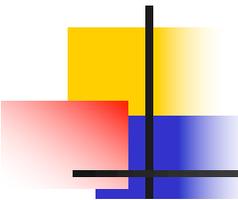


# UKOPA UpDate

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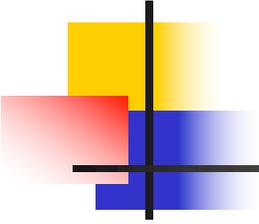
By  
Patrick Lydon  
to  
UKOPA

patl@iacsltd



# Applicable UKOPA Documents

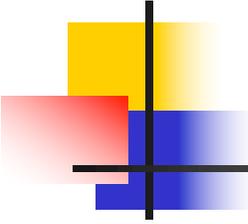
<b>Standard Number</b>	<b>Title</b>
<b>UKOPA/TBN/019 Edition 1</b>	<b>Technical Note Issues associated with overhead pipeline crossings of electrified and non-electrified railway lines</b>
<b>UKOPA /GPG/031</b>	<b>DC Stray Current Guidelines</b>
<b>UKOPA/GPG/014 Edition 1</b>	<b>Requirements for the Siting and Installation of Solar Photovoltaic (PV) Installations in the Vicinity of Buried Pipeline</b>
<b>UKOPA /GPG/036</b>	<b>Managing-developments-and-works-in-the-proximity-of-high-pressure-pipelines</b>



# Background

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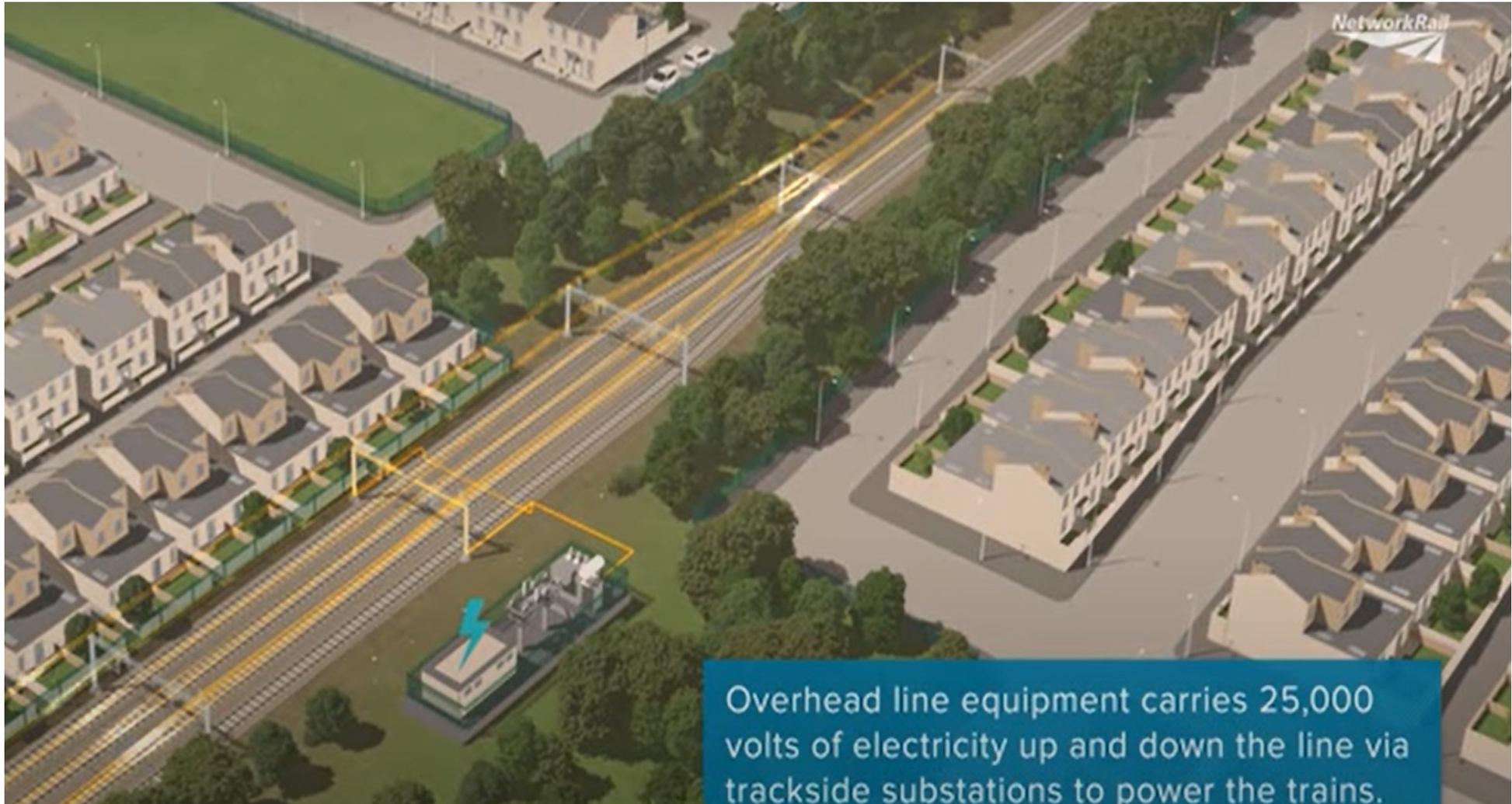
- Identify the reasons why we need a Technical Briefing Note (TBN) to cover overhead pipe crossings of rail traction systems and the issues electrification of rail traction systems can create for pipeline operators .
- Provide an update of proposed changes to UKOPA/GPG/014 on solar farms close to pipelines
- Provide an over view of UKOPA/GPG/031 on DC stray current interference
- Look at issues that need to be considered for developments near Major Accident Hazzard Pipelines (MAHP)s and do we need an Update of UKOPA/GPG/036 to reflect recent developments that seem to be occurring close to pipelines ?



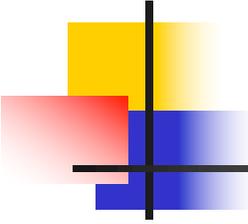
# Overhead Pipeline Crossings of Rail Lines

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# Rail Electrification



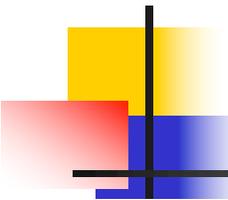
Overhead line equipment carries 25,000 volts of electricity up and down the line via trackside substations to power the trains.



## Why produce Standard for Overhead Pipe Crossings

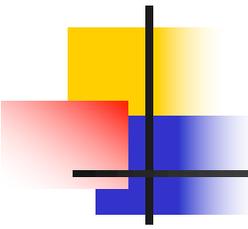
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- Network Rail has electrified a number of existing rail traction systems but also plan to reinstate some abandoned rail lines and electrify these.
- This can create issues where there are overhead pipeline crossings of rail lines and where pipelines are routed in parallel with traction systems.
- It is important to note that Network Rail have different standards in relation to touch potential risks for utilities in close proximity to rail lines to the ones that pipeline operators use.



# Applicable Standards

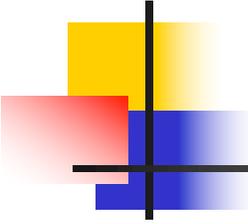
Standard Number	Title
BS EN 50122-1 :2011+A4:2017	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit. Protective provisions against electric shock
BS EN 50122-2	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit. Provisions against the effects of stray currents caused by d.c. traction systems
BS EN 50122-3	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit. Mutual Interaction of a.c. and d.c. traction systems
ENA Technical Specification 43-8 Issue 3 -2004	Overhead Line Clearances
NR/L2/ELP/21085 Issue 4	Specification Earthing and Bonding on A.C. Electrified Railways



## Understanding of Pipeline Operators Concerns

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- Pipeline operators tend to specify that there is a 3m separation distance between different earthed structures (main reason for this is lightning risks)
- Network rail require a higher separation distance of 5.2m from track centre line, as that is the distance the overhead 25kV line conductor can reach if it was to break.
- All metallic structures within this distance of the traction circuits need to be earthed



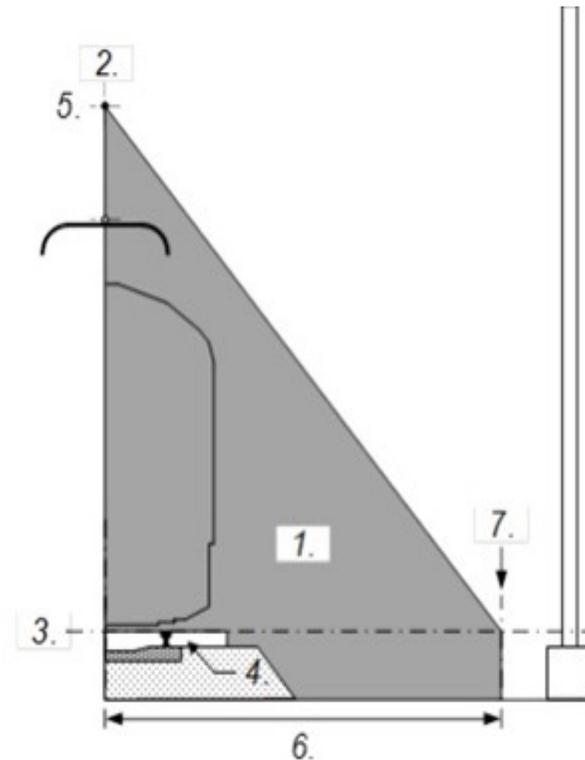
# Useful Definitions

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- Current collector zone (CCZ)-Zone whose limits are in general not exceeded by an energised collector no longer in contact with the contact line or broken collector and its fragments
- Overhead contact line (OCL) Conductor system for supplying traction units with electrical energy via current-collection equipment. NOTE This includes all current-collecting conductors and conducting rails or bars
- Overhead contact line zone (OCLZ) Zone whose limits are in general not exceeded by a broken overhead contact line.

# OCLZ

- Any pipe or pipe bridge support within OCLZ needs to be earthed.
- If pipe or pipe bridge directly connected to traction earth though the CP on the pipeline will be compromised as pipeline CP will try and protect entire rail line.
- Need to check if pipe bridge bonded to pipeline as if it is then it will drain CP current off pipeline
- Also if directly bonded to rail line the AC voltage on rail line can reach 25V and DC traction systems it is 60V.
- DC traction systems if pipeline connected direct to them they can suffer DC stray current.
- If direct connection to AC traction line AC voltage can exceed 15V safety limit for pipelines.



1. Overhead contact line zone (OCLZ)
2. Track centre line (TCL)
3. Top of rail (TOR); the cant of the track is taken into account and can be neglected
4. Protected zone within the OCLZ, below rails and within 0.8 m of rails  
[Source: Cl. 6.3.1.5, BS EN 50122-1:2011+A4:2017]
5. OCLZ parameter HP, highest point of the catenary wire or contact wire above TOR
6. OCLZ parameter X, maximum unidirectional horizontal OCLZ distance (measured from TCL at TOR)
7. Limit of OCLZ (at ground level or upper surface of deck when the railway runs over a bridge)

# Overhead Pipe Crossings

VJ coupling creates Zone 2 NE area



**IACS**

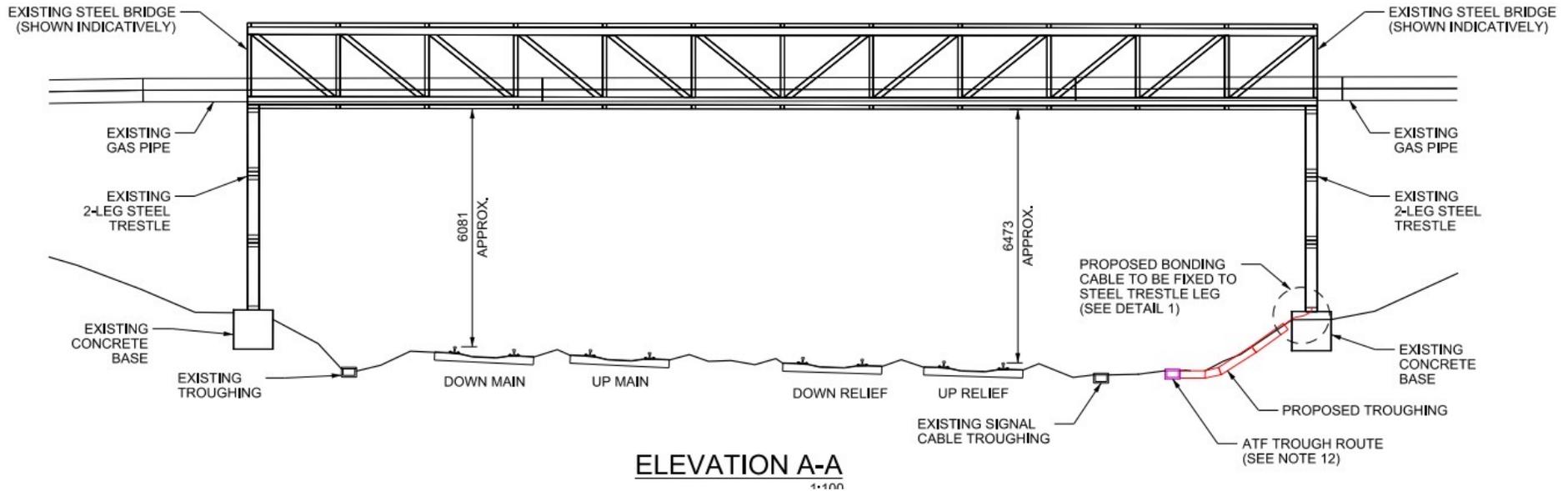
Corrosion Engineering Ltd.

# Pipeline and Pipe Bridge

- Once rail line energised the pipeline operator will not get easy access to carry out inspection and recoating operations in future.
- Also need to consider electrical continuity along pipe bridge and between pipeline and pipe bridge.
- Bolting materials may be subject to fatigue cracking and consideration should be given to relacing these.
- Risk of settlement also needs to be evaluated



# Pipe Bridge Construction



- Lightning risk assessment conducted to BS EN 62305-2, risks acceptable and no lightning protection required
- If lightning protection was installed it would reduce bridge resistance to remote earth and improve circuit protection if there was a pantograph strike

# Piling for Overhead Electrification

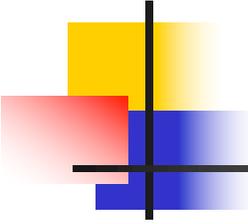
- Need to consider vibration risks on overhead and also any buried pipelines to ensure safe peak particle acceleration limits not exceeded.
- Pylons should be located 50 to 60m apart so ideally located at mid point between pipeline and rail line to ensure ground potential rise levels during pylon to earth faults don't impose high touch potentials on pipeline.
- Need to ensure that buried pipe sections running parallel to pipeline do not have increased levels of AC interference



# 39 barg Gas Line Crossing



- Bridge needs to be recoated and inspected before rail electrification.
- Continuity between pipe bridge sections and also bridge and pipeline
- Welding to line need welded not pin brazed connections to take fault current, which could be up to 12 kA
- Clearance between pipe bridge and electrification circuit
- Lightning risk assessment BS EN 62305
- Stress analysis and pipe bridge settlement risks and civil engineering assessment of embankment movement



# General Considerations

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- One of main Network Rail risks is pantograph striking pipeline and energising it to 25kV but if pipeline or pipe not effectively earthed the protective devices would not operate on the power system would not operate;
  - Ensure pipeline has a low resistance to remote earth sufficient to allow protective devices to operate.
  - Connect pipeline to rail line via a Voltage Limiting Device or VLD.
  - Note should not use VLDs on DC traction systems for pipeline bonding because of DC stray current risk. Office of Road and Rail recommendation

# Fault Current Capabilities



CLS type	1	1	1	1	2	2	2	SC
	RAY	RB Y	RBC C	RCY	RAY	RB Y	RE Y	
Working voltage	75 V AC	150 V AC	150 V DC	50 V DC	50 V DC	150 V DC	75 V AC	50 V AC
Withstand voltage	150 V AC	300 V AC	400 V DC	150 V DC	150 V DC	300 V DC	150 V AC	150 V AC
Maximum sparkover voltage	220 V AC	400 V AC	550 V DC	250 V DC	250 V DC	400 V DC	220 V AC	300 V AC
Maximum leakage current under working voltage (mA)	50	50	50	50	50	50	50	50
Short duration flow capability (A / s)	3 500 / 0,2	3 500 / 0,2	3 500 / ---	3 500 / 0,3	8 000 / 0,3	8 000 / 0,3	8 000 / ---	10 000 / 0,5
Continuous flow capability (A / 30 min)	1 000	1 000	1 000	1 000	4 000	4 000	4 000	---

AC applications

DC applications

# VLD Device



Certificate of Acceptance

PA05/05742

Manufacturer:  
Matthew C Blythe and Son Limited

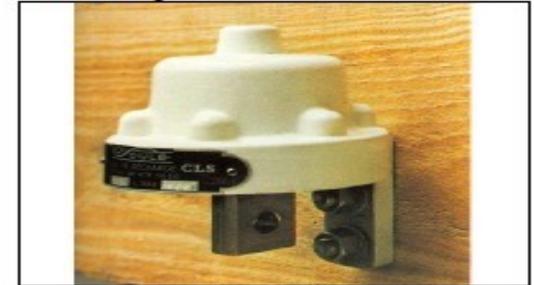
Issue : 1  
Valid From : 03/05/2013

Soule Voltage Limiting Device

### Product Description

A voltage limiting device for protecting against a rise in potential on exposed metalwork in 25kV AC OLE electrified areas.

### Product Image



### Scope of Acceptance

#### Full Acceptance

Accepted for use on all Network Rail 25kV AC OLE electrified lines where allocated as part of an approved design.

Network Rail Acceptance Panel (NRAP) hereby authorises the product above for use and trial use on railway infrastructure for which Network Rail is the Infrastructure Manager under the ROGS regulations.  
Authorised by:

PP

James Levits  
Technology Introduction Manager

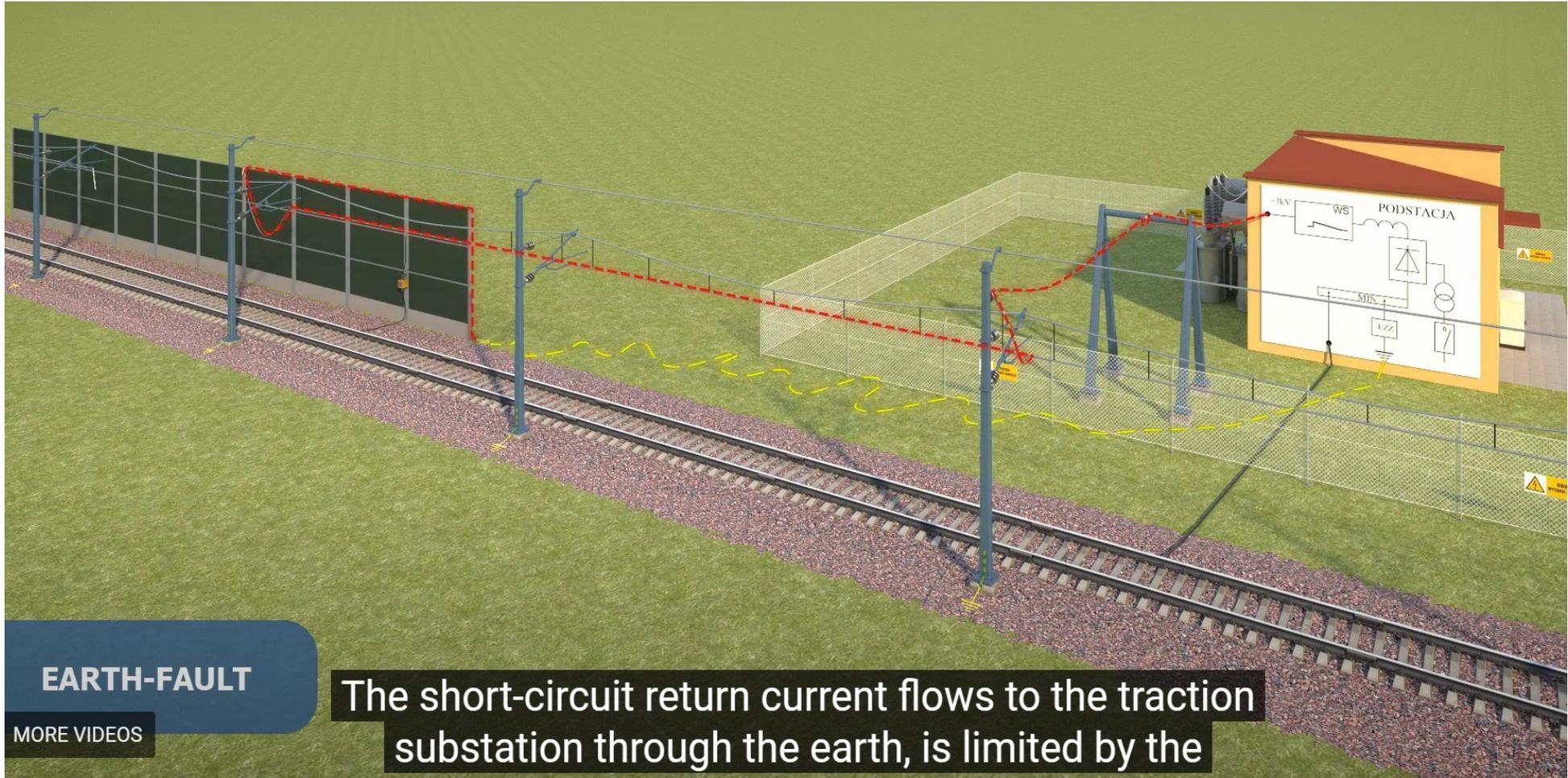
Date: 2013.05.09  
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Richard Stainton  
Professional Head

Please contact [technologyintroduction@networkrail.co.uk](mailto:technologyintroduction@networkrail.co.uk)

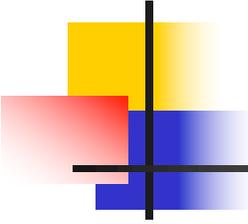
Network Rail Infrastructure Ltd Registered Office 10 Kings Place 90 York Way London N1 9AG Registered in England and Wales No. 2904507 [www.networkrail.co.uk](http://www.networkrail.co.uk)  
Version 6.1 February 2013

# VLD Operation



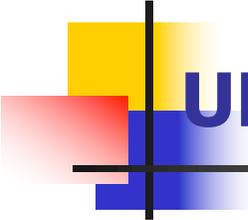
# Issues Identified

Item	Topics
1.0	Network Rail (NR) requires any third party metallic structures in vicinity of rail line to be equipotential bonded and it should be noted it can take time to get these resolved
2.0	Network Rail have specific safety requirements e.g working from height, safety helmet and overall colour, specification for work in vicinity of rail lines
3.0	Need to ensure inspection overhead pipe crossing of rail lines at a regular basis
4.0	VLD devices require specific tests and Network Rail personnel would be only ones with experience to check these out
5.0	Need to advise NR personnel that AC voltages can be present on pipelines as well since they are often now aware of that.
6.0	If putting bond cables in should be of sufficient conductor size NR use 150mm <sup>2</sup> single core Al cables to take fault current
7.0	Best practice would be to put remote monitoring device at bond location to warn of alarm situation, as rail operatives see pipework within OCLZ they have been know to bond it directly to the rail line traction return
8.0	Should agree test procedure with NR and ensure structure connection has low contact resistance use ductor tester or low resistance earth meter



# DC Stray Current

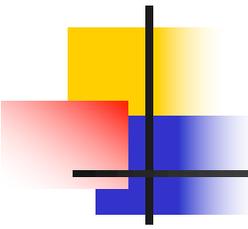
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# UKOPA/GPG/031- DC Stray Current Guidelines

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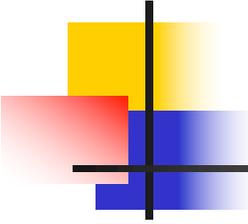
- This document issued on October 2020 includes information given in new ISO stray current standard BS EN ISO 21857-2021
  - DC interference from traction systems and assessment methods
  - HVDC power cable interference
  - DC reverse polarity and stray current from groundbeds
  - Internal stray current corrosion across I/Js
  - Corrosion caused by incorrect welding operations
  - Stray current interference testing



# UKOPA/GPG/031

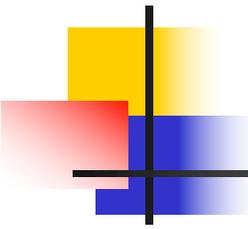
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- Will produce a presentation at the next technical conference to cover stray current issues and related topics
- Will give examples of case histories of where stray current corrosion has occurred.
- Important to look at CIP plots as they can give early evidence of stray current risks if examined by competent personnel.



# Solar Farms

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# Aspects of Installation

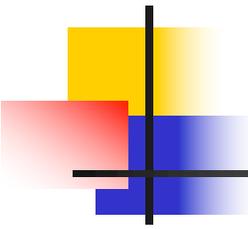
Select appropriate CP system design standards but also follow industry codes of practice and other relevant operator standards

Ascertain details of pipeline system, age, pressure, CP levels, existing stray current levels.

Confirm if pipeline if groundbeds in close proximity to solar farm

Complete CDM design risk register of CP related risks and update residual risks following construction e.g examination of ILI features in vicinity of solar farm, stray current, monitoring, touch potential

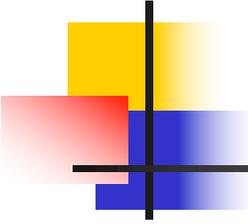
Ascertain nature of solar farm construction, electrical systems employed, developers aware of pipeline procedures and impact protection and cable crossing arrangements



# Future Topics to Discuss

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Item	Topics
1.0	HVAC cable crossings of pipelines
2.0	Location of electrical sub stations in close proximity to pipelines
3.0	Solar farm installations in close proximity to pipelines
4.0	Battery Energy Storage Systems (BESS) and the effect these can have on pipelines
5.0	HVDC or HVAC cable systems routed in close proximity to pipelines
6.0	Telecommunication systems in close proximity to pipelines
7.0	New AC traction systems in close proximity to pipelines



**End**

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