return 2010.pdf	Rob Evison	27/07/2010
4	MUC 09/10 breakdown by region	09_10 MUCs for Arup 100729.xls	Rob Evison	30/07/2010
5	Ellipse worksheets Y09-10 summary spreadsheets (each region)	Ellipse-scotland.xls, Ellipse-Sussex.xls, Ellipse-Wessex.xls, Ellipse-Western.xls, Ellipse-Anglia.xls, Ellipse-Kent.xls, Ellipse-LNE.xls, Ellipse-LNW.xls, Ellipse-MAC.xls	Ed Mulcahy	09/08/2010
6	Z567 PWay Ellipse Work Order unit spread (Excel document)	Z567 Pway Work Order Unit Spread (30-07-2010 to 05-08-2010).xls	Ed Mulcahy	11/08/2010
7	"KPI 1" Ellipse Work Order data quality report (produced weekly)	KPI 1 - Work Order Data Quality Report (05-08-2010).xls	Ed Mulcahy	11/08/2010
8	MUC Rolling Graphs – data quality and spread	MUC Rolling graphs.pdf	Ed Mulcahy	11/08/2010
9	Reporting process timeline for Ellipse outputs and MUC figures	MUC Reporting-A10.xls	Ed Mulcahy	11/08/2010
10	MUC Data Quality Metrics graph (7 x quality measures)	MUC data quality metric example (2).pdf	Ed Mulcahy	11/08/2010
11	MUC calculation macro YTD10/11(processing and derivation of MUCs)	Macro output P3 wk3.xlsx	Ed Mulcahy	11/08/2010

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Ref	Document name	File name	Document source	Date received
12	Standard Jobs in Ellipse	xx Z567 Norm Ref and Conversion Mapping (05-08-2010).xlsx	Ed Mulcahy	11/08/2010
13	MUC calculation macro extract FYE 09/10 (for MUC derivation macro)	Macro output P3 wk3.xlsx	Ed Mulcahy	17/08/2010
14	CAF Data	CAFs by Territory.xls	Robin Hamilton	10/08/2010
15	Track Data	SEA Info for ARUP (MM).xls	Mark Hadley	11/08/2010
16	Track Data	P13 0809 Non Volume.xls	Mark Hadley	11/08/2010
17	Track Data	P13 0809 Cost and Volume v1.1.xls	Mark Hadley	11/08/2010
18	Track Data	MasterTemplateRenP13.xls	Mark Hadley	11/08/2010
19	LNE Signalling	101503 CAF 060110.xls	Tony Smith	
20	LNE Signalling	102515 Lincoln CAF 7 vs 1.22.xls	Tony Smith	
21	LNE Signalling	cafaudit.pdf	Tony Smith	
22	LNE Signalling	GGRK48 CAF GRIP 7 26-03-10.xls	Tony Smith	
23	LNE Signalling	GGRK57 CAF 070110.xls	Tony Smith	
24	LNE Signalling	Habrough GRIP 7 CAF 109.xls	Tony Smith	
25	LNE Signalling	UCM 1 22-SIG-LNE-104548-7AR Scunthorpe WESTLOCK SSI to CBI Renewal (27012010) (2).xls	Tony Smith	
26	LNE Signalling	UCM 1 22-SIG-LNE-GGRJ63-7AR Greetland Elland RRI Renewal (01022010) (2).xls	Tony Smith	
27	LNE Signalling	UCM-SIG-LNE-104552-4BR Maltby & Harworth Life Extension Works.xls	Tony Smith	
28	LNE Signalling	UCM-SIG-WES-100366-7AR Kings	Tony Smith	

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Ref	Document name	File name	Document source	Date received
		Cross Panel Refurb.xls		
29	Western Civils	100332 Chipping Sodbury West CAF7C.xls	Julian Humphries	
30	Western Civils	100332.xls	Julian Humphries	
31	Western Civils	103015 Foxham Embankment CAF7C.xls	Julian Humphries	
32	Western Civils	103015.xls	Julian Humphries	
33	Western Civils	103149 Sebastopol Embankment CAF7C.xls	Julian Humphries	
34	Western Civils	103149.xls	Julian Humphries	
35	Western Civils	103191 Dawlish Phase IV CAF 7C.xls	Julian Humphries	
36	Western Civils	103191.xls	Julian Humphries	
37	Western Civils	103777 Heywood Road Junction Embankment CAF7C.xls	Julian Humphries	
38	Western Civils	103777.xls	Julian Humphries	
39	Western Civils	103890 Bedminster West Embankment CAF7C.xls	Julian Humphries	
40	Western Civils	103890.xls	Julian Humphries	
41	Western Civils	105169 River Leri Ynyslas FB CAF7C.xls	Julian Humphries	
42	Western Civils	105169.xls	Julian Humphries	
43	Western Civils	105740 Kemble Cutting CAF7W.xls	Julian Humphries	
44	Western Civils	105740.xls	Julian Humphries	
45	Western Civils	107372 Colwall Green OB CAF7C.xls	Julian Humphries	
46	Western Civils	107372.xls	Julian Humphries	

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Appendix F

ORR Mandate (14th June 2010)

Appendix F   ORR Mandate (14th June 2010)

Please note: an agreement was made between the ORR, Network Rail and Arup, as specified within Arup's proposal document for this assignment (version 3, 18/07/2010), that that sections of the original ORR Mandate the mandate marked below in italics will not fall within the scope of this audit.

Annual return audit – reporter instructions for the efficiency, unit costs and financeability data assurance mandate

As part of the audit of Network Rail's Annual Return, the independent reporter will review Network Rail's calculation of the measures it is using to assess its efficiency, financeability and its calculation of renewals and maintenance unit costs, as well as reporting on the reasonableness of Network Rail's commentary on these measures.[3]

We require the reporter to audit the following for Great Britain and where appropriate Scotland and England & Wales and regionally. We recognise that there is the danger of overlap with the reporter's unit cost audit. We therefore require the following minimising repetition where applicable:

- *An audit of the commentary provided in Network Rail's budget variance analysis.*

- *We require a review of whether Network Rail's explanation of the variances between actual costs and those assumed in the 2009-10 budget, CP4 delivery plan, and ORR's PR08 determination is reasonable.*

- *Whether Network Rail's breakdown of the renewals underspend, when compared to the 2009-10 budget and CP4 delivery plan, between deferral and efficiency is reasonable, particularly given that Network Rail's asset policies have been in a state of flux. This audit should identify whether Network Rail's breakdown of efficiencies between scope and unit cost is reasonable.*

- An audit of the unit costs in the CAF and MUC to check that they have been calculated in accordance with company's unit cost handbook.

- An assessment of the confidence that we can have in the underlying 2009-10 data for each of the unit costs in the CAF and MUC, not repeating commentary already given on the system and process behind the CAF and MUCs.[4]

- *An assessment of the quality of the data used to calculate the CAF's and MUCs. This assessment will identify how the quality of data in 2009-10 compares to previous years where appropriate.*

- *[Review the civils' unit costs and describe in detail how they have been calculated and whether it is reasonable to use them to derive volumes of activity by dividing total spend by the unit cost – ORR is currently*

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[3] The reporter should not duplicate work it did for the reporters' May 2010 audit of the unit cost framework.

[4] Some of this work will already have been done as part of the audit of the unit cost framework but the requirement here is to give a confidence score to each unit cost. See Halcrow's report from last year for further detail.

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clarifying whether a specific areas on civils should be included, which we are clarifying internally].

- *An audit to check whether Network Rail's calculation of its CEM and FVA are in accordance with its policy and is reasonable. This should include an assessment of whether the data used to calculate the measures is accurate, of a sufficient quality and consistent with the purpose of the measures.*

- *Not duplicating work currently undertaken by Deloitte, we require an audit of the accuracy of Network Rail's calculation of its debt to RAB ratio and its AICR ratio, in particular whether they are calculated in accordance with the PR08 determination and Network Rail's licence, as well as reporting on the reasonableness of Network Rail's commentary on these measures*

- *We require the reporter to set out a clear approach for assessing the quality and accuracy of the data, looking forward towards using this methodology in subsequent years to ensure consistency. We expect the reporter to make clear recommendations, drawing on previous years' audits and make a judgement on the quality and coverage of the data. We also expect the reporter to monitor Network Rail's implementation of any actions that it agrees to take forward as a result of the reporter recommendations in coming years.*

Delivery dates:

- Draft report issued by Friday, 16 July
- Final report issues by Friday, 30 July

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