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Level 2

Risk-Based Maintenance for Overhead Line Electrification Assets

Endorsement and Authorisation

Endorsed by:

R. Wilkins, Reliability Improvement Specialist

Authorised by:

R. Stainton, Professional Head Electrical Power Engineering

Accepted for issue by:

M. McManus, National Standards Manager

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Issue record

Issue	Date	Comments
6	December 2014	Re-written to comply with Risk-Based Maintenance requirements

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 31 March 2016.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

NR/L2/SIG/10662	Process for the Introduction of New or Revised Maintenance Regimes (formerly RT/E/S/10662)
ORR Guidance	ORR guidance on the application of the common safety method (CSM) on risk evaluation and assessment

Moubray, J, Reliability Centred Maintenance (2nd edition) 1997, Elsevier
ISBN 978-0-7506-3358-1

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1 Purpose

This specification describes the process that must be followed in order to apply a risk based maintenance analysis to Overhead Line Equipment

The document is to be used in conjunction with any other relevant, equipment specific, Network Rail maintenance standards.

2 Scope

This specification applies to all persons responsible for planning or undertaking preventive or reactive inspection and maintenance activities on 25 kV a.c. or 1.5 kV d.c. overhead line electrification equipment.

This document describes the agreed method for Network Rail to demonstrate compliance with the ORR guidance to the common safety method on risk evaluation and assessment. Variations from the process within this document can only be granted where an alternative method of risk assessment is produced and agreed.

3 Definitions

For the purpose of this standard, the following terms and definitions apply.

DU	Delivery Unit
ERA	European Railway Agency
FMEA	Failure Modes & Effects Analysis
MPA	Mid-Point Anchor
MST	Maintenance Scheduled Tasks
MWh	Megawatt Hours
OLE	Overhead Line Equipment
PTFE	Polytetrafluoroethylene
RAM	Route Asset Manager
RCM	Reliability Centred Maintenance (RCM2 Defined Process)
STK	Single Track Kilometres

4 Route/Line Categorisation

4.1 Number of Analyses Required for the Route

The RAM shall decide how many separate equipment analyses are required to cover the assets in operation within the Route. The primary drivers for considering how many analyses will be required are: -

- Equipment Type
- Age of Installation
- Operational Importance.

4.2 Recording of Analysis

For each analysis, the decisions regarding analysis selection, maintenance periodicities and defect rectification times shall be recorded along with the

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associated FMEA/Economic calculations and supporting evidence. This documentation shall be agreed and authorised by the RAM and relevant DU Engineers.

All proposed deviations from the RCM Analysis Recommendations shall be clearly identified and all supporting data supplied where appropriate.

A copy of the agreed analysis shall be provided to the Professional Head of Electrical Power after authorisation.

4.3 Mechanical Categorisation of Wire Runs

Within each analysis, a wire run shall be assigned a category from 1 to 5 which will be determined by the parameters shown in Table 1.

Line Type	Line Cat	Linespeed (mph) Min	Linespeed (mph) Max	Pantograph Passage Min	Pantograph Passage Max
High Speed	1				
	2				
Slow Speed	3				
	4				
Other	5				

Table 1 – Line categorisation chart

This information may be gathered using published timetables / sectional appendices to produce a range of operating conditions that cover all assets. Alternatively, the actual linespeed and pantograph passages of the wire runs may be charted and grouped into categories.

Not all categories are required if there is little variance between services. Categories 1 and 2 are reserved for high-speed inter-city type services (typically >100 mph) while 3 and 4 are for slower suburban types. Category 5 is for other types of line such as sidings and loops.

Crossovers shall be evaluated separately to the lines which they connect. A higher priority matching the adjacent lines may be adopted for the wire run but the correct categorisation shall be applied to assets such as section insulators contained within the crossover.

4.4 Electrical Categorisation of Wire Runs

Each wire run shall have an electrical categorisation applied to the mechanical category. This is defined as the energy usage (MWh) per single track kilometre (STK) and is taken from diagram in Appendix A. The Wire Run shall be categorised as given in Table 2.

Elec Cat	MWh per STK
A	400 – 500
B	300 – 400
C	200 – 300
D	100 – 200
E	000 – 100

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Table 2 – Electrical categorisation chart

4.5 Mechanical Categorisations of Other Assets

All discrete assets except isolators shall be assigned a category matching the wire run within which it is contained. Isolators shall be categorised as heavy / light usage where the following definition for heavy usage shall applies: -

heavy usage

- > 50 Operations per annum or > 25 Operations per annum with live switching

All other isolators shall be considered as light usage.

5 Maintenance Activities

5.1 Types of Maintenance Scheduled Tasks (MSTs)

5.1.1 Mandatory Tasks (M)

Mandatory MSTs are those that are assigned to a particular asset to maintain reliability and condition.

5.1.2 Reliability-Based Tasks (R)

Reliability-based tasks shall be applied to identified areas where further works are required to maintain reliability due to the type of equipment or external features that cannot be reasonably managed within a standard maintenance regime. These locations and frequencies shall be agreed between the RAM and DU Engineers prior to the implementation of the regime.

5.1.3 Technical MSTs (T)

Technical tasks are either tasks that need to be carried out by other members of staff (Technical / Supervisory) or tasks that involve the processing of data or information off-site but are considered productive time in identifying areas of work or additional inspection.

5.2 Selection and Identification of Maintenance Periodicities for Assets

5.2.1 Parameters for Selection

The following section lists the key components of assets whose failure or condition shall define the suggested maintenance task. Each failure shall be analysed to determine the most appropriate frequency of inspection.

The applicable availability criteria shall be listed for each section. Both the ERA target and NR Target shall be met to demonstrate full compliance. Where one or both targets cannot be met a cost - benefit analysis shall be conducted.

Lists are not exhaustive and local conditions may determine that additional components should be analysed. Where applicable, this shall be agreed with the RAM prior to any FMEA work being carried out.

The output of this work shall be recorded as per Appendix B, including the tolerance as defined in section **6.3**.

Where an inspection already has a periodicity listed in Appendix B, this shall be followed as local data will not produce a variance.

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5.2.2 OLE Cab Patrols

OLE cab patrolling will be required to find failures linked primarily to vegetation as shown in Table 3. Due to the nature of cab patrolling and the limited detail visible from the cab it is not recommended that other failure modes are analysed with this method.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
Vegetation	10^{-8}	24	1-in-11,408	1-in-10,000	$\frac{km \times 1000}{55}$	ERA Target based on a catastrophic failure of OLE due to vegetation. NR Target is a normalised rate.

Table 3 – Failure finding tasks for OLE cab patrolling

5.2.3 OLE Patrols

The Failure finding tasks identified as those requiring a basic visual inspection most frequently are given in Table 4.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
In-Line Droppers	10^{-6}	18	1-in-152	1-in-184	$\frac{km \times 5000}{55}$	ERA Target based on a catastrophic failure of OLE due to dropper defects. NR Target is the average failure rate recorded between 2010 to 2013.
Jumpers	10^{-6}	18	1-in-152	1-in-250	5 jumpers per W/R	ERA Target based on a catastrophic failure of OLE due to jumper defects. NR Target is a target failure rate.
In-Line Insulation	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available
Catenary Damage	10^{-7}	24	1-in-1141	1-in-1250	$\frac{km \times 1000}{55}$	ERA Target based on a catastrophic failure of OLE due to catenary defects. NR Target is a

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						target failure rate.
MPA Damage	10^{-7}	24	1-in-1141	1-in-1200	1 per full wire run	ERA Target based on a catastrophic failure of OLE due to MPA defects. NR Target is a target failure rate.
Cross-Contact Assemblies	10^{-7}	18	1-in-1521	1-in-1500	Nos of cross-overs	ERA Target based on a catastrophic failure of OLE due to cross-contact defects. NR Target is a target failure rate.
Bonding	10^{-6}	24	1-in-114	1-in-100	Nos of structures	
Red Bonds	10^{-7}	18	1-in-39	1-in-40	Ellipse or route estimate	This is determined by the requirement to maintain safety of staff and public from electrical shock
Overbridge Bonds	10^{-8}	24	1-in-107	1-in-100	Nos of bridges	This is determined by the requirement to maintain safety of staff and public from electrical shock

Table 4 – Failure finding tasks for OLE foot patrolling

5.2.4 OLE Wire Runs

The on-condition & scheduled restoration tasks were identified as those requiring a high-level intrusive inspection most frequently are given in Table 5.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
Electrical Clearance to other Structures	10^{-9}	24	1-in-114077	1-in-114077	Nos of Bridges	Breach of electrical clearance
OLE Geometry	10^{-5}	18	1-in-15	1-in-25	Minimum 10% analysis of Wire Run Maintenance Work	ERA Target based on a technical failure of OLE due to Geometry defects. NR Target is a target failure rate. Based on 1 failure per wire run.

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Electrical Burning of Registrations Arms	10^{-5}	18	1-in-152	1-in-150	Minimum 10% analysis of Wire Run Maintenance Work	ERA Target based on a technical failure of OLE due to Geometry defects. NR Target is a target failure rate. Based on 1 failure per wire run.
Mechanical Wear of Registration Arms	10^{-6}	18	1-in-15	1-in-30	Minimum 10% analysis of Wire Run Maintenance Work	ERA Target based on a technical failure of OLE due to Geometry defects. NR Target is a target failure rate. Based on 1 failure per wire run.
Wear of Support & Registration Droppers	10^{-8}	18	1-in-15210	1-in-15000	Maintenance DU Estimate	ERA Target based on a technical failure of OLE due to registration dropper failure. NR Target is a target failure rate. Based on 1 failure per wire run.

Table 5 – On-condition & scheduled restoration tasks most frequently requiring a high-level intrusive inspection

The output of this work will also define the maintenance requirements for height and stagger recording and analysis prior to maintenance taking place.

5.2.5 Neutral Sections

The following tasks were identified as those requiring an inspection most frequently are given in Table 6. The nature of inspection and any ability to conduct this in-line with another inspection type (such as patrolling) should also be considered.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
Heights & Staggers incorrect	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Splice Interfaces Incorrect	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
PTFE Rod Wear	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into

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						future issues.
Skid Wear	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Ceramic Bead Damage	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.

Table 6 – Tasks most frequently requiring an inspection of a neutral section

5.2.6 Section Insulators

The following tasks were identified as those requiring an inspection most frequently are giving in table 7. The nature of inspection and any ability to conduct this in-line with another inspection type (such as patrolling) should also be considered.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
Heights & Staggers incorrect	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Splice Interfaces Incorrect	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
PTFE Rod Wear	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Skid Wear	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Ceramic Bead Damage	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.

Table 7 – Tasks most frequently requiring an inspection of a section insulator

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5.2.7 Isolators / Switches

The tasks identified as those requiring an inspection most frequently are given in Table 8. The nature of inspection and any ability to conduct this in line with another inspection type (such as patrolling) should also be considered.

Failure	Potential / Hour	Operating Hours Per Day	ERA Target Availability	NR Target Availability	Route Estimation	Justification for Selection
Electrical Burning of Connections	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.
Mechanical Seizure of Operating Movement	TBC	TBC	TBC	TBC	Ellipse Population	Data not yet available To be included into future issues.

Table 8 – Tasks most frequently requiring an inspection of an isolator

5.3 Selection of Reliability-Based Maintenance Periodicities for Assets

5.3.1 Parameters for Selection

Sections **5.3.2** to **5.3.8** lists the required tasks used to mitigate external influences. These tasks will not be required for all assets and may only need to be applied seasonally or in specific extreme climatic conditions (e.g. ice / heat).

Both the justification and the assets for which these tasks are to be applied shall be agreed with the RAM prior to implementation.

5.3.2 Early Life Failure Inspection

An Early Failure Inspection shall be undertaken in the following circumstances:

- where a main conductor, e.g. catenary or contact wire has been renewed over a complete wire run/tension length;
- where a new or novel OLE system has been installed over a complete wire run/tension length;
- where a major electrification/re-modelling scheme has been implemented involving significant re-design/re-adjustment of OLE.

The inspections shall be undertaken on a representative sample of wire runs in order to establish any new failure mode drivers and check general quality of OLE construction work. Sample sizes shall be:

- For renewals involving <10 wire runs, a 100% sample shall be inspected.
- For renewals involving ≥10 wire runs, a 10% representative sample shall be inspected.

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5.3.3 Insulator Cleaning (Polluted/Covered Areas)

Insulator cleaning shall be applied to areas where the insulation is not subject to 'self-cleaning' by means of rainwater. These are locations such as depot sheds and train station areas where the presence of diesel pollution leads to extreme contamination of the insulator.

5.3.4 Tunnel Inspection/Maintenance (Dry Tunnels)

Tunnel inspection/maintenance shall be applied to dry tunnel locations where the insulation are not subject to 'self-cleaning' by means of rainwater and diesel pollution will lead to contamination of the insulator.

5.3.5 Tunnel Inspection/Maintenance (Wet Tunnels)

Tunnel inspection/maintenance shall be applied to wet tunnel locations an excessive ingress of water can lead to pollution contaminating the insulator causing a flashover. There is also a risk of water ingress affecting the aluminium earth wire/return conductor and other fittings within the tunnel.

5.3.6 Hot Weather Patrols

Hot weather patrols shall be applied to the following locations:

- Termination locations and MPA locations where fault rectification before the onset of hot weather is not feasible.
- Fixed termination wire runs where there are known issues with electrical clearance or excessive uplifts in high temperatures.
- To all areas where a specific survey of balance weight equipment is required to determine condition.

The frequency of patrols will be dependant on the weather and knowledge of the temperature where the risk is prevalent.

5.3.7 Icicle Patrol

Icicle patrols shall be applied to bridge and tunnel locations where icicles are known to have an operational impact on the OLE in cold weather conditions. Patrol periodicities shall be determined by local knowledge of the speed and effect of icicle growth at specific locations.

5.3.8 Nesting Patrol

Nesting patrols shall be applied to any locations where birds' nests have had an impact on the operation of the asset. Typical locations include: -

- Portals
- Twin Tack Cantilevers
- and Overbridges.

5.4 Tolerances, Risk Assessment and Reprioritisation

A planning tolerance is to be applied to all MSTs. This allows for an acceptable variance in planning timescales due to access constraints. The tolerance should be rounded to the most convenient unit of measure. Where data does not provide the analysis of a tolerance a standard tolerance of +/- 10% shall be assumed.

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Where the *Required Finish Date* for an MST within Ellipse is or will be missed the risk assessment in Appendix E shall be carried out as a minimum action and recorded against the asset with a copy supplied to the Route Asset Manager. The risk assessment is not a means of compliance and should only be considered as mitigating actions between the required date and the actual date of maintenance.

For any asset where the tolerance specified in Appendix B is exceeded before maintenance is carried out, a TNC shall be submitted to the RAM. This shall include the Risk Assessment Work and the plan to achieve access within the timescales indicated by this work.

Where >10% of any asset has exceeded the *Required Finish Date* for a particular MST, a TNC shall be submitted regardless of the tolerance. This shall include the risk assessment work and the plan to achieve access and confirmation of available resources required to recover this work.

Where a TNC is granted the TNC Number shall be recorded within the appropriate field within the Ellipse MST. The *Required Finish Date* shall not be amended. No Work Order shall be closed down until the asset has received maintenance to the appropriate work instruction.

For reprioritisation of defects, the risk assessment in Appendix E.1 shall be followed. The required finish date may be amended along with an appropriate reason code.

6 Defects

6.1 Risk Assessment of Categories

Each defect in each category assigned to an analysis shall be issued with a time for rectification. This time represents the typical maximum allowable timescales for a defect to be removed from the system. Beyond this, the asset will require reprioritisation as per section **5.4** and possibly additional mitigation works to prevent degraded operation. This will depend on the type of failure and the criticality of the location.

Where individual factors require a reduced timescale to that agreed, the DU Engineer shall clearly state the contributing factors for the timescales within the Work Order.

A template is supplied for each Route/DU to create a defect prioritisaiton matrix including the timescales for the rectification of defects specific to that Route/DU. Where the template has a timescale already included, the rectification is defined for safety purposes and no deviation from the maximum timescale is allowed.

6.2 Defect Codes

Each defect shall have the appropriate defect code applied as per the guidance in Appendix C and D.

Any defect not listed shall be coded as ‘any other defect’ with all relevant information being included in the description field of the Work Order

Campaign changes identified donot require a defect code to be entered.

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6.3 Defect Priorities

One of the numerical categories given in Table 9 shall be assigned to each defect depending on line category and defect description.

Work Orders raised in Ellipse shall be assigned the Defect Code and shall be raised against the asset specified in Appendix B. Once a defect has been categorised and recorded, it shall only be re-categorised in accordance with the guidance given within Appendix E.1 unless the guidance in **6.4** is followed.

Ellipse Code	Rectification Time	Comments
I0	Rapid Response	This is used as a retrospective code to indicate the response to an incident/call-out. This cannot be used as a planning timescale.
I1	36 Hours	
I2	7 Days	
I3	28 Days	
I4	6 Months	
M3	3 Months	
I5	1 Year	
I6	2 Years	
I7	Maint	Refer to guidance below.
I8	Assess	Refer to guidance below.

Table 9 – Ellipse Codes

Campaign Changes identified within Ellipse shall be treated as a Defect Not Listed in Appendix C in section **6.4** and dated accordingly. A shorter rectification timescale may be used where agreed with the RAM to allow priority defects to be delivered early.

Any defect assigned a rectification timescale of 28 days or less shall additionally be reported to fault control via normal means of communication. This will be required to support any request for disruptive or short notice access to the infrastructure.

6.4 Maintenance Guidance

The I7 code for maintenance may be used in one of three ways.

Inspection required

Any asset requiring a further inspection to judge a change in condition should be assigned a priority for a further inspection to be carried out. The Work Order extended text should start with the words “RE-ASSESSMENT REQUIRED” with the specified detail added afterwards.

Defects Listed in Appendix C

Any defect listed shall have a rectification date of the next due maintenance for the wire run applied. Where this defect is not completed it shall be assessed as per section **5.4**

Defects Not Listed in Appendix C

Any defect not listed should be assigned the appropriate code for a miscellaneous item and assigned a rectification date of 31/12/2099.

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6.5 Assessment Guidance

Where a defect is assigned priority I8, the Assessment Matrix (see Appendix D) shall be used to provide a simple risk assessment that justifies the priority to be applied. This assessment may need additional information and these requirements are listed in Appendix D comments for a sample of defects. Others may be added/changed by the Route/DU as appropriate.

The factors identified in the matrix shall form the minimum assessment requirements to adequately determine the risk or condition of a defect. The persons assessing the defect should be able to apply two priorites based on the assessment being ‘OK’ or ‘Not OK’. This means that defects in Appendix D may be given targeted priorities based on local conditions.

Assessment is split into 3 categories. The priority should be the following: -

Assess 1	The patroller should seek immediate guidance before deciding on priority and information to be gathered. This may be the On-Call Engineer or Technical Office as appropriate.
Assess 2	The patroller should highlight this failure to the Technical Office / E&PME at the end of the patrol and submit the required information.
Assess 3	This information can remain on the walkout report and be entered into Ellipse for further action at a later date.

7 Completion of forms

The standard forms associated with maintenance activities referenced in NR/L3/ELP27237 – OLE Work Instructions shall be completed in accordance with the requirements of each particular work instruction.

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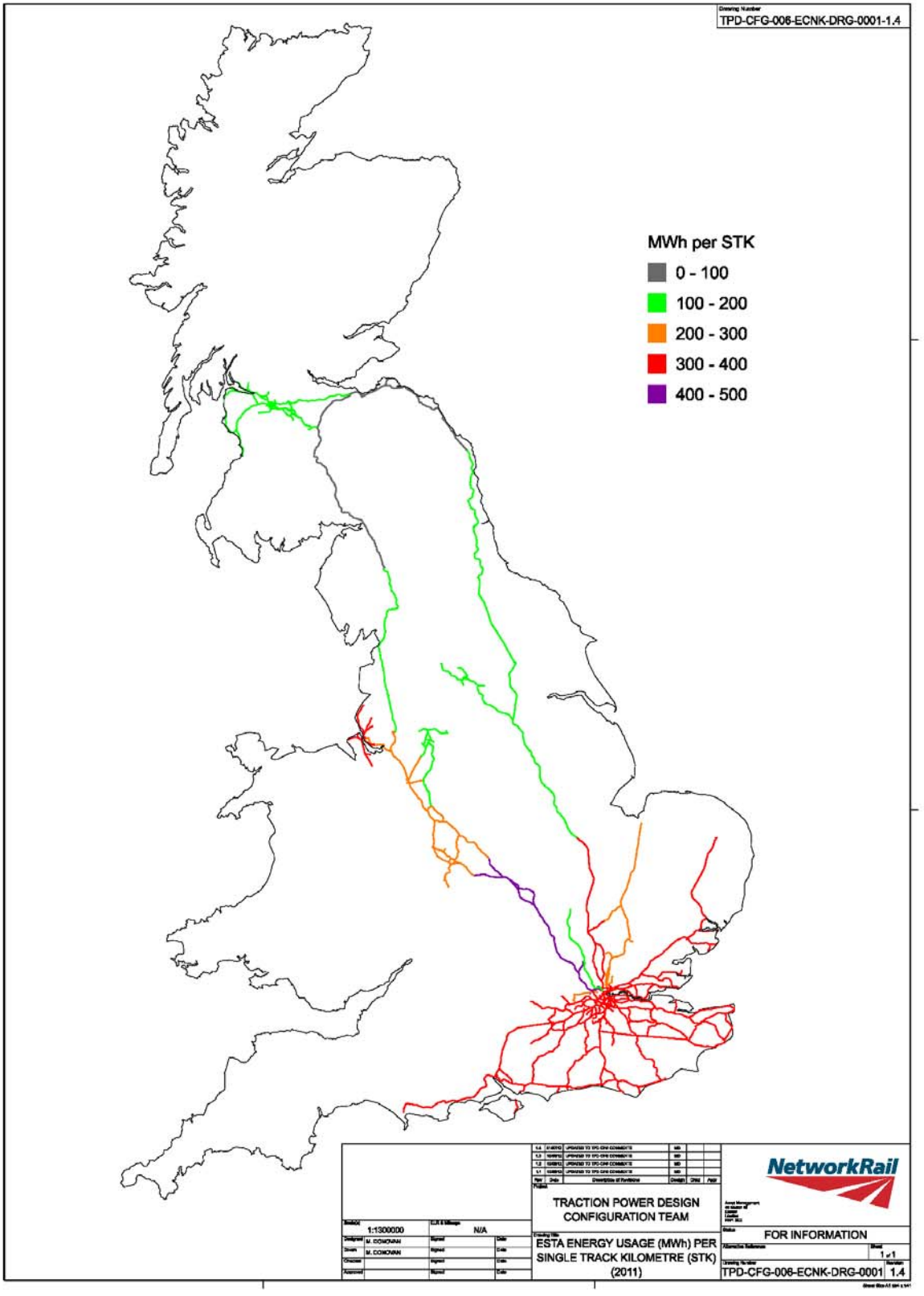
Appendix A - Electrical Map of OLE Equipment



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Appendix B – Maintenance Scheduled Tasks

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NR/L2/ELP/21087 - Risk Based Maintenance for Overhead Line Assets
Appendix B - Maintenance Frequencies and Tolerances

Type of MST	Ellipse Standard Job No.	Asset	Normal Frequency		Category	Tolerance		Inspection Type	Work Activity name	Applicable Work Instructuion(s)	Comments
M	010200	Wire Run			All			High-Level Inspection	Maintenance of OLE Wire Run	NR/OLE/B10	
M	010199	Wire Run			All	- 28/+0 of planned geometry adjustment date	Days	Measurement	OLE Geometry (Manual)	NR/OLE/B09	Not required where train-borne data is available and use is agreed with RAM
M	010203	Wire Run			All	- 28/+0 of planned geometry adjustment date	Days	Measurement	OLE Geometry (Train Borne Data)	NR/OLE/B09a	Where data available and agreed with the RAM
M	012211	Wire Run			All	- 28/+0 of planned geometry adjustment date	Days	Non-Intrusive Patrolling	Pre-Maintenance Inspection	NR/OLE/B01	
M	001444	Wire Run			All			Non-Intrusive Patrolling	Cab-Ride	NR/OLE/B07	This will primarily be a vegetation patrol
M	001445	Wire Run			All			Non-Intrusive Patrolling	Ground Level	NR/OLE/B01	Can only be extended to 13 Weeks where compliant Cab Patrolling is also carried out
M	001448	Wire Run			All			Non-Intrusive Patrolling	Ground Level - Supervisors Patrol	NR/OLE/B01	
M	004987	Wire Run	2	Years	All	3	Months	Off-Site Work	Asset Condition Assessment - 50% Desk-based Work	NR/OLE/B13	Desk-based work
M	004744	Wire Run			All			High-Level Inspection	Balance Weight Maintenance	NR/OLE/C10	
M	TBC	Wire Run	10	Years	All	1	Year	High-Level Inspection	Conductor Beam Inspections	TBC	
M	010029	Neutral Section			All			Non-Intrusive Patrolling	Ground Level Neutral Section Inspection	NR/OLE/B03	
M	010196	Neutral Section			All			High-Level Inspection	Neutral Section Maintenance - Arthur Flury - Single Rod Skidless Type	NR/OLE/C02A	
M	010196	Neutral Section			All			High-Level Inspection	Neutral Section Maintenance - Arthur Flury - Twin Rod Skidded Type	NR/OLE/C02	
M	001500	Neutral Section			All			High-Level Inspection	Neutral Section Maintenance - BICC - Ceramic Bead Skidded Type	NR/OLE/C01	
M	001500	Neutral Section			All			High-Level Inspection	Neutral Section Maintenance - BICC - Ceramic Bead Skidless Type	NR/OLE/C01	
M	001500	Neutral Section			All			High-Level Inspection	Neutral Section Maintenance - BICC - Ceramic Bead Skidless Type	NR/OLE/C01	
M	010197	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - Arthur Flury - HI25 Symettrical Type	NEW STD REQ	
M	001502	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - Arthur Flury - Standard / Overlapping skidded Type	NR/OLE/C03	
M	010030	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - BICC Symetrical	NR/OLE/C05	
M	010031	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - Brown Boveri	NR/OLE/C04	
M	010197	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - Jaques Galland	NEW STD REQ	
M	001502	Section Insulator			All			High-Level Inspection	Section Insulator Maintenance - Pre-1970	NR/OLE/C06	
M	001514	Isolator			Heavy			High-Level Inspection	Isolator Switch Maintenance (All Rotating Post Types)	NR/OLE/C07	
M	001514	Isolator			Light			High-Level Inspection	Isolator Switch Maintenance (All Rotating Post Types)	NR/OLE/C07	
M	001514	Isolator			Heavy			High-Level Inspection	Isolator Switch Maintenance (Rauscher Stoecklin)	NR/OLE/C08	
M	001514	Isolator			Light			High-Level Inspection	Isolator Switch Maintenance (Rauscher Stoecklin)	NR/OLE/C08	
M	010209	Isolator			Light			Non-Intrusive Patrolling	Isolator Switch Operational Test (All Rotating Post Types)	NR/OLE/C07	
M	010209	Isolator			Light			Non-Intrusive Patrolling	Isolator Switch Operational Test (Rauscher Stoecklin)	NR/OLE/C08	
M	010208	Signage	5	Years	All	6	Months	Non-Intrusive Patrolling	Lineside Signage Patrol	NR/OLE/B01	Patrol to investigate all lineside and off lineside signage required to comply with NR/SP/ELP/21131
M	004716	Earth	8	Weeks	All	1	Week	Off-Site Work	Inspection of Portable Earths (Depot Inspection)	NR/OLE/B15	
R	004989	Wire Run			All			High-Level Inspection	Early Life Failure Inspection	NR/OLE/B11	Required for all new assets 1 Year after installation. For >10 Wire Runs a 10% check is required, for less, a 100% check is required. Raise as Work Arising at required Timescale
R	001504	Wire Run			All			High-Level Inspection	Insulator Cleaning (Polluted/Covered Areas)	NR/OLE/B12	
R	010201	Wire Run			All			High-Level Inspection	Tunnel Inspection/Maintenance (Dry Tunnels)	NR/OLE/B12	Quantify will vary based on nameplate attribute value "NOOFTUNNEL"
R	010201	Wire Run			All			High-Level Inspection	Tunnel Inspection/Maintenance (Wet Tunnels)	NR/OLE/B12	Quantify will vary based on nameplate attribute value "NOOFTUNNEL"
R	010029	Wire Run	1	Year	All	2	Weeks	Measurement	Hard Spot Inspection	Not required	Raise as Work Arising Identified Locations only

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Appendix B - Maintenance Frequencies and Tolerances

Type of MST	Ellipse Standard Job No.	Asset	Normal Frequency		Category	Tolerance		Inspection Type	Work Activity name	Applicable Work Instructuion(s)	Comments
R	012225	Wire Run			All			Non-Intrusive Patrolling	Hot Weather Patrols	Not required	Raise as Work Arising Used for Fixed |Termination Equipment of BWA known to be out of specification.
R	004984	Wire Run			All			Non-Intrusive Patrolling	Icicle Patrol	Not required	Raise as Work Arising
R	012224	Wire Run			All			Non-Intrusive Patrolling	Nesting Patrol	Not required	Raise as Work Arising
R	001521	Structure	1	Weeks	All	1	Day	Non-Intrusive Patrolling	Inspection of Temporary Bonding Arrangements on Non-Network Rail Infrastructure (i.e. Scaffolding)	NR/OLE/B14	Raise as Work Arising
R	001521	Structure	2	Weeks				Non-Intrusive Patrolling	Inspection of Temporary Bonding / Portable Earths left in-service	NR/OLE/B14 (Section 5b)	Raise as Work Arising
R	001445	Electrical Section	1	Weeks	All	1	Day	Non-Intrusive Patrolling	Short Circuit Patrol - Single Tripping	NR/OLE/B05	Raise as Work Arising Defects to be raised as per defect matrix
R	003195	All			All	0	Weeks	Non-Intrusive Patrolling	Inspection / Analysis (Slipping Structure).	NR/OLE/B11	Raise as Work Arising 6 months to be undertaken from initial report and extended to 1 year after 2 checks.
T	001445	Electrical Section	2	Weeks	All	2	Day	Non-Intrusive Patrolling	Short Circuit Patrol - Multiple Tripping	---	Raise as Work Arising Required for all repeat trippings where cause has not been established Defects to be raised as per defect matrix
T	010198	Wire Run	2	Years	All			Non-Intrusive Patrolling	Asset Condition Assessment - 50% Check of Asset Condition	NR/OLE/B13	Desk-based work
T	010207	OLE Area	28	Days	All	3	DAys	Off-Site Work	Carry Out Short Circuit Analysis (Repeat Failure Investigation)	---	Any locations identified for futher inspection to be raised for further on-site inspection
T	010211	Wire Run			All	- 28/+0 of planned geometry adjustment date	Days	Off-Site Work	Conduct Height & Stagger Analysis	---	Analysis Pack required for final work bank.
T	010212	OLE Area	6	Months	All			Off-Site Work	Review Train-Borne Data for Exceedances	---	Exceedances identified should be reviewed using Technical Guidance Notes. All defects identified to be raised as Work Arising

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Appendix C – Defect Prioritisation Matrix

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