

Bury Interchange

EMC HAZID Output Report

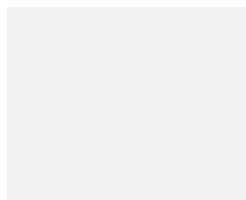
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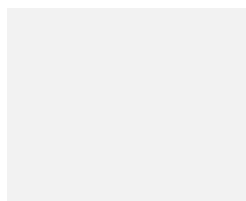
Contacts



PIOTR STENCEL
Project Manager

dd ++44 1925 800796
m ++44 7880 374340
e piotr.stencel@arcadis.com

Arcadis Consulting (UK) Limited
80 Fenchurch Street
London
EC3M 4BY
United Kingdom



GRAHAM DIVERS
E&P CRE

dd ++44 1925 843550
m ++44 7809 231646
e graham.divers@arcadis.com

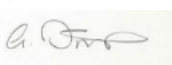
Arcadis Consulting (UK) Limited
80 Fenchurch Street
London
EC3M 4BY
United Kingdom

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Author Chukwuma Odinye 

Checker Amith Karayil 

Reviewer/Approver Graham Divers 

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This report dated 19 January 2026 has been prepared for Wilmott Dixon (the "Client") in accordance with the terms and conditions of appointment dated 19 January 2026 (the "Appointment") between the Client and **Arcadis Consulting (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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Abbreviations & Definitions

Table 1: List of Abbreviations

Abbreviation	Terminology
AC	Alternating Current
ALARP	As Low as Reasonably Possible
BS	British Standard
DC	Direct Current
E&P	Electrical & Plant
EMC	Electromagnetic Compatibility
EN	European norm
HV	High Voltage
kV	kiloVolt
LV	Low Voltage
NR	Network Rail

Definitions

Table 2: List of Definitions

Term	Definition
Risk	The likelihood or probability of an accident if expose to a hazard
Hazard	Any situation or source that has the potential to cause an accident.
Accident	An incident which causes death or injury to passengers, personnel working on the railway, or members of the public.
Incident	An event which, under different circumstances could have resulted in causing harm to people or damage to property.

References

Source	Document Title	Document Number
Ref 1	Bury Interchange EMC Control Plan	16012-ARC-BRY-ZZZ-T-EC-000002
Ref 2	Bury Interchange EMC Strategy	16012-ARC-BRY-ZZZ-T-EC-000001
Ref 3	Bury Interchange EMC Project File	16012-ARC-BRY-ZZZ-T-EC-000003
Ref 4	Bury Interchange - EMC HAZID Workshop Briefing Note	16012-ARC-BRY-ZZ-T-EC-000005

2 Introduction

2.1 Purpose of this document

This document is the EMC HAZID Output Report for the Bury Interchange EMC HAZID Workshop held on (05/12/2025) at RIBA 4. This report is to be distributed to participants and relevant discipline lead designers in the HAZID workshop, in the aim of maintaining a record of the EMC hazards applicable to Bury Interchange.

2.2 Project Scope

The HAZID brief's scope is focused on identifying and addressing potential hazards and risks associated with the EMC aspects of the Bury Interchange. It covers new infrastructure within the project's designated limits, including commercial interfaces that may be affected by EMC requirements. The HAZID brief outlines the necessity for compliance with the EMC strategy & Control Plan, ensuring that design processes and methodologies adhere to EMC directives.

It involves a systematic approach to identifying EMC-related hazards and assessing and managing risks throughout various project phases. Additionally, the brief aims to engage relevant stakeholders by distributing the document to participants and facilitating collaborative workshops to foster understanding and proactive risk mitigation.

2.3 Geographical Extents



Figure 1: Geographical View of Bury Interchange Tramstop

The geographical boundaries which are covered by this EMC HAZID consist of the following:

- Bury Interchange Tramstop approximately 9.9 miles 72 chains (15.9 km) from Manchester Victoria on the Metrolink Bury Line.

2.4 Workshop Exclusion

2.4.1 Signalling Design Scope

Hitachi is responsible for the signalling design scope. During the workshop it was verified Hitachi had yet to be fully contracted or integrated into the project team at the time of the workshop. The absence of a signalling representative meant that certain signalling-related EMC risks could not be fully discussed or resolved during the workshop.

The absence of a signalling representative meant that certain signalling-related EMC risks could not be fully discussed or resolved during the workshop. It was acknowledged that some hazard - particularly those involving signalling could only be effectively addressed once Hitachi was on board and able to participate in detailed hazard identification and mitigation planning.

All signalling-related hazards identified during the workshop would be recorded and included in the wider project hazard log. These hazards would be revisited in future sessions or additional workshops once Hitachi was fully engaged. Meeting notes and the hazard log would be shared with all stakeholders, including Hitachi and TfGM, to ensure continuity and traceability of risk management.

3 Workshop Purpose

This HAZID workshop focused on the specific changes to the EMC environment within Bury Interchange Metrolink facilities, including both phase 1 and phase 2 proposed works, and any hazard arising from changes to the EMC environment.

Note EMC risks considered as part of this HAZID exercise do not take into account CDM hazards as these will be covered by the project wide designers risk register. Therefore, there is no differentiation between Phase 1 and Phase 2 EMC risks as the Metrolink boundary for Bury Interchange is considered as one environment regardless of the construction sequence.

3.1 Bury Interchange Project Overview

Bury Interchange within Bury town centre is to undergo redevelopment to create a new Transport Interchange and ancillary infrastructure, including improved Metrolink access (temporary and permanent) and platform works ('the Metrolink Access & Platform Improvement Works'), all of which form part of an overall wider development in the location together referred to as Bury Interchange.

Five scheme objectives for the overall redevelopment of Bury Interchange have been developed as follows:

- **Carbon Neutral:** To minimise embodied carbon in construction and deliver an outcome that is carbon neutral in operation in line with local and national targets.
- **Operability:** To enhance safety and operational resilience and provide sufficient capacity to accommodate future transport services.
- **Regeneration and Economic Growth:** To contribute to regeneration and economic growth in Bury Town Centre, including facilitation of commercial development opportunities.
- **Town Centre Integration:** To improve visibility and strengthen connections between Bury Interchange and key town centre locations.
- **User experience and sustainable travel behaviour:** To facilitate an increase in travel by public transport and active modes to, from and around Bury in line with Greater Manchester's 2040 Transport Strategy Right Mix targets and meet customer requirements based on the Network Principles as defined in the Greater Manchester Transport Strategy 2040.

3.2 Discipline Specific Scope of Works

For the analysis of the electromagnetic coupling, the immunity (susceptibility) of devices under threat (victims e.g. track circuits for signalling systems) against known emitters (e.g. traction power, radiated interference sources) have been consolidated in the list of specific disciplines scope of works below based on the sensitive systems/sub-systems interfaces.

3.2.1 Mechanical & Electrical

A summary of the proposed M&E works is shown below as follows:

3.2.1.1 LV Distribution

The proposed LV distribution at Bury Interchange consists of the following:

- A new 18-way TP&N 630 A panel board
 - DB1 (Split metered L&P) serving the Tram Stop lighting & power
 - Change Over Switch (supplying DB2 and existing SER General Purpose DB)
 - Southern Access Evacuation Lift 1 primary supply via life safety Automatic Transfer Switch (ATS)
 - DB3 for Lighting and Small Power of the Southern Access Footbridge
 - Northern Access Escalator (Phase 2)
 - Northern Access Lift 2 (Phase 2)
 - Northern Access Lift 1 (Phase 2)
 - DB4 (Split metered L&P) serving the Northern Staff Accommodation (Phase 2)
 - Photovoltaic Array (Phase 2)
 - Fire Alarm PA/VA Fire Alarm Panel
 - DB5 Union Square Feeder Pillar
 - DB6 Pyramid Park Feeder Pillar
- For the sub distribution, a new 8+8-way TP&N 125 A distribution board

3.2.1.2 Photovoltaic Array

- New PV array to be installed at the Interchange Vertical Circulation Roof level

3.2.1.3 Lighting

Lighting related proposed works are listed as follows:

- New platform standalone lighting fittings – for the canopy area
- New platform 5m heavy duty flange plate mounted raise and lower lighting column
- Pyramid Park Lighting – Proposed illuminated ‘flag’ at the footbridge entrance, additional lighting for the walkway
- Union Square Lighting – Proposed illuminated ‘flag’ at the footbridge entrance, additional lighting for the walkway

3.2.1.4 Cable Management System

There are proposed additions to the existing platform canopy level cable management system., this will be carried out via a combination of high-level compartment trunking, cable tray and buried duct system. New high

level compartment trunking within platform canopy to facilitate the supply for the lighting and small power mounted on the canopy structure.

- New cable tray for the fire alarm system power supply.
- Below ground ducting and cable tray for the new submain cables
- Fully co-ordinated CMS for proposed Telecoms SISS

3.2.1.5 Fire Control System

The new fire alarm system features the following additions:

- New 4 loop addressable fire alarm panel (Fed by the proposed 18-way TP&N Panel board 'PB-1' installed within the Metrolink Electrical Plant Room (EPR)
- Interface with the proposed vertical circulation & bus interchange fire alarm system

3.2.2 Signalling

Hitachi is the lead signalling designer for the Bury Interchange works and will be responsible for ensuring the safe implementation of the signalling changes. However, the signalling interfaces with all other elements of the works, as detailed in this document, will still be subject to this workshop to ensure that potential hazards are identified and appropriately managed and/or transferred.

3.2.3 Telecoms

A summary of the proposed SISS Telecommunications Systems works is shown below as follows:

- Video Surveillance System (VSS) – replacing the existing CCTV cameras on the existing Platform canopy with new Dome CCTV cameras (on the new proposed platform canopy) to provide complete CCTV coverage of the Platform areas
- Public Address (PA) System – relocating the existing back-to-back integrated Horn PA speakers on the existing Platform canopy along with new PA Horn speakers (supported by additional PA Amplifiers) to provide complete PA coverage of the Platform areas
- Customer Information System (CIS) – existing Passenger Information Displays underneath the existing station canopies to be relocated underneath the new proposed platform canopy in addition to new multiple Passenger Information Displays along the platforms
- Passenger Emergency Call-Point – replacing the existing Call-point at the platform with new Call-points which are to be installed on posts located at the platform areas
- Emergency Voice Communication (EVC) System – new EVC Call point (Type-B Outstation) at the designated Refuge point associated with the platform area
- Third-Party Assets (Ticket Vending Machines and Smart Ticket Validators) – CAT6 cabling for any data connectivity requirement of the assets
- SISS Telecommunication Cabinets – new headend equipment to support proposed SISS Telecommunications Systems
- SISS Telecommunication Systems cabling – new CAT6/multi-pair copper cabling to support new/relocated SISS Telecommunication assets in the platform

3.2.4 OLE

The OLE scope of works involves changes to the existing OLE arrangements to accommodate the design of the Southern Access with the proposed footbridge. This also involves changes to the current anchoring

positions to align with both the buffer stop positioning and also ensuring the OLE clearances to the platform, canopies and overbridges are maintained.

For the purpose of this EMC HAZID workshop the OLE is considered to be the main source of EMI due to the EMF generated along the transmission line as well as the transients caused by the switching of the onboard rectifiers as the rolling stock draws current from the electrification system, induced coupling occurs to lineside electronic systems which may be susceptible to electromagnetic interference (EMI) and connected copper cables and other CSS systems for example.

4 HAZID Workshop Attendance check

The workshop followed the procedure outlined in the HAZID briefing note [Ref 4]. This followed an analysis of the existing Hazard Log/Interface matrix in order to discuss relevancy of specific hazards with responsible hazard owners.

Risk ranking of the hazards was not discussed during the workshop as more detail would be required from the session in order to accurately rank the hazards. An updated Hazard log has been produced and attached to this report as an appendix.

The minimum required participants are derived from the scope of works which have been outlined in section 3.1 of this report. It is to be noted; there are other key members from TfGM rolling stock specialists who were absent from this workshop. This EMC HAZID output report has been distributed to relevant personnel who were absent from the workshop. The attendance list below is a collation of the following representatives:

Table 3: EMC HAZID Workshop attendance representatives

HAZID Representative	Attendance Recorded
EMC Consultants/Specialist: Arcadis	✓
Design Engineers: • M&E: Arcadis & Futureserve • Telecoms: Arcadis • OLE: Arcadis • Fire: OFR	✓
Signalling: Hitachi	✗
Safety Representatives: Nextec Engineering	✓
Client/Stakeholder Representatives: TfGM & Willmott Dixon	✓

A full consolidated attendance list can be found in Appendix A below.

4.1 HAZID Summary

This section highlights the HAZID exercises activities and discussions that have taken place during the workshop. Section 4.1.1 summarises these discussions summarised as notes in a tabulated format, taking into account the key stages of the workshop whilst section 4.1.2 highlights all recorded specific actions and the responsible party tasked with carrying out the recorded actions. Note there are some generic EMC design-based co-ordination actions within section Table 6 which have been carried out as part of the EMC Control Plan not as a product of the EMC Workshop. These actions are included and tracked in the EMC Control Plan.

4.1.1 HAZID Meeting Notes

Table 4: EMC HAZID Workshop Meeting Notes

Item	Workshop activity Stage	Description
1) Introduction & Workshop Scope		
1.1	Introduction & Competencies	Introduction to the EMC HAZID workshop by the chairperson with a breakdown of the order of agenda as stipulated in the workshop briefing note. Team members introduced themselves and their roles, including EMP Design Engineers, Technical Directors, Project Engineers, and Safety/Telecom disciplines. Attendance was logged for record-keeping.
1.2	Workshop Purpose	Identification of reasonable and foreseeable EMC hazards in the current design option. Focus on equipment with EMC responsibilities, not benign items (e.g., cables). Establishing limits for EMC certification. Hazards to be tracked in the product log. Safety hazard identification only, not design review
1.3	Project Overview	Delivered by Arcadis PM: The project is at the RIBA Stage 3 with 90% design submission due 12th Dec. Scope includes Metrolink infrastructure, new footbridge and lift, servicing units, buffer stops, OLE structures, telecoms, lighting, drainage, canopy, and future interchange/residential plans
1.4	EMC Principles Recap	Brief explanation of Electromagnetic Compatibility (EMC): Ability of products/systems to operate satisfactorily in an electromagnetic environment. EMC hazards identification is a key focus.
2) HAZID Identification Session		
2.1	DC Traction System & Lineside Cabling	Review of the DC Traction System (OLE- Increased Traffic) as a source & Lineside Cables (Telecoms/signalling) as a victim of EMI.

		The team discussed how increased traffic on the DC traction system (OLE) could generate higher levels of electromagnetic interference (EMI), with lineside telecoms and signalling cables identified as particularly vulnerable victims due to proximity and potential long parallel runs. It was noted that future development, such as a potential third platform, could further increase EMI risk. The hazard exists now and may become more significant if additional infrastructure is introduced. It was also noted that an introduction of a third platform does not necessarily mean a change to the current headway of the bury line, which would require restructure of the existing traction power in the line to accommodate such changes. This EMC study considers all activity for Phase 1 and 2 of the Bury Interchange – Metrolink Access & Platform Improvement works, any significant change to the EMC environment requires another EMC study in which this EMC study may be used as a subsidiary. The need to confirm cable routing and separation in the technical design was highlighted, along with ongoing review as project scope or traffic levels change. Coordination with telecoms and signalling teams was advised for detailed planning. Actions & Follow-up: TfGM to provide supporting documentation for the plans for the 3rd Platform (existing layout drawings etc) [Action ID No.7]
2.2	DC traction System & Third-Party Telecommunications System	The workshop identified electrical noise generated by the DC traction (OLE) activity as a risk to third party telecommunications systems, such as analogue phone lines and GSM cell towers located near the station or railway infrastructure. Though major changes to OLE were not planned in the current phase, temporary stanchions and permanent fixings for the new interchange could elevate EMI exposure for adjacent third-party telecoms infrastructure. Actions & Follow-up: - Ensure project surveys identify all adjacent third-party telecoms infrastructure – Check Supporting documentation for third party telecoms equipment adjacent to Bury Interchange Metrolink station boundary (especially near the line) [Action ID No.8] - Notify affected third parties and facilitate discussions to mitigate any risks. - Track any issues in the EMC assessment and hazard log for future review

2.3	DC traction System & Station Fire Alarm System (FAS)	The workshop highlighted that increased traffic on the DC traction system (OLE) can generate large transient currents, particularly at pantographs and during switching operations with inverters and rectifiers. These transients are a source of electromagnetic interference (EMI) that can affect the station's fire alarm system cables. The workshop identified a possible increased traffic on the DC traction (OLE) system as a significant EMI hazard for the station fire alarm system. The team focused on physical and technical mitigations—especially cable routing, separation, and metallic segregation—to prevent false or missed fire alarms. These measures will be embedded in the design process and tracked via the hazard log. Actions & Follow-up: • Incorporate cable routing and separation requirements into the technical design documentation. • Confirm that fire alarm system cable runs comply with recommended separation and crossing angles. • Continue hazard tracking in the EMC assessment and update the hazard log as the project progresses
2.4	DC traction System & Lineside Conductors parallel to the track	The team discussed how the DC traction system (OLE) can induce higher electromagnetic fields. Lineside conductors such as long fences, handrails, and other metallic elements parallel to the tracks are susceptible to these induced currents and voltages. Review all lineside conductors' design lengths and materials in relation to proximity to OLE. Actions & Follow-up: • Confirm that earthing, bonding, and insulation measures are included in the final design documentation. • Minimize lengths and ensure clear segregation, especially in high-risk areas. • Update hazard log and coordinate with civils for closure of related actions
2.5	LV Distribution & Rail Systems Comms and Rad-Rail Systems Communications	The team discussed the potential for Low Voltage (LV) distribution circuits to interfere with rail systems communications, including Rad-Rail systems. The primary concern is that running LV power cables in close proximity to communications cables can introduce noise, leading to data corruption or degraded system performance. It was noted that, in existing platform voids, signalling and communications cables are often poorly routed, sometimes just resting loose without proper support or segregation.

		Introducing new LV distribution cables into this already congested and unstructured environment could exacerbate electromagnetic compatibility (EMC) risks. The team raised the need for surveys to assess the existing condition of communications and signalling cables, ensuring risks are fully understood before introducing new LV routes. Maintenance and design surveys should be documented to provide an accurate baseline. Actions & Follow-up: - Record the need for condition surveys of existing comms/signalling cables within the platform void areas [Action ID No.6&8] - Ensure all new LV cable routes are planned with proper segregation from comms systems. - Track the risk and mitigations in the EMC hazard log for ongoing review
2.6	LV Distribution & Station Fire Alarm Systems (FAS)	The team identified the risk of electromagnetic interference (EMI) from Low Voltage (LV) distribution cables affecting the Station Fire Alarm System (FAS). The main concern is that LV cabling, if routed near FAS circuits, can induce noise or voltage transients that may cause false alarms, missed alarms, or degraded FAS performance. Actions & Follow-up: - Incorporate segregation and separation requirements into the design and installation documentation. - Verify FAS cable runs and LV routing during site inspections and design reviews. - Log this risk and corresponding mitigations in the EMC hazard log for ongoing project tracking
2.7	LV Distribution & Station SISS	The team discussed the risk of electromagnetic interference (EMI) from Low Voltage (LV) distribution systems impacting the Station SISS (Station Information and Security Systems), which include CCTV, public address (PA) systems, customer help points, and other IP-based communication and security systems. Workshop participants confirmed that mitigations as shown in the hazard log are in place and effective for the current design. Ongoing monitoring and verification during installation are required to ensure compliance. Actions & Follow-up: Maintain strict adherence to cable routing and shielding requirements during design and installation.

		• Include all mitigations in the EMC hazard log and verify compliance during on-site reviews.
2.8	LV Distribution & Station Audio Frequency Induction Loops (AFILS)	The workshop identified the risk that LV (Low Voltage) distribution cables, if routed near station Audio Frequency Induction Loops (AFILS), could induce electromagnetic interference (EMI) through inductive and capacitive coupling or harmonic distortion. AFILS are used to support hearing-impaired passengers and are sensitive to electrical noise, which can cause service loss or degraded audio quality. The team agreed on cable segregation, shielding, and surge protection as key mitigations to ensure accessibility and safety for hearing-impaired users. These measures are to be incorporated into design, installation, and hazard tracking. Actions & Follow-up: • Verify that AFILS cable routes and LV distribution layouts maintain required separation and shielding as per EMC control plan. • Include these controls and risks in the hazard log for ongoing monitoring and review.
2.9	LV Distribution & Station Public Address (PA)	The team discussed the risk that Low Voltage (LV) distribution circuits could emit electromagnetic interference (EMI), which may adversely affect the Station Public Address (PA) system. Specifically, LV cables running in proximity to PA cabling could induce noise, causing service loss or degradation of audio quality—especially critical during emergency scenarios. The agreed mitigations include cable segregation, use of EMC-compliant equipment, and surge protection. These measures are incorporated into the design and tracked through the hazard log and installation reviews.
2.10	LV Distribution & Signalling – Signalling through circuits	The team discussed the risk that Low Voltage (LV) distribution cables could cause electromagnetic interference (EMI) to signalling through circuits, especially if LV and signalling cables are routed in close proximity or within the same trench or duct. Such interference could cause false operation of signalling systems, resulting in "long side failure" or "right side failure"—terms referring to incorrect or missed signalling events, both of which impact safety and reliability. There is uncertainty about the exact routing of existing signalling cables—whether they run within the platform or elsewhere—which makes risk assessment more challenging.

		The existing environment is described as “compromised,” with many cables simply resting in the platform void without proper support or segregation. Given uncertainties about existing cable routes, the team emphasized segregation, condition surveys, and structured cable management as key mitigations, and committed to tracking the risk in the hazard log. Actions & Follow-up: • Note the need for further investigation and surveys to clarify signalling cable routing. [Action ID No.8] • Ensure segregation and cable management principles are applied in all new works. • Track this hazard and mitigation actions in the project EMC hazard log.
2.11	3 rd Party Equipment/Operations & Railway/Station Systems	The team discussed the risk that third party equipment and operations—such as telecoms towers, landlines, and external construction or maintenance activities—could introduce electromagnetic interference (EMI) affecting railway and station systems (including signalling, communications, and safety-critical systems). Actions & Follow-up: • Document all identified third party risks and mitigations in the hazard log. • Ensure ongoing engagement with external stakeholders (e.g., telecoms providers, utility companies, contractors). [Action ID No.7] • Review compliance documentation for all equipment introduced into the station environment, including third party-supplied items.
2.12	Lift Motor Drives & Station Systems	The team identified lift motor drives—particularly those controlled via variable frequency drives (VFDs)—as potential sources of electromagnetic interference (EMI) and harmonic distortion. These drives can emit high levels of EMI that may affect sensitive station systems, including communications, signalling, CCTV, PA, and other electronic equipment. The agreed mitigations include EMI and harmonic filters, surge protection, cable segregation, and robust earthing. Manufacturer’s regulatory compliance and emissions data are to be reviewed, and all actions tracked in the EMC hazard log. Actions & Follow-up: • Confirm EMI and harmonic filter requirements with lift supplier. [Action ID No.9]

		- Record all mitigations and compliance documentation in the EMC hazard log. - Ensure surge protection and proper earthing are implemented in final design. - Ongoing risk review as design progresses and manufacturer input is received
2.13	Lift Power & Control Cables and Station Systems	The workshop identified that lift power and control cables (including those carrying signals for lift operation and communications) can act as sources of electromagnetic interference (EMI) to adjacent station systems. This risk is increased in areas where cable routes are shared or in close proximity to sensitive systems such as communications, signalling, CCTV, fire alarm, or PA circuits. Key mitigations include dedicated trays/ducts, physical separation, shielding, surge/harmonic protection, and robust earthing. Compliance and segregation are to be verified in design, installation, and hazard tracking. Actions & Follow-up: - Confirm all cable routes and CMS details in design reviews. - Verify separation and shielding during installation. - Track all identified risks and mitigations in the EMC hazard log.
2.14	Lift Control Systems & LV Distribution	The workshop identified that lift control systems, which include microprocessors and communications devices, can emit electromagnetic noise and harmonic distortion. These emissions can couple into the LV (Low Voltage) distribution system, potentially causing voltage irregularities and power quality issues for other connected systems. Key mitigations include harmonic filters, surge protection, robust earthing, and supplier compliance assurance. These actions are to be confirmed in design reviews and tracked in the EMC hazard log. Actions & Follow-up: - Confirm inclusion of harmonic filters and SPDs in the station's lift design. [Action ID No.1] - Ensure declaration of conformity from the lift supplier is reviewed as part of project assurance. - Track all risks and mitigations in the EMC hazard log and verify compliance during system commissioning

2.15	Lift Control Systems & DNO Supplies	The team discussed the electromagnetic interference (EMI) and harmonic distortion risks posed by lift control systems (especially those with variable frequency drives and motor controllers) on Distribution Network Operator (DNO) supplies. The concern is that EMI generated by the lift equipment can propagate through the LV network and affect the overall quality of the DNO supply feeding the station. The primary and secondary supplies for the lift are both derived from the main LV switchboard, without a separate backup generator due to site constraints. This approach was agreed with the project's fire consultant (OFR) and is considered acceptable for this project. A new supply is being brought in from the street at Union Square, distributed via a DNO cubicle through ducted systems to the platform and LV switch room Key mitigations include harmonic filtering, surge protection, robust earthing/bonding, and supplier compliance with EMC regulations. These measures are to be tracked through the hazard log and confirmed through design and commissioning processes. Actions & Follow-up: • Confirm inclusion of harmonic filters and SPDs in lift supply design [Action ID No.1] • Track all relevant risks and mitigations in the EMC hazard log. • Review supplier declarations of conformity as part of project acceptance.
2.16	Handheld Radios & Railway Systems	The team discussed the risk that handheld radios, used by Metrolink staff, customer service representatives, and travel safe officers, could emit radiated RF interference. This interference may affect sensitive railway systems, especially signalling, train detection, and communications equipment—potentially leading to operational delays or even safety concerns. Existing handheld radios are in use across the system; a project is underway to replace all tram-based radios, which may introduce new or changed EMC risks. The need to ensure compatibility of new radios with existing railway systems was emphasized. It was acknowledged that, as long as the same types of handheld radios are used and no changes are made, no new risks should be introduced; however, ongoing review is necessary for peace of mind and regulatory compliance Actions & Follow-up:

		• Confirm details of handheld and train-borne radios with the project engineer and ensure ongoing compatibility assessments. [Action ID No.2] • Update the EMC hazard log with any changes or findings. • Continue stakeholder coordination, especially with Operations & Maintenance (O&M) and as new systems are implemented [Action ID No.2]
2.17	Train Borne Radio Transmitters & Railway Systems	The team discussed the risk that train-borne radio transmitters could emit radiated RF interference, potentially affecting railway systems such as signalling and train detection equipment. Maloperation of these systems could result in operational delays or safety concerns for tram operations. Mitigations include strict regulatory compliance, physical protections (RF gasketing/mesh), staff training, and robust documentation. All actions and risks are to be continuously tracked in the EMC register and through ongoing coordination with operations teams. Actions & Follow-up: • Ensure all new and existing train-borne radio systems are assessed for EMC risks. [Action ID No.2] • Update and maintain records in the EMC register, including any changes or upgrades to radio systems. • Maintain an EMC register and Declaration of Conformity certificates for all equipment, ensuring traceability and evidence of compliance with regulations and standards [Action ID No.1]
2.18	Train Borne Radio Transmitters & Station Equipment	The workshop identified that train-borne radio transmitters can emit radiated RF interference, potentially impacting sensitive station equipment such as signalling, detection systems, lifts, PA, CCTV, and other electronic systems. It was highlighted ongoing coordination with Operations & Maintenance (O&M) is required, as the operator may change (currently CAM, but subject to tender in the next two years). Key mitigations include regulatory compliance, restricted zones, shielding of vulnerable equipment, staff training, and ongoing EMC documentation. These controls are to be embedded in both the design and operational phases, with continued review and coordination across project stakeholders.

2.19	Rolling Stock & Signalling Equipment	The workshop identified rolling stock (trams) as a source of electromagnetic emissions—particularly from traction equipment, pantograph contact fluctuations, and onboard radio or power electronics. These emissions can interfere with lineside and station signalling equipment. Rolling Stock Engineer Review: - The project’s principal rolling stock engineer (Neil Sewell) is to review all requirements to ensure compatibility and address any nuances specific to light rail vehicles. [Action ID No.10] Assumption of Compliance: - The workshop assumed rolling stock meets relevant EMC standards and that the focus should be on protecting the ‘victim’ (signalling equipment) within the station infrastructure. Mitigations focus on adherence to railway EMC standards, specialist engineering review, and ongoing tracking of requirements and risks. The team agreed to seek confirmation from the principal rolling stock engineer to ensure all context-specific risks are addressed.
2.20	Rolling Stock & Station Fire Alarm Systems	The workshop identified rolling stock (e.g., trams) as a source of electromagnetic emissions, especially during pulse width modulation events, braking, and traction operations. These emissions can couple into fire alarm system cabling—particularly where fire alarm loops run parallel to tracks or are routed close to the platform edge—posing a risk of interference. Agreed mitigations include careful cable routing, use of shielded and LSZH cables, design confirmation, and continuous hazard log tracking. These controls are essential for ensuring reliable fire alarm operation and overall station safety. Actions & Follow-up: Confirm the exact locations and lengths of fire alarm circuits running parallel to the track and ensure all mitigation is implemented as designed.
2.21	Rolling Stock & Lineside Equipment	The workshop identified rolling stock (trams) as a source of electromagnetic emissions, particularly from harmonics in traction currents and transients due to pantograph contact fluctuations. These emissions can affect lineside equipment, including protection and control systems, signalling power supplies, and other critical infrastructure adjacent to the tracks. Actions & Follow-up:

		• Ensure all rolling stock and lineside equipment hazards are logged and attributed for specialist review. [Action ID No.10] • The need to involve the principal rolling stock engineer in hazard reviews to confirm that all requirements and unique aspects of the light rail context are properly managed [Action ID No.10]
2.22	DNO Supplies & Telecoms, Radio base stations, Train Detection Systems & other signalling systems	The workshop discussed the risk that Distribution Network Operator (DNO) supplies could be a source of electromagnetic interference (EMI) affecting sensitive equipment such as telecoms systems, radio base stations, train detection systems, and other signalling or railway systems. The workshop confirmed that a specialist lightning protection and surge risk assessment will be undertaken by parties in the supply chain (e.g., Wilmot Dixon) to identify and mitigate risks related to DNO supplies. Provision for SPDs has been included in the design, with details (type and location) to be confirmed. Type 1 and Type 2 SPDs are being considered for railway systems; further discussion required to determine if Type 3 are also needed as the wider interchange project develops. Actions & Follow-up: • Complete a specialist lightning risk assessment and finalize SPD specifications and locations. [Action ID No.11] • Confirm all mitigations with telecoms, radio, and detection systems suppliers and designers. [Action ID No.1] • Record hazards and mitigations in the EMC hazard log for ongoing tracking and review.
2.23	Lightning Strikes & Railway Systems	The workshop identified lightning strikes as a direct and indirect source of electromagnetic interference (EMI) that can cause damage to railway systems, including critical equipment such as signalling, telecoms, train detection, and radio base stations. Lightning can induce surges and transients on both power and communication lines, resulting in equipment failure or operational delays. Current Status & Requirements: • No dedicated lightning risk assessment had been completed at the time of the workshop. [Action ID No.11] • Provisions for surge protection devices (SPDs) are included in the design; however, the actual lightning protection risk assessment and design need to be carried out by a specialist (as part of the supply chain's responsibility—e.g., Wilmot Dixon). [Action ID No.11]

		SPD types (Type 1 and Type 2 for railway systems; Type 3 for wider developments) and their locations are to be confirmed as part of the final design. The team agreed on the need for a specialist risk assessment, installation of suitable surge protection devices, and ongoing coordination with system stakeholders. All actions and risks are to be tracked in the EMC hazard log and through project design reviews.
3) HAZID Interface Matrix		
3.1	Introduction to the HAZID Interface Matrix Approach & Methodology.	The HAZID (Hazard Identification) interface matrix session focused on systematically analysing how different systems within the Bury Interchange project could act as sources or victims of electromagnetic interference (EMI). The session aimed to visually capture possible system-to-system EMC interactions, using a matrix approach to identify where hazards may arise and inform further risk assessment and mitigation planning. The interface matrix was presented as a grid, with systems listed as both possible sources (e.g., DC traction, rolling stock, LV distribution, third-party equipment, lightning, etc.) and potential victims (e.g., telecoms, signalling, fire alarm systems, SISS, lineside equipment, etc.). Interactions were marked with green ticks (where potential EMC interconnection/interference exists) and red ticks (where no significant interaction is anticipated). The session focused on a qualitative assessment, capturing foreseeable hazards for further analysis rather than assigning likelihoods or risk rankings at this stage.
3.2	Systematic Review	Each source system was reviewed against possible victim systems. The team discussed both direct and indirect EMC hazards, such as induced voltages, radiated RF interference, harmonic distortion, and surge propagation. Specific attention was given to common interfaces, e.g., DC traction as a source and lineside cables, third-party comms, fire alarms, and lineside conductors as victims.
3.3	Capturing Hazards and Actions	For each identified interface hazard, the relevant risk was recorded for inclusion in the EMC hazard log. Actions or further investigation points were noted for cases where information was incomplete or a system's configuration was yet to be finalised (e.g., outstanding lightning risk assessment, supply chain input for surge protection, confirming technical details for new radio systems).

		The interface matrix was to be used as a traceability and review tool, with cross-reference to the more detailed hazard log and risk register.										
3.4	Next Steps	Once the interface matrix is finalised, all numbered hazards are to be attributed and tracked, with unresolved items flagged for further follow-up. The matrix and associated notes will support ongoing design development, EMC compliance, and stakeholder engagement. Table 5 below summarises the outline of events during the HAZID Interface Matrix exercise. <i>Table 5: HAZID Interface Matrix Summary</i> <table><tr><th>Activity/Stage</th><th>Description</th></tr><tr><td>Matrix Introduction</td><td>Explanation of the interface matrix concept, qualitative approach, and how it supports the HAZID process.</td></tr><tr><td>System-by-System Review</td><td>Stepwise assessment of each system as a source and potential victim; flagged where EMC interaction is foreseeable.</td></tr><tr><td>Hazard Documentation</td><td>Hazards arising from interfaces logged for further review and mitigation; open actions assigned for unresolved issues.</td></tr><tr><td>Traceability & Follow-up</td><td>Interface matrix to be used alongside the hazard log for ongoing risk management, with cross-references and actions tracked throughout project stages.</td></tr></table>	Activity/Stage	Description	Matrix Introduction	Explanation of the interface matrix concept, qualitative approach, and how it supports the HAZID process.	System-by-System Review	Stepwise assessment of each system as a source and potential victim; flagged where EMC interaction is foreseeable.	Hazard Documentation	Hazards arising from interfaces logged for further review and mitigation; open actions assigned for unresolved issues.	Traceability & Follow-up	Interface matrix to be used alongside the hazard log for ongoing risk management, with cross-references and actions tracked throughout project stages.
Activity/Stage	Description											
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Hazard Documentation	Hazards arising from interfaces logged for further review and mitigation; open actions assigned for unresolved issues.											
Traceability & Follow-up	Interface matrix to be used alongside the hazard log for ongoing risk management, with cross-references and actions tracked throughout project stages.											
4) HAZID Closure/Conclusion												
4.1	Review of Findings & Actions	The workshop ended with a recap of all identified EMC hazards, actions, and mitigations discussed during the session. The team confirmed that all hazards had been logged and attributed in the hazard log for ongoing tracking and management.										
4.2	Approach to Hazard Management	It was agreed between the EMC Specialist and the project safety engineer; the EMC hazards would be referenced at high-level within the centralised project safety register.										

4.3	Close out Actions	Outstanding actions such as the completion of the lightning protection risk assessment, final confirmation of cable routing, and technical details for new or replacement systems - would be followed up and closed out as the project progresses – Refer to section 4.1.2 for the specific actions log. The findings would be summarised in a workshop report or circulated via email (as appropriate) for team and stakeholder review. Engagement with Operations & Maintenance (O&M), supply chain partners, and other stakeholders would continue to ensure all risks are managed throughout the design and implementation phases.
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4.1.2 HAZID Specific Actions Log

Table 6: EMC HAZID Workshop Specific Actions Log

Item	Action	Description	Action Owner	Status
1.	Input required in the EMC register (As per the EMC Project File Requirements) and Declaration of Conformity certificates obtained for all equipment	As a minimum, all designers from M&E, Telecoms & Signalling (once contracted) require input in the project EMC register as part of the EMC Project File to evidence compliance ensure all new equipment introduced is fit for purpose, compliant with EMC regulations, and has Declaration of Conformity.	- M&E: Arcadis, Futureserve & OFR - Telecoms: Arcadis - OLE: Arcadis	Open
2.	Obtain further details from project engineer on the existing and proposed radio systems.	TfGM has an ongoing project to replace all tram based onboard radios. Portable handheld radios used by Customer Service Representatives, Travel Safe Officers and in some cases tram drivers may also be updated. The hazard log must account for both the current radio systems and the future replacement systems, ensuring that new radio emissions do not adversely affect signalling, detection systems or new cables installed as part of this project. Timing of the roll out is currently unknown.	Lewis. C - Senior S&T Systems Engineer - TfGM	Open
3.	Keep systems included in the EMC matrix. Update interconnection arrangements for Fire Protection once design becomes available.	CCTV and PA systems are included due to their AV/IT equipment, long external cable runs and susceptibility of front-end electronics. Fire Protection systems are also included because future interconnection with other systems is expected, although the exact method is still to be confirmed. No objections were raised to these selections.	C.Odinye - EMC Specialist - Arcadis	Closed

4.	Add Bus Station EVC chargers to the consolidated EMC Hazard log as a low-risk item.	Futureserve highlighted plans for the future bus station to include electric vehicle (EV) charging infrastructure, potentially three layover chargers around 150 kW DC. This is part of the separate bus station project with its own substation and independent LV supply, not shared with Metrolink traction or station systems. Therefore: radiated EMI is unlikely to be an issue due to substation separation and conducted EMI risk is negligible due to isolated electrical infrastructure. The item is still worth noting in the hazard log for traceability and future coordination.	C.Odinye - EMC Specialist - Arcadis	Closed
5.	TfGM to distribute information on the parameters of the EMC Testing	Annual EMC Testing planned to be carried out at Bury Interchange by external party. All associated documentation shall be utilised to bolster the evidence for the Bury Interchange project.	J.Manock - Principal Systems Engineer - TfGM	Open
6	TfGM to provide supporting documentation for the plans for the 3 rd Platform (existing layout drawings etc)	Future Passive provision already in place for an additional 3 rd platform in place. Any supporting information on future plans is worth documenting in this EMC Study.	J.Manock - Principal Systems Engineer - TfGM	Open
7	TfGM to advise on existing documentation for possible third-party telecoms equipment adjacent to Bury Interchange.	EMI from OLE could induce noise into nearby sensitive third-party telecommunications circuits, leading to service disruption, degraded signal quality, or even complete loss of communication for external networks	J.Manock - Principal Systems Engineer - TfGM	Open
8	TfGM/WD to conduct/provide conditions report (or supporting documentation) for the existing platform void area CMS.	As stipulated in section 4.1.1, the current condition of the platform void is an area of concern as It was noted that, in existing platform voids, <i>“signalling and communications cables are often poorly routed, sometimes just resting loose without proper support or segregation”</i>	TfGM/WD	Open

9	M&E (non-lineside) Confirm EMI and harmonic filter requirements with lift supplier.	M&E lift design shall rely on the lift manufacturer's (e.g., Kone's) declaration of conformity with EMC standards. The supplier must demonstrate emissions are within regulation. Review emissions data and system integration at design stage; ensure compliance is documented.	M.Bryan - M&E Lead (Non-Linside)	Open
10	TfGM to distribute all Rolling Stock Hazards in the Hazard Log to the Rolling Stock Engineer.	The project's principal rolling stock engineer (Neil Sewell) is to review all requirements to ensure compatibility and address any nuances specific to light rail vehicles.	S.Owen - Metrolink Integration and Assurance Manager	Open
11	WD to confirm a lighting risk assessment study shall be undertaken in another phase	The footbridge scope as part of the M&E design does not include a Lightning Risk Assessment. During the workshop it was highlighted this is a "supply chain" item under the responsibility of WD.	M.Etherson – Wilmott Dixon – Technical Lead	Open

Appendix A. HAZID Attendance Sheet

Bury Interchange Phase 1 HAZID Workshop Attendees

Date: 05/12/2025

Venue: Microsoft Teams

Time: 09:30-12:30

Chair: Chuma Odinye

Scribe: Seyi Sanni

Name	Company	Role	Contact (Email Addressed)
Chuma Odinye	Arcadis	E&P Design Engineer	Chuma.odinye2@arcadis.com
Graham Divers	Arcadis	EMC CRE	Graham.Divers@arcadis.com
Seyi Sanni	Arcadis	E&P Engineer	seyi.sanni@arcadis.com
Joey Clark	Arcadis	M&E Lead	Joseph.Clark@arcadis.com
Souvik Banerjee	Arcadis	Telecoms Lead	souvik.banerjee@arcadis.com
Thomas Nicholas	Arcadis	OLE Lead	thomas.nicholas@arcadis.com
Piotr Stencel	Arcadis	Associate Project Manager	Piotr.Stencel@arcadis.com
Alex Littlewood	Arcadis	Design Manger	alex.littlewood@arcadis.com
Max Bryan	Futureserve	M&E Lead (Non-Linside)	mbryan@futureserv.co.uk

Jesus Gil	OFR Consultants	Fire Engineer	jesus.gil@ofrconsultants.com
Sooyash Dosonyee	Nextec Engineering	Safety Engineer	sooyash.dosonyee@nextec.engineering
Chris Lee	Nextec Engineering	Safety Engineer	chris.lee@nextec.engineering
Greg Chapman	Contractors Design Approver	Ramboll	greg.chapman@ramboll.co.uk
John Manock	TfGM	Principal Systems Engineer	john.manock@tfgm.com
Lewis Cogley	TfGM	Senior S&T Systems Engineer	lewis.cogley@tfgm.com
Alireza Hosseinkhani	TfGM	Project Engineer	alireza.hosseinkhani@tfgm.com
Sara Owen	TfGM	Metrolink Integration and Assurance Manager	sara.owen@tfgm.com
Neil Sewell	TfGM	Principal Rolling Stock Engineer	Neil.Sewell@tfgm.com
Mike Etherson	Willmott Dixon	Technical Lead	mike.etherson@willmottdixon.co.uk

Appendix B. Hazard Record

New Hazards derived from the workshop HAZID exercise are highlighted in the Hazard matrix/Log below in yellow.

RISK DEFINITION										RATING			MITIGATION			RATING			RISK MANAGEMENT	
Ref ID	Hazard Type	Hazard Owner	Source	Victim	EMC Hazard Description	Consequence	Primary Bus objective	Comments	CSM Significant?	SEVERITY	LIKELIHOOD	RISK	Mitigation Action	SEVERITY	LIKELIHOOD	RISK	Applicable Standards	Design Hazard Open/Close		
1	EMC	Transport for Greater Manchester (TIGM) Greater Manchester Combined Authority (GMCA)	DC Traction System (OLE- Increased Traffic)	Lineside Cables (Telecoms/signalling)	Any future traffic capacity improvement may increase the induction between any energised and non-energised cales. Long parallel runs increased magnetic coupling into unshielded or poorly bonded cables. Common mode noise enters via equipment I/O, power or reference conductors. Degradation of Signal to Noise ratio of radio communications	Radio Communication Disruption, Data loss or corruption & Compromised Safety Reliability	SAFETY	Potential for a 3rd platform - Currently a passive provision included as part of this project. Headroom for Bury line unlikely to change, no increased traffic. TMS to be reviewed again once third platform is constructed. This is will require a revaluation of all EMC related activities. Cable length will be kept within 90 m.(CAT6 Cu Cable)	YES	5	2	7	Increase cable segregation, use orthogonal crossings and dedicated S&T CMS especially in congested areas. Check that the EMC good practices recommended within the EMC Control Plan (16012-ARC-BRY-ZZZ-T-EC-000002) have been applied during the design and installation phases – EMC Action list within the EMC Project File . Circuit lengths must be kept to permitted limits: •Cable lengths should not exceed 1 km and Return Screen Conductor installed in cable troughs •Spacing between HV and sensitive class A & B cables as detailed in the EMC Control Plan as per BS IEC 61000-5-2 and BS EN 50174-2. •Check that the EMC good practices recommended within the EMC Control Plan (16012-ARC-BRY-ZZZ-T-EC-000002) have been applied during the design and installation phases – EMC Action list within the EMC Project File. •Ensure equipment has Declaration of Conformity EMC Certificates •Undertake specific induced voltages calculations for S&T cables longer than 1 km.	5	1	6	BS EN 50238-3:Railway applications. Compatibility between rolling stock and train detection systems - Compatibility with axle counters BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus BS EN 50121-5: Railway applications. Electromagnetic compatibility - Emission and immunity of fixed power supply installations and apparatus IEC 61643: Low-voltage surge protective devices - General Requirements and test methods BS IEC 61000-5-2: Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling BS EN 50174-2: Information technology. Cabling installation - Installation planning and practices inside buildings	CLOSED		
2	EMC	Transport for Greater Manchester (TIGM)	DC Traction System (OLE)	Third Party Telecommunications	Electrical Noise on station and neighbouring telecommunications circuits: •Analogue phone lines •GSM cell towers	Reputational Issues	PERFORMANCE	Annual EMC Baseline Testing conducted	YES	3	3	6	Cable routing to be designed to prevent excessive noise as per the recommendations of the EMC Control Plan (16012-ARC-BRY-ZZZ-T-EC-000002). Equipment must show evidence of conformity to ensure emission levels are compliant to BS EN 50121-2:2017. Avoid co-routing with third-party copper; add bonding shielding where proximity is unavoidable. Third party telecommunications towers and landlines to be identified as being at risk during surveys (RIBA 5) TIGM to liaise with the owners.	3	1	4	BS IEC 61000-5-2: Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments BS EN 50174-2: Information technology. Cabling installation - Installation planning and practices inside buildings BS EN 50121-2:2017: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world	OPEN		
3	EMC	Transport for Greater Manchester (TIGM)	DC Traction System (OLE)	Station Fire Alarm System (FAS)	Arcing generated at the pantographs of switching operations through inverters and rectifiers generate large transient currents.	False Alarms due to induced voltages/noise Missed or delayed alarms if signals are corrupted.	PERFORMANCE / SAFETY	Fire Alarm cabling to run on its own dedicated cable tray before terminating at the proposed Fire Alarm Panel within the proposed Metrolink Electrical Room 9-Way Multiduct System	YES	5	3	8	keep FAS cables out of trackside verge; cross at 90°, maintain ≥300–500 mm separation; metal segregation in shared ducts.	5	1	6	BS EN 50121-2:2017: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world	OPEN		
4	EMC	Transport for Greater Manchester (TIGM)	DC Traction System (OLE)	3 rd party radio and Police/Fire TETRA communication system	Nuisance to 3rd party telecommunications systems that are used for safety/public security purposes	Reputational Issues	PERFORMANCE / SAFETY		YES	3	4	7	Cable routing to be designed to prevent excessive noise as per the recommendations of the EMC Control Plan (16012-ARC-BRY-ZZZ-T-EC-000002). Equipment must show evidence of conformity to ensure emission levels are compliant to BS EN 50121-2:2017. Third party telecommunications towers and landlines to be identified as being at risk during surveys (RIBA 5)	3	3	6	BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments. BS EN 50121-2:2017: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world	OPEN		
5	E&B	Transport for Greater Manchester (TIGM)	DC Traction System (OLE)	Lineside Conductors (e.g. long fences)	Higher Induction levels to long (> 1km) conductors	Risk of Electric Shock	SAFETY		YES	5	4	9	E&B Design in accordance with ITS 3003 & BS EN 50122-1/2. Lengths of other conductors to be minimised as much as possible, using appropriate segregation	5	1	6	ITS 3003: Earthing & Bonding BS EN 50122-1: Fixed installations for railway applications. 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 DC traction systems BS EN 61140:Protection against electric shock. Common aspects for installation and equipment.	OPEN		

6	EMC	M&E - Bridge and Tramstop	LV Distribution	Rail Systems Comms and Rad-Rail Systems Communications	LV circuits interfere with rail system communication.	Noise in the communication system, may cause data change. However, it will not be a direct safety hazard.	PERFORMANCE	Existing cables are currently lying unsecured within the platform void, resting on the floor with no support. No surveys appear to have been undertaken to confirm their condition. This environment is already compromised from an EMC perspective.	YES	2	3	5	LV cables and communication cables are completely segregated. There are dedicated risers, cables trays with minimum separation according to BS 7671	2	2	4	BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
7	EMC	M&E - Bridge and Tramstop	LV Distribution	Station Fire Alarm System (FAS)	LV system interferes with fire alarm panels	Disrupt the signals, loss of data. Missed or delayed alarms if signals are corrupted.	PERFORMANCE / SAFETY	Fire Alarm cabling to run on its own dedicated cable tray before terminating at the proposed Fire Alarm Panel within the proposed Metrolink Electrical Room 9-Way Multiduct System	YES	5	3	8	LV cables and fire circuits are segregated. Use dry contacts / voltage free contacts. Use approved and EMC compliant products (DoC)	5	2	7	BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
8	EMC	M&E - Bridge and Tramstop	LV Distribution	Station SISS	LV system interferes with CCTV system	Loss of Service Lack of security coverage	PERFORMANCE / SAFETY	Passenger emergency call points will have a fire interface unit located in an IP-rated box positioned close to the individual PEC. From each fire interface unit, an individual cable will run back to the system	YES	5	3	8	Separation and segregation of cable routes. CCTV system is IP based, circuits surge protected. Cables are fully shielded CAT6 cable for CCTV and for IP network	5	1	6	BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environment BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments	OPEN
9	EMC	M&E - Bridge and Tramstop	LV Distribution	Station - AFILS	LV cable interfering with the hearing loop via Inductive/capacitive coupling & harmonic interference.	Affects PHP systems and Passengers with Hearing impairment using hearing aids Loss of service, noise in the systems. Safety risks: to be operational in emergency scenario	PERFORMANCE		YES	4	3	7	Separation and segregation of LV cables from the AFILS Use approved and EMC compliant products (DoC) Shielded cables where LV cables are in areas close to AFILS system.	4	2	6	BS EN IEC 60118-4: Electroacoustics. Hearing aids - Induction-loop systems for hearing aid purposes. System performance requirements	OPEN
10	EMC	M&E - Bridge and Tramstop	LV Distribution	Station-PA	LV cables may interfere with comms circuits of the PA system	Loss of service, noise in the systems. Safety risks as the PA system to be operational in emergency scenario	PERFORMANCE / SAFETY		YES	4	3	7	Separation and segregation of cable routes. PA system to be made of PADS approved equipment 2 pairs of Copper Cable for the PA System	4	2	6	BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
11	EMC	M&E - Bridge and Tramstop	LV Distribution	Signalling-Signalling through circuit cables	LV cables may interfere with Signalling circuits, in the same trench with different conduits.	False operation of Train System causing Wrong Side or Right Side Failure affecting safety and reliability. Tram Delays	SAFETY	Hitachi signalling is engaged directly by TFGM. Meeting notes will need to be shared with TFGM so that they can pass them to Hitachi. Additional workshops may be required for hazards that cannot be mitigated or designed out at this stage. Full coordination with Hitachi will be needed once their involvement increases. The team currently has no detailed information on the existing signalling circuits, but this hazard will still be included in the Hazard Log. A question was raised about whether any LV trunking or	YES	5	3	8	Provide separation and segregation between LV and signalling according to BS 50121-4	5	2	7	BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
12	EMC	3rd Party/TFGM (Transport for Greater Manchester)	3 rd Party Equipment/Operations	Railway/Station Systems	"Malfunction of the railway and station equipment due to the operation of 3rd party systems such as: - Laboratories - Power systems - Airports - etc."	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	3	3	6	Desktop study has been carried out to identify 3rd party potential sources of EMI, no 3rd party equipment has been identified Coordinate with asset owners where required. Follow EMC good practices and follow EMC standards, as set out in project EMC strategy	3	2	5	BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments. BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.	CLOSED

13	EMC	M&E - Bridge	Lift Motors Drives	Station Systems	Lifts powered by electric motors controlled by variable frequency drives (VFDs) or inverters which can generate high levels of EMI, interfering with sensitive station equipment	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	3	3	6	Ensure EMI filter is present in the motor drives to minimise conducted EMI.	3	2	5	BS EN 61000-6-3: Adjustable speed electrical power drive systems. EMC requirements and specific test methods for PDS and machine tools. BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments. BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.	OPEN
14	EMC	M&E - Bridge	Lift power & control cables	Station Systems	Power and control cables can act as an antenna, radiating EMI that can disrupt the operation of station systems, greatly impacting those in the closest vicinity.	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	3	3	6	Control and Power cables for the lift must be shielded and routed adequately as per BS 7671 & BS EN 50121-1.	3	2	5	BS 7671: Requirements for Electrical Installations. IET Wiring Regulations BS EN 50310: Telecommunications bonding networks for buildings and other structures BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus BS EN 50121-2: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world Tolerable	OPEN
15	EMC	M&E - Bridge	Lift Control Systems	LV/Distribution	The lift control system, including the micro-processors and communication devices can emit EMI noise which can potentially induce coupling into the power supply cabling, leading to harmonic distortion and voltage irregularity.	Harmonic Distortion of Power Supply Voltage Fluctuations and Transients	PERFORMANCE		YES	2	3	5	Install harmonic filters for lift supplies as well as SPDs (Surge Protection Devices) for LV distribution.	2	2	4	BS EN 61543-11: Low-voltage surge protective devices - Surge protective devices connected to low-voltage power systems. Requirements and test methods. BS EN 61000-3-12: Electromagnetic compatibility (EMC) - Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase.	OPEN
16	EMC	M&E - Bridge	Lift Control System	DNO Supplies	The VFDs (Variable Frequency Drives) in the Lift motor control can generate high levels of harmonic distortion which at a significant level can reduce the power quality of items of equipment connected to the DNO. This can lead to overheating of transformers and conductors. The Earthing and Bonding system can also be impacted by the induction of currents in the earthing system leading to the formation of ground loops, increase of touch and step voltages.	Harmonic Distortion of Power Supply Voltage Fluctuations and Transients	PERFORMANCE	Confirm and record the authority or approval basis for using the same LV source for both primary and secondary lift supplies. Ensure DNO interface and duct routes are fully documented. Assess whether any additional mitigation is needed for harmonic distortion and earthing impacts.	YES	2	3	5	The lifts must be equipped with harmonic filters to mitigate against the generation of harmonic filters. The basic EMC guidelines and separation distances as described in section 8 of the EMC Control Plan must be followed in line with BS IEC 61000-5-2, BS EN 50310 & BS EN 50174-2 & BS 7671. Where practicable, the lift control system should be supplied from a separate and dedicated power circuit to be isolated from the main DNO supply – Although it is noted this is luxury requirement.	2	2	4	BS IEC 61000-5-2: Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling BS EN 50310: Telecommunications Bonding Networks for buildings and other structures BS EN 50174-2: Information technology. Cabling installation - Installation planning and practices inside buildings BS 7671: Requirements for Electrical Installations. IET Wiring Regulations	OPEN
17	EMC	Transport for Greater Manchester (TGM)	Handheld Radios	Railway Systems	Radiated RF interference, particularly when used close to vulnerable devices	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE	Confirm whether any RF restricted zones currently exist on the system. Verify compliance with EN 50401 and include evidence in the EMC project file. Assess whether any additional RF protection (gasketing, mesh, restricted areas) is required for vulnerable cabinets.	YES	1	3	4	Determine distance from handheld radios where fields levels of BS EN 50401 are met. Compliance of Metrolink tram detection & signalling systems with EN 50121-4 Mark restricted zones; fit additional RF gasketing/mesh to vulnerable cabinets; brief staff and contractors. Measurements and tests, or alternatively documentary evidence to be provided (EMC Project File) from equipment suppliers and/or from other UK projects.	1	2	3	BS EN 50401: Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when put into service EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
18	EMC	Transport for Greater Manchester (TGM) - Rolling Stock Operator	Train borne Radio Transmitters	Railway Systems	Radiated RF interference can cause maloperation of Railway Handheld Radios, which can impact on railway systems such as signalling, Train Detection	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE	Identify O & M lead responsible for RF management on the project. Confirm whether existing RF control measures or restricted zones are in place for train-borne systems. Verify transmitter compliance with licence requirements. Update the EMC file accordingly.	YES	2	3	5	Use radio transmitters within their license requirements Mark restricted zones; fit additional RF gasketing/mesh to vulnerable cabinets; brief staff and contractors.	2	1	3	BS EN 50121-3-1: Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle BS EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
19	EMC	Transport for Greater Manchester (TGM) - Rolling Stock Operator	Train borne Radio Transmitters	Station Equipment	Radiated RF interference can cause maloperation of Railway Handheld Radios, which can impact station equipment	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	2	3	5	Maloperation of Equipment and Possible delays of TramsModerateDetermine distance from handheld radios where fields levels of BS EN 50401 are met. Compliance of Metrolink tram detection & signalling systems with EN 50121-4. Re-site sensitive equipment away from the platform edge; RF sealing; signage for separation. Measurements and tests, or alternatively documentary evidence to be provided (EMC Project File) from equipment suppliers and/or from other UK projects.	2	1	3	BS EN 50401: Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when put into service EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments. BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.	OPEN
20	EMC	Transport for Greater Manchester (TGM)	Rolling Stock	Signalling Equipment	Train interference induced onto S&T cables cause Right Side Failure of Lineside systems. Sources from the rolling stock such as traction transformers, auxiliaries & inverters/converters generate magnetic leakage, harmonics, transients and HF power supply noise.	False operation of Train System causing Wrong Side or Right Side Failure affecting safety and reliability. Tram Delays	SAFETY	Hitachi signalling is engaged directly by TFGM. Meeting notes will need to be shared with TFGM so that they can pass them to Hitachi. Additional workshops may be required for hazards that cannot be mitigated or designed out at this stage. Full coordination with Hitachi will be needed once their involvement increases.	YES	5	2	7	ModerateConfirm compliance with specific signalling design standards/specifications. Signalling system to follow immunity limits specified in BS EN 50121-4 Use of Optic Fibre for telecoms and apply EMC Good practices	5	1	6	EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus BS EN 50121-3-1: Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle BS EN 50238-3: Railway applications. Compatibility between rolling stock and train detection systems - Compatibility with axle counters	OPEN

21	EMC	Transport for Greater Manchester (TfGM)	Rolling Stock	Station Fire Alarm Systems	PWM edges and braking events radiate wideband noise; vehicle antenna/RF systems raise local field strength; Near-field H-fields inductively couple to the loop wiring along platform edge.	False Alarms due to induced voltages/noise Missed or delayed alarms if signals are corrupted.	SAFETY	Identify all locations where fire alarm circuits run parallel to the track. Confirm the length of each parallel section. Assess whether further separation or shielding measures are needed. Update EMC file and drawings accordingly.	YES	5	2	7	Keep FAS loops back-of-shelter; minimize parallelism with track; use twisted, shielded Low Smoke Zero Halogen cables; correct shield termination.	5	1	6	BS EN 50121-3-1: Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
22	EMC	Transport for Greater Manchester (TfGM)	Rolling Stock	Lineside Equipment	Train Harmonics on feed current (including transients due to pantograph contact fluctuation)	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE	Engage with Neil Sewell to validate rolling stock EMC assumptions and confirm whether any light rail specific adjustments are needed. Share all rolling stock related hazards with him for review. Update hazard records if additional nuances are identified.	YES	4	3	7	Compliance with EN 50121-3-1 and immunity below 150 kHz. Design to be performed as per BS EN 50388 section 10 (harmonics criteria) and BS EN 50317 (interaction between pantograph and overhead contact line). Apply EMC Good practices, follow the applicable standards: Improve cabinet shielding	4	2	6	EN 50121-3: Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle BS EN 50388-1: Railway Applications. Fixed installations and rolling stock. Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - General BS EN 50317: Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line BS EN 50121-5: Railway applications. Electromagnetic compatibility - Emission and immunity of fixed power supply installations and apparatus EN 50121-4: Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus	OPEN
23	EMC	Transport for Greater Manchester (TfGM)	Rolling Stock	Station Equipment	Train Harmonics on feed current (including transients due to pantograph contact fluctuation)	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	4	3	7	Compliance with EN 50121-3-1 and immunity below 150 kHz. Design to be performed as per BS EN 50388 section 10 (harmonics criteria) and BS EN 50317 (interaction between pantograph and overhead contact line). Apply EMC Good practices, follow the applicable standards.	4	2	6	EN 50121-3: Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle BS EN 50388-1: Railway Applications. Fixed installations and rolling stock. Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Generals BS EN 50317: Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line BS EN 61000-6-2: Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments. BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.	OPEN
24	EMC	Transport for Greater Manchester (TfGM)	DNO Supplies	Telecoms, Radio base stations, Train Detection Systems & other signalling systems	Excessive interference on DNO supplies causes equipment malfunction	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE		YES	2	2	4	Provide back-up power supply to most critical systems. Implement adequate maintenance processes to ensure back-up power sources will operate as required on demand (e.g. that diesel is always available for diesel generators). Ensure adequate bonding to prevent high fault current and voltages.	2	1	3	EN A EREC G5/5: Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom BS EN 61643-11: Low-voltage surge protective devices - Surge protective devices connected to low-voltage power systems. Requirements and test methods BS EN IEC 61000-3-12: Electromagnetic compatibility (EMC) - Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase	OPEN
25	EMC	Transport for Greater Manchester (TfGM)	Lightning Strikes	Railway Systems	Railway System(s) equipment damage due to lightning strikes	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE / SAFETY	Confirmed that for the railway systems within this phase of the project, only Type 1 and Type 2 SPDs are required. Type 3 SPDs will not be applicable in this scope because there are no sub boards feeding downstream areas, and the assessment is limited to railway systems only.	YES	4	2	6	Risk assessment to be performed at RIBA 4-5 stages. SPD to be installed at DB feeding critical equipment. Type 1/2 SPDs coordinated; bonded per 50122-1; route sensitive cables away from strike-prone paths; ensure shield bonding.	4	1	5	BS EN 50122-1: 2022+A1: 2025: Fixed installations for railway applications. Electrical safety, earthing and the return circuit - Protective provisions against electric shock BS EN IEC 62305-1: 2024: Protection against lightning - General principles BS EN IEC 61643-11: Low-voltage surge protective devices - Part 11: Surge protective devices connected to AC low-voltage power systems - Requirements and test methods IEC 61643-21: Low voltage surge protective devices - Surge protective devices connected to telecommunications and signalling networks. Performance requirements and testing methods	CLOSED
26	EMC	Transport for Greater Manchester (TfGM)	Bus Station EV Chargers	Tramstop Railway Systems (Metrolink Signalling, Comms, etc)	HF EMI from power electronics could couple into adjacent station system cabling or equipment (comms, signalling, etc)	Maloperation of Equipment and Possible delays of Trams	PERFORMANCE / SAFETY	Confirmed that for the railway systems within this phase of the project, only Type 1 and Type 2 SPDs are required. Type 3 SPDs will not be applicable in this scope because there are no sub boards feeding downstream areas, and the assessment is limited to railway systems only.	YES	3	3	6	Mitigation through design, no shared infrastructure/equipment. Both the Bus Station and the Tramstop have separate electrical power supplies. Physical separation from the systems is ensured.	3	1	4	BS EN IEC 61851-21-2: Electric vehicle conductive charging system - Electric vehicle requirements for conductive connection to an AC/DC supply. EMC requirements for off-board electric vehicle charging systems BS EN IEC 61000-6-4: 2019: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments	CLOSED

Arcadis Consulting (UK) Limited
80 Fenchurch Street
London
EC3M 4BY
United Kingdom
Phone: +44 207 812 2000

www.arcadis.com