

# Bury Interchange Metrolink

## EMC Project File

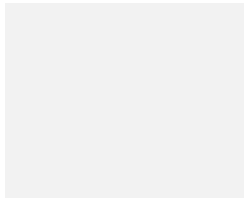
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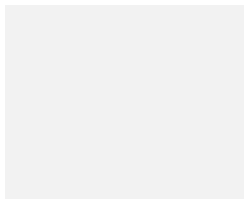
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### EMC Project File

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This report dated 27 February 2026 has been prepared for Wilmott Dixon(the "Client") in accordance with the terms and conditions of appointment dated 27 February 2026(the "Appointment") between the Client and **Arcadis (UK) Ltd** ("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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## 1 Acronyms and Abbreviations

| Abbreviation | Definition                                                       |
|--------------|------------------------------------------------------------------|
| A            | Ampere                                                           |
| Al           | Aluminium                                                        |
| AFC          | Approved for Construction                                        |
| ALARP        | As Low as Reasonably Possible                                    |
| BS EN        | British Standard European Norm                                   |
| CER          | Communications Equipment Room                                    |
| CMS          | Cable Management System                                          |
| Cu           | Copper                                                           |
| DALI         | Digital Address Lighting Interface                               |
| DNO          | Distribution Network Operator                                    |
| DoC          | Declaration of Conformity                                        |
| EMC          | Electro-Magnetic Compatibility                                   |
| EMI          | Electro-Magnetic Interference                                    |
| EVC          | Electric Vehicle Charging                                        |
| GRP          | Glass Reinforced Plastic                                         |
| IDC          | Inter Disciplinary Check                                         |
| LV           | Low Voltage                                                      |
| m            | metre                                                            |
| MEP          | Mechanical Electrification & Public Health                       |
| mm           | Millimetre                                                       |
| RIBA         | Royal Institute of British Architects                            |
| SCADA        | Supervisory Control and Data Acquisition                         |
| STP          | Shielded Twisted Pair                                            |
| SP&N         | Single Phase & Neutral                                           |
| TP&N         | Third Phase & Neutral                                            |
| ROGS         | Railways and Other Guided Transport Systems (Safety) Regulations |
| V            | Voltage                                                          |

*Table 1: List of Abbreviations*

## 2 Definitions

| Definitions                                     | Meaning                                                                                                                                                                                                                                   |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Critical Systems                                | Systems or products that, when installed, would be safety-critical or performance-affecting.                                                                                                                                              |
| Deviation / Variation                           | A departure or alternative approach from the originally specified requirement.                                                                                                                                                            |
| Engineering Deliverables                        | Designs, specifications, reports, certificates, data and other information that fulfil the requirements of the Project Engineering Requirements (CRD/RRD/DRRD).                                                                           |
| Hazard                                          | Situation with potential causes of harm or loss.                                                                                                                                                                                          |
| Manufacturer                                    | Produces any equipment.                                                                                                                                                                                                                   |
| Project Engineering Requirements (CRD/RRD/DRRD) | The Project Engineering Requirements are included as part of the Sponsors Instructions (SI) and shall be updated by the sponsor whenever the Sponsors Instruction is issued (Previously known as Project Requirements Specification PRS). |
| RIBA 3 – Spatial Co-ordination                  | Spatial co-ordination of the developed design involving architectural, structural and building services system refinement. A co-ordinated design ready for technical development.                                                         |
| RIBA 4 – Detailed Design                        | Finalised design information of the building/infrastructure buildability. Including specification, schedules and comprehensive technical detailed drawings. Complete technical information for construction and tendering.                |
| RIBA 5 – Manufacture/Construction Stage         | Following approval of the detailed design (Approved for Construction), onsite construction of the building/infrastructure. Completion of the build asset, ready for handover.                                                             |
| Risk                                            | Something that may happen in the future with an adverse effect on the Project.                                                                                                                                                            |
| Sponsor                                         | A person who acts as the single point of contact between the Client and the Project or Development Manager.                                                                                                                               |
| Supplier                                        | Any provider of engineering deliverables or functions.                                                                                                                                                                                    |

Table 2: List of Definitions

### 3 Introduction

Bury Interchange within Bury town centre is 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.

#### 3.1 Scope of Works

The scope of this project has been divided into two phases of work, phase 1 and phase 2. The extent of each phase can be identified using the temporary staircase at the north end of the platform. Phase 1 includes anything to the south (including the staircase), whilst phase 2 includes any work immediately adjacent and north of the staircase. For clarity the hoarding line in shows the separation.

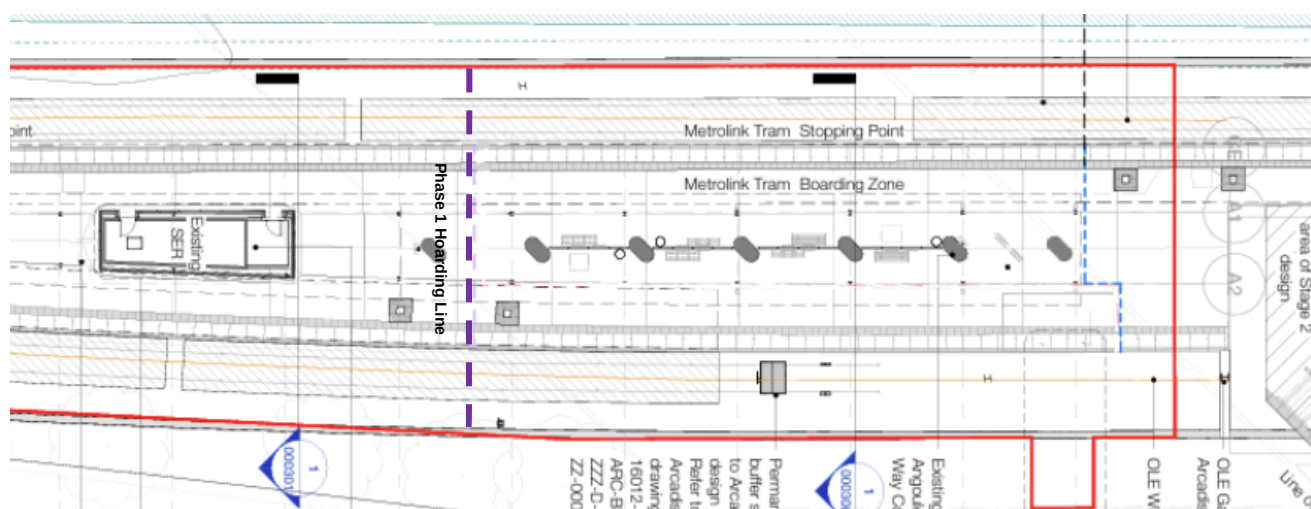


Figure 1: Phase 1 Hoarding Line

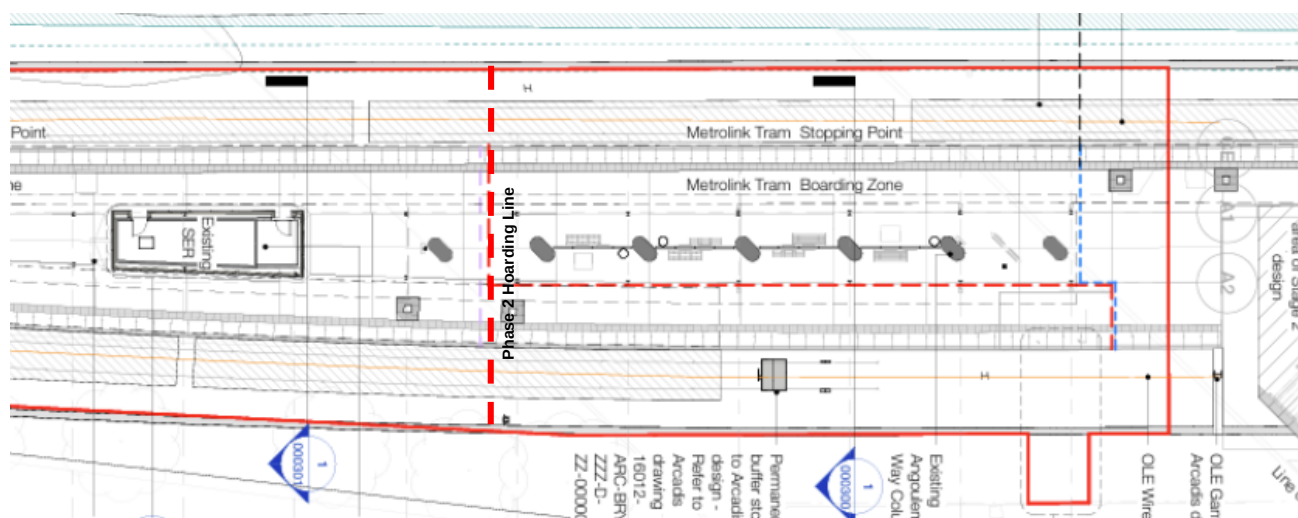


Figure 2:Phase 2 Hoarding Line

## 3.2 Purpose of Document

The purpose of this EMC project file is to provide EMC assurance for the Bury Interchange project as per the requirements of the EMC Control Plan [Ref 5]. This project file has been compiled to provide evidence of how the EMC aspects shall be assessed and maintained throughout the project life cycle. The EMC risks have been assessed, and appropriate mitigation measures have been put into place to reduce these risks to ALARP.

This EMC Project File should be read in conjunction with the EMC Control Plan as it highlights a series of requirements for Designated Project Engineers (DPEs), Designers and Contractors, in terms of managing EMC activities to deliver a safe and reliable railway and to provide the appropriate level of assurance to the following parties:

- TfGM Systems Review /Approval Panel (or equivalent)
- Statutory Bodies
- Competent Independent Persons (CIPs)

The project file is a live document that shall be kept updated from RIBA 4 and onwards until the project's completion. It ensures and demonstrates that the engineering practices for the project align with the European EMC Directive 2014/30/EU as per the auditing process specified in NR/L2/INI02009 and that the project's EMC scope has been verified against the Railways and Other Guided Transport Systems (Safety) Regulations (ROGS) risk evaluation and assessment as defined in NR/L2/RSE/100/02.

## 3.3 Scope

The scope of this EMC Project File applies to all existing and new infrastructure within the limits of the Metrolink tram stop boundary at Bury Interchange, including domestic and commercial interfaces which could be or will be affected by the EMC requirements in conjunction with this EMC Project File.

The proposed works listed below are intended to follow the detailed recommendations within the EMC Control to be best aligned with the verification/Validation exercise which each discipline must partake in to demonstrate compliance to key EMC regulation. The scope of works listed below are derived from Metrolink Access & Platform Improvement Works client requirements [Ref 2] and the RIBA 3 multidiscipline report [Ref.

1], which consists of an exhaustive list of all activities regarding the supply, installation, testing and commissioning of the following railway systems:

### **3.3.1 Mechanical & Electrical Services –**

#### **3.3.1.1 LV Distribution**

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

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

#### **3.3.1.2 Photovoltaic Array**

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

#### **3.3.1.3 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

#### **3.3.1.4 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 [Ref. 1].

- 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

### 3.3.1.5 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

### 3.3.2 Telecoms

- 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

## 4 Reference Docs

| Reference | Document Number                | Document Title                                                                        |
|-----------|--------------------------------|---------------------------------------------------------------------------------------|
| Ref. 1    | 16012-ARC-BRY-ZZZ-T-ZZ-00004   | Bury Interchange Metrolink – Multidiscipline RIBA 3 report                            |
| Ref 2     | 16012-TGM-XX-XX-CD-R-0002      | Bury Interchange – Metrolink Access & Platform Improvement Works Clients Requirements |
| Ref 3     | 16012-ARC-BRY-ZZZ-T-EP-000001. | Bury Interchange Metrolink – E&B Strategy                                             |
| Ref 4     | 16012-ARC-BRY-ZZZ-T-EC-000001. | Bury Interchange Metrolink – EMC Strategy                                             |
| Ref 5     | 16012-ARC-BRY-ZZZ-T-EC-000001. | Bury Interchange Metrolink – EMC Control Plan                                         |

Table 3: List of Reference Documents

## 5 Applicable Standards/Specifications

### 5.1 Metrolink

| Code     | Title                                                       |
|----------|-------------------------------------------------------------|
| ITS 3003 | Earthing and Bonding Infrastructure Technical Specification |

### 5.2 Applicable EMC Standards

The standards applicable to this project in line with the recommendations and guidelines provided below in table

| Code              | Title                                                                                                                                                                                                                                           | Issue Date    |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| BS EN 12016       | Electromagnetic Compatibility. Product family standard for lifts, escalators and moving walks. Immunity                                                                                                                                         | 2013          |
| BS EN 50121-1     | Railway Applications. Electromagnetic Compatibility- General                                                                                                                                                                                    | 2017          |
| BS EN 50121-2     | Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world                                                                                                                                 | 2017          |
| BS EN 50121-4     | Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus                                                                                                                  | 2016+A1:2019  |
| BS EN 50121-5     | Railway applications. Electromagnetic compatibility - Emission and immunity of fixed power supply installations and apparatus                                                                                                                   | 2017+A1:2019  |
| BS EN 55015       | limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment                                                                                                                             | 2019+A11:2020 |
| BS EN 61000-3-2   | Electromagnetic Compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase                                                                                                        | 2019+A2:2024  |
| BS EN 61000-3-3   | Electromagnetic compatibility (EMC) - Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection | 2013+A2:2021  |
| BS EN IEC 60947-1 | Low-voltage switchgear and control gear – General rules                                                                                                                                                                                         | 2021          |
| BS EN IEC 62040-2 | Uninterruptible power systems (UPS) - Electromagnetic compatibility (EMC) requirements                                                                                                                                                          | 2018          |
| BS EN IEC 62920   | Photovoltaic power generating systems. EMC requirements and test methods for power conversion equipment                                                                                                                                         | 2017+A1:2021  |
| BS EN 61547       | Equipment for general lighting purposes. EMC immunity requirements                                                                                                                                                                              | 2023          |
| BS EN 61000-6-1   | Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for residential, commercial and light-industrial environments                                                                                                        | 2019          |

|                   |                                                                                                                                                                                          |               |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| BS EN 61000-6-2   | Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments                                                                                   | 2019          |
| BS EN 61000-6-3   | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for equipment in residential environments                                                                     | 2022          |
| BS EN 61000-6-4   | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments                                                                                   | 2019          |
| BS EN 50130-4     | Alarm systems - Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder, hold up, CCTV, access control and social alarm systems.  | 2011+A1:2014  |
| BS EN 55032       | Electromagnetic compatibility of multimedia equipment. Emission requirements.                                                                                                            | 2015+A1:2020  |
| BS EN 55035       | Electromagnetic compatibility of multimedia equipment. Immunity requirements.                                                                                                            | 2017+A11:2020 |
| 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. | 2011+A1:2024  |
| BS EN IEC 61800-3 | Adjustable speed electrical power drive systems - EMC requirements and specific test methods for PDS and machine tools.                                                                  | 2023          |
| BS EN IEC 62040-2 | Uninterruptible power systems (UPS) – Electromagnetic Compatibility (EMC) requirements                                                                                                   | 2018          |
| BS 7671           | Requirements for Electrical Installations. IET Wiring Regulations                                                                                                                        | 2018/A3:2024  |

### 5.3 Network Rail Standards

| Code             | Title                                                                                                              |
|------------------|--------------------------------------------------------------------------------------------------------------------|
| NR/SIG/30040     | EMC Strategy for Network Rail                                                                                      |
| NR/L2/RSE/30041  | Electromagnetic Compatibility                                                                                      |
| NR/L2/INI02009   | Engineering Management for Projects                                                                                |
| NR/L2/RSE/100/02 | Network Rail Assurance Panel Processes: Application of the Common Safety Method for Risk Evaluation and Assessment |
| NR/L2/SIG/11201  | Signalling Design Handbook                                                                                         |

## 6 EMC Project File V&V

The project file documents all the relevant EMC activities that are undertaken/shall be undertaken up until the completion of the project. These activities are described as the following:

- **EMC Project File:** The EMC Project File will demonstrate compliance of the finished project against the requirements of The EMC Directive. It shall draw upon specific information contained within the Declarations of Conformity, test reports and test certificates for any new products and equipment being installed as part of the project and establishing that they can satisfy the EMC Compliance Framework described in the EMC Control Plan.
- **EMC Control Plan:** This document describes the management activities of the project during its life cycle including design, manufacturing, installation, testing, commissioning, testing and asset handover. The EMC Control Plan shall remain “live” until the project delivery stage and shall be updated periodically to reflect the current stage of the project.
- **The EMC Hazard Log:** This document has been presented as the table which outlines a list of all EMC related hazards which may arise based on the proposed scope of works. For each hazard there are several standards to be applied as part of the control measures.
- **The Declaration of Conformity (DOCs)** of all the proposed electrical items of equipment that are to be installed on this project.

### 6.1 EMC V - Model

The V-model presented below can be considered as an overall EMC assurance process which guarantees each step of the EMC demonstration has been comprehensively checked. This process has been implanted for the Bury Interchange project.

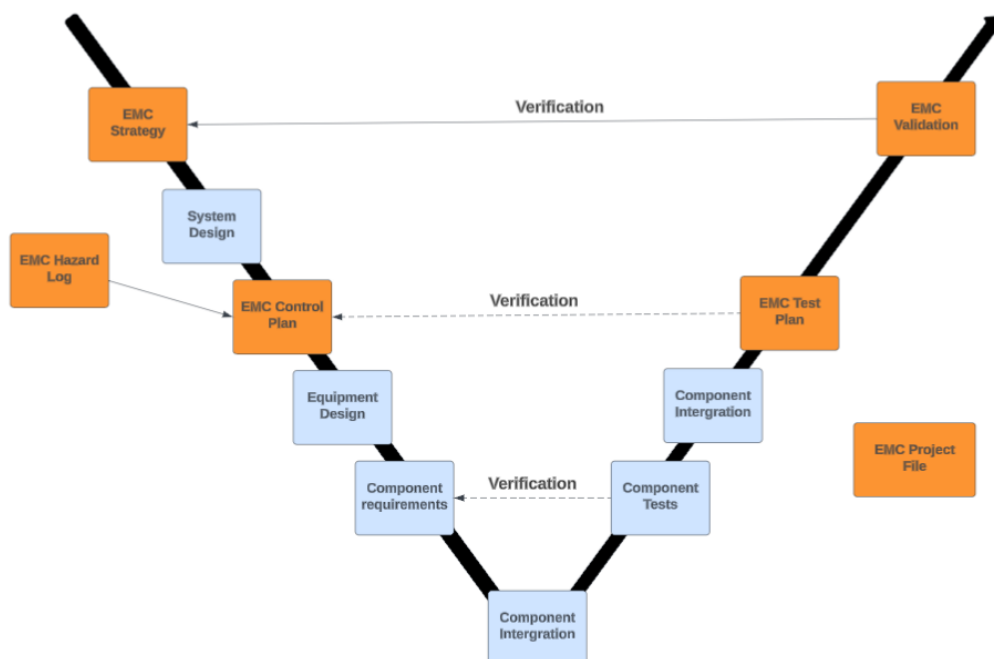


Figure 3: EMC Verification and Validation Model

**Use documentary evidence such as:**

- EMC type test certificate
- Already used somewhere else in a similar environment
- Detailed information (e.g single line diagrams, wiring details etc.)

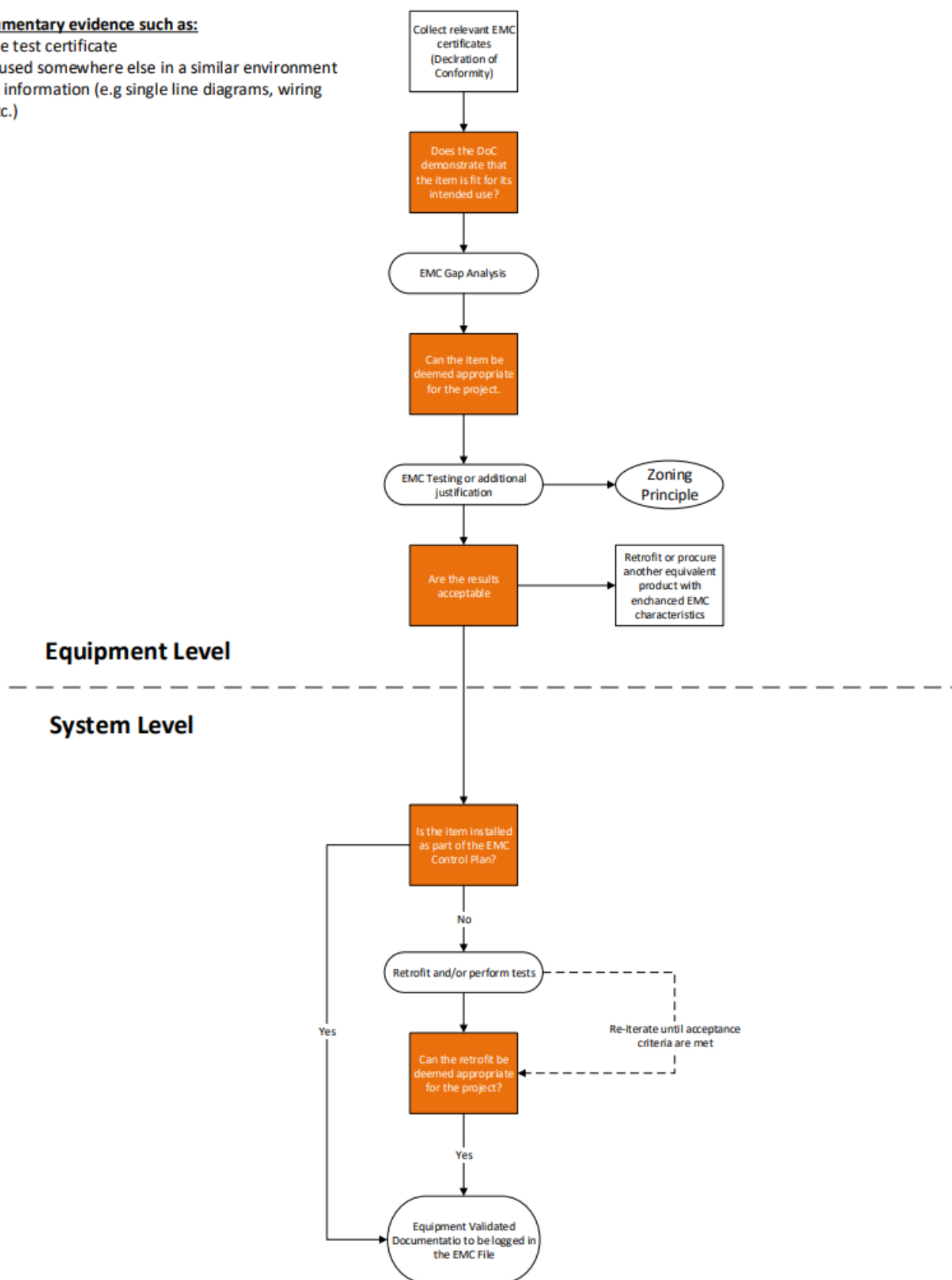


Figure 4: Equipment & System Level Validation

## 6.2 EMC Action List

The table below specifies the EMC actions that have been defined for the RIBA 4 design stage and shall be undertaken for the completion of this EMC Project File.

Table 4: RIBA 4 to RIBA 6 EMC Actions List

| Stage: RIBA 4                        | Actions from the EMC Control Plan                                                                                                                                                                                                                                                                                                                                                                       | Actions Completed/ to be completed                                                                                                                                                                                                                                                                           |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detailed Design                      |                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                              |
| 1.                                   | <p>Record compliance of all EMC related electrical systems being integrated within the Metrolink Tramstop infrastructure in an EMC Products List.</p> <p>Ensure that all procured equipment is compliant with the requirements of the EMC Control Plan.</p> <p>Ensure all evidence recorded as per the verification and validation programme to ensure EMC management is carried out appropriately.</p> | <p>Compliance of all equipment involved are recorded.</p> <p>Evidence shall be attached to this document as follows:</p> <p>Declaration of Conformity (if located)</p> <p>A table which represents the assessment to be undertaken for each individual product in terms of its installation environment.</p> |
| 3.                                   | <p>Compile and complete the EMC Project file for the RIBA 4 stage.</p> <p>Note. The EMC file is a live document and will remain so until project handover and closure of all risks identified in the EMC Hazard Log (see item 4. Below)</p>                                                                                                                                                             | <p>This document is the Project EMC File for the RIBA 4 project stage.</p>                                                                                                                                                                                                                                   |
| 4.                                   | <p>Maintain an EMC Hazard Log and formally close out all EMC hazards following the Verification and Validation programme.</p>                                                                                                                                                                                                                                                                           | <p>Update the Hazard Log &amp; EMC HAZID matrix for current project stage and attach it to this EMC File for RIBA 4 submission.</p>                                                                                                                                                                          |
| Stage: RIBA 5 - 6                    | Actions from the EMC Control Plan                                                                                                                                                                                                                                                                                                                                                                       | Actions Completed/ to be completed                                                                                                                                                                                                                                                                           |
| Construction Testing & Commissioning |                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                              |
| 5                                    | <p>Procure E&amp;P equipment to EN 50121-5 and test shortfalls, where identified by the compliance gap analysis within the EMC Product List.</p>                                                                                                                                                                                                                                                        | <p>The following evidence(s) have been attached to this document:</p> <p>Declaration of Conformity (if located)</p> <p>A table which represents the assessment to be undertaken for each individual product in terms of its installation environment</p>                                                     |

|    |                                                                                                                                                                                                               |                                                                                                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | If required, produce applicable test specifications, test plans, method statements and resultant test reports to demonstrate the EMC according to the series of standards defined in NR/SIG/30040 – (Table 2) | EMC Test Plan has not been envisaged at this stage of the project.                                                                                                                    |
| 7  | Compile EMC checks into appropriate inspection check sheets and carry out inspections and record findings.                                                                                                    | An EMC site survey shall be conducted; the findings shall be added to section 13 of this EMC file, as further evidence of EMC verification and validation of the installed system(s). |
| 8  | Maintain hazard log and formally close out all EMC hazards following the Verification and Validation programme.                                                                                               | Update the Hazard Log & EMC HAZID matrix and attach it to this EMC File.                                                                                                              |
| 9  | Define maintenance requirements within the O&M manual to ensure on-going EMC.                                                                                                                                 | Update O&M manuals as required.                                                                                                                                                       |
| 10 | Compile and complete the final Project EMC File for RIBA 5 Submission                                                                                                                                         | This document is the Project EMC File, to be updated until completion of the project.                                                                                                 |

## 7 EMC Hazards and Risk Analysis

### 7.1 EMC Hazard Log

An EMC Hazard Log has been developed, which is part of the EMC Control Plan and appended to this EMC Project File as documentary evidence of risk management.

Note, the EMC HAZID activities are separate to the project Designers Risk Assessment exercise carried out at RIBA 3 and RIBA 4 stages. However, all hazards as part of the EMC HAZID exercise shall be recorded and fully co-ordinated with risk owners to be closely monitored.

Table 5; Acceptance of EMC Hazards

| Risk Rating    |     | Assessments                                                                                                                                                                             | Actions to be completed                                                                                |
|----------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Not Applicable | N/A | Item is not present                                                                                                                                                                     | No Actions Required.                                                                                   |
| Low            | L   | It is considered that the source emissions WILL NOT exceed the recommended or guideline limits AND the source emissions WILL NOT interfere with the normal operation of the receiver.   | No Action Required.                                                                                    |
| Medium         | M   | It is considered that the source emissions MAY exceed the recommended or guideline limits AND the source emissions are UNLIKELY to interfere with the normal operation of the receiver. | The risk is to be further assessed and co-ordinated between package owners.                            |
| High           | H   | It is considered that the source emissions WILL exceed the recommended or guideline limits OR the source emissions are LIKELY to interfere with the normal operation of the receiver.   | The risk and effect is to be assessed and mitigated to reduce the interference. Add to EMC Hazard Log. |
| Not Known      |     | Awaiting Information                                                                                                                                                                    | Information to be provided by other stakeholders results from their assessments.                       |

## 8 EMC Methodology

The EMC system analysis is carried out in three parts, which are as follows:

- The EMC analysis at sub-system / apparatus level, which encompasses all equipment in the system and its EMC characteristics.
- The EMC analysis at system level, which focuses on how new equipment installed in a particular environment will impact the EMC eco-system.
- The EMC analysis at Global level which observes the relationship between other external / third party sources and items adjacent to the depot boundary.

### 8.1 Guidelines

A robust and systematic approach should be adopted to allow for rigorous, robust and fair evaluation of the EMC of the System, focusing on its ability to work to a satisfactory standard within its electromagnetic environment. A fully functional EMC system should not generate errors, malfunctions or safety risks.

### 8.2 EMC Analysis

An exhaustive list of all electrical equipment to be installed as part of the Bury Interchange upgrade works, has been provided along with the Declaration of Conformity certificates / Data sheets (where found) from the suppliers relating to the key disciplines.

As the level of documentary evidence regarding EMC compliance differs from suppliers, a method to evaluate the documentation has been developed by Arcadis; the methodology presented below applies.

#### Step 01: Selection of EMC – Relevant items of Equipment

The initial step of the analysis of items at equipment level is to identify which of these items could be of interest. This refers to which items of equipment which create sources of electromagnetic interference (EMI). For example, non-electric items such as troughs, clips, pipes, non-electrical Air conditioning equipment (other than electrical) are not related to any EMC standard and are not considered to be relevant from an EMC perspective.

#### Step 02: Level of priority for Electromagnetic Compatibility Analysis

This stage of the evaluation process aims to provide an assessment of the importance of the equipment items that are important for determining EMC compliance. If any Declarations of Conformity documentation is discovered to be non-existing, this priority level will be utilised to indicate their criticality.

Therefore, each piece of equipment that is essential to facilitate EMC is evaluated, and a priority level from 1 (highest priority, i.e. item for which appropriate EMC proof is critical) to 3 (lowest importance) will be assigned.

The priority levels have been defined considering the following criteria:

- The electromagnetic emission level that can be generated, i.e. the level of EMC pollution an item of equipment can induce to its environment.
- The electromagnetic immunity level, i.e. the sensitivity of an item of equipment withing a given EMC environment.
- The safety levels. This criterion reveals if the equipment under consideration is essential to the system's safety. In essence, it provides clarity as to what might occur should the item fail to operate under normal circumstances.

#### Step 03: Assessment of DOCs

Good practice of EMC ensures that all proposed items of equipment to be added to the system comply with the relevant EMC standards. Proof of this adherence is typically provided within the Declaration of Conformity documentation. This evaluation step is dissected into the following steps:

- **Step 03A: Evaluation of the Declaration of Conformity documentary evidence**  
 Checking the Declaration of Conformity Documentary Evidence, taking into close

Checking the Declaration of Conformity Documentary evidence, taking into close consideration the quality of said evidence. The grading criteria can be seen below in Table 6.

Table 6: EMC Documentary Evidence Score

| Available EMC Documentary Evidence                   | Risk – Associated |
|------------------------------------------------------|-------------------|
| EMC Certificate obtained from equipment manufacturer | 0-2               |
| EMC standards quoted in the item datasheet`          | 3-4               |
| No EMC certification available                       | 5                 |

## Step 02: EMC Gap Analysis

Performing an EMC gap analysis in the event the documentary evidence provides insufficient EMC evidence. This analysis consists of a comparison between documentary evidence from the suppliers and the list of generic/product standards as stated in section 5 of this report.

The grading criterion in for the EMC Gap Analysis ranges form 0-5, where 5/6 represents the worst score and 0 is the highest, respectively. As mentioned previously, in the event where the suppliers/manufacturers existing certificates do not demonstrate adequate levels of compliance with the requirements specified herein, the score (i.e., risk level) will be high. On the contrary, if the compliance with the relevant standards can be demonstrated, the score will be low.

It is important to note whilst a PADS certificate provides “grandfather rights” for some equipment, this is not a direct equivalent of a manufacturer EMC certificate as traceability concerns become apparent. The PADS certification has its limitations where legacy items of equipment were approved under previous standards which may be non-compliant to current EMC requirements but are still in use under grandfather rights. This leaves uncertainty in environments where legacy equipment is installed in the vicinity of newer compliant systems.

As per clause 8 of NR/L2/RSE/30041, where this risk is identified the verification process shall be applied to close out residual risks on a case-by-case basis.

Table 7: EMC Gap Analysis Criteria

| EMC Gap Analysis                                                                                                     | Risk – Gap Analysis |
|----------------------------------------------------------------------------------------------------------------------|---------------------|
| Declaration of Conformity Certificate. All EMC standards quoted in the EMC Control Plan are also present in the DoC. | 0                   |

|                                                                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| TfGM Approved Item                                                                                                                                       | 1-2 |
| Conformity to at least one EMC standard (Preference given to BS EN 50121 based on the priority and proximity of the item following the zoning principle. | 2-3 |
| The item is only stated as being compliant with the EMC European Directive 2004/108/EC                                                                   | 4-5 |
| No EMC certification available (Note: To be left open on hazard log until a suitable alternative is provided)                                            | 6   |

### **Making a sum of both steps 03A and 03B criteria**

Summing both parameters defined in section **03-01** and **03-02** above, a score ranging from 0 (Low) to 10 (High) is assigned to assess the quality of the EMC Documentary evidence of each item of equipment. This exercise helps to establish the level of confidence in the EMC certificates to determine how trustworthy it is. For this assessment, a score below 5 is an acceptable threshold.

## **8.2.1 EMC Assessment at System Level**

It is imperative that each item of equipment to be installed is examined based on its proximity to other nearby sensitive equipment such as Comms and LV equipment. Each individual location has been assessed to evaluate their electromagnetic environment with the application of the EMC Zoning principle as mentioned in the EMC Control Plan [Ref 5]. The analysis conducted at system level takes into account the following input data:

- Equipment Layout drawings produced by key priority disciplines as highlighted by the EMC Control Plan
- Any EMC focused site visits
- Baseline testing results conducted prior to installation of equipment.
- Items which are located closest to the track centre line (within 3m as depicted in Figure 4 below) shall be considered to be within a heavy industrial EMC environment.

Items which are located closest to the track centre line (within 3m as depicted below) shall be considered to be within a heavy industrial EMC environment.

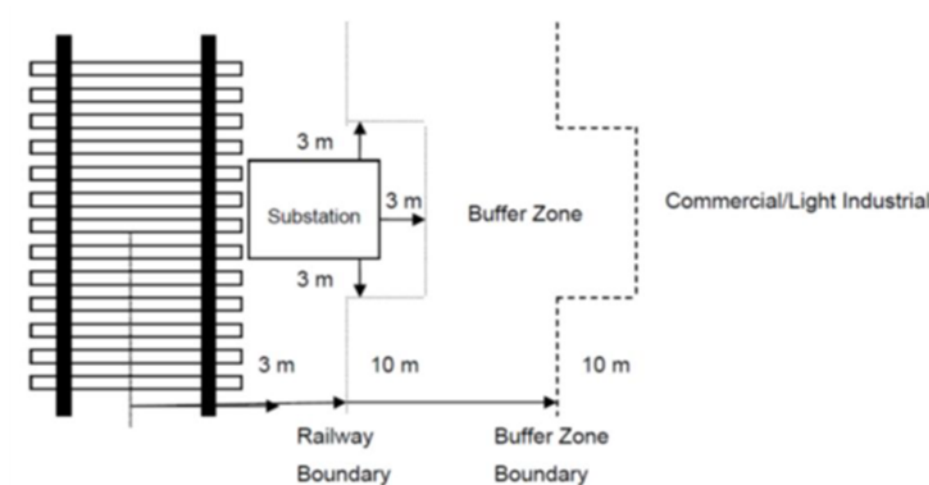


Figure 5: EMC Zoning Principle - NR/L2/RSE/30041

In a similar fashion to the gap analysis, a grading criterion is utilised for the equipment located within the site boundaries. A score from 1 (lowest) to 10 (highest) is given based on the level of threat which the equipment is susceptible to. Items in the vicinity which does not pose any EMC risk will be represented by a low score. On the contrary, an area which poses a high-level EMC risk will be presented with a higher score. The risk grading below has been developed by using the EMC Zoning principles as per clause 14 of NR/L2/RSE/30041.

Table 8: EMC Zoning Analysis Scores

| Distance to the track centre line (both horizontally and radially) | Risk |
|--------------------------------------------------------------------|------|
| Less than 3 m 10                                                   | 10   |
| Between 3 m and 10 m                                               | 7-9  |
| Between 10 m and 20 m                                              | 5-6  |
| Between 20 m and 50 m                                              | 3-4  |
| More than 50 m                                                     | 1-2  |
| Not Applicable (Item is deemed appropriate for the project)        | 0    |

#### **Proximity between equipment:**

A summary of all systems and subsystems can be found on this project have been documented within the EMC HAZID matrix [Appendix B].

This is the primary step to assess the electromagnetic environment of each item in the of sources and victims, analysing their location and their proximity to other systems. For a given location, the more sub-systems in the vicinity, the higher the perceived risk. Mitigative actions must be applied as part of the risk management to control these risks.

The key recommendations for this site survey (if required) are as follows:

- Provide general photos of the environment where the systems are to be installed
- Provide photos that show the distance to the railway system, and proximity to the DC traction system.
- Provide some photos of the cable management systems (cable troughs, cable trays) taking into account examples of how the cables have been installed (cables entry into modules, segregation between HV, traction and LV/S&T cables)

## **8.2.2 EMC Assessment – Global / Third Party**

The EMC analysis at a global level observes sources which might cause background electromagnetic incompatibility. The most efficient method is by conducting a survey of the established boundary which contain sensitive receivers which require protection; however, a desktop study of the site can be conducted as a method of the identification of sensitive sources and receivers.

The following information are determined from desktop studies.

- Name & Address of sensitive emitters and receivers
- Geographic Co-ordinates
- Distance from nearest track/substation fence.

## **8.3 EMC Register**

The EMC register is a live document, that is to be updated as the design progresses through the RIBA 5 project stage. Efforts to capture the DoCs, PADS and/or Metrolink Approved equipment used on the project are to continue in conjunction with the contractor as more information comes to light.

The majority of the equipment still deemed high risk on the register is low priority equipment – non-safety critical, for the most part like-for-like replacements, and products selected with designer's knowledge of their suitability for use of the railways from prior use and projects.

## 9 Compliance to Earthing & Bonding Requirements

| Item No. | E&B Strategy Section Reference | Recommendation/Good Practices                                                                                                                                                                                                                                                                                                                                   | Actions Completed                                                                                                                                                                                                                                                                                                                                          |
|----------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | 5.2                            | Ensure there is appropriate segregation between DC traction and any other earthing systems. Where equipotential bonding between traction bonded equipment and LV equipment (subject to OCLZ proximity assessment) a VLD shall be utilised in compliance with BS EN 50122-1 and ITS 3003.                                                                        | A proposed VLD has been incorporated within the Tramstop earthing design to facilitate between traction and station earth.                                                                                                                                                                                                                                 |
| 2        | 6.4                            | Platform infrastructure CBCs are to be suitably dimensioned (CSA and length) as according to the traction fault current.                                                                                                                                                                                                                                        | CBC sizing and length has been verified by the M&E design. Minimum CSA shall be sized as per clause 6.6 of the Earthing & Bonding Strategy - 16012-ARC-BRY-ZZZ-T-EP-000001.                                                                                                                                                                                |
| 3        | 6.5                            | Ensure Surge Protection Devices (SPDs) are installed in LV distribution, section boards and mains distribution panel, to mitigate against voltage transients which can lead to high-frequency EMI emissions                                                                                                                                                     | As part of the LV distribution, there is adequate surge protection for the 'PB-1' 18-Way TP&N Panel Board located in the proposed Metrolink Electrical Plant Room (See Platform LV Schematic 16012-ARC-BRY-PFM-D-EE-000001 – As well as the TfGM Main LV Switchboard within the Electrical Switch Room ( See LV Schematic – 16012-FUT-BU0-ZZZ-D-BV-106000) |
| 4        | 6.6.3.                         | Where fencing/handrails is to be installed and is in the OCLZ or 2.75m (following OCLZ clearance assessment from traction bonded equipment , the length shall not exceed 1km to mitigate the risk of induced voltages and shall be connected to the traction return at one single point, to prevent the risk of circulating traction currents within the fence. | There are no risks of induced voltages through long sections of fencing within the OCLZ. No fencing exceeds the small conductive parts.                                                                                                                                                                                                                    |

## 10 Compliance to the EMC Control Plan

The aim of this section is to highlight the requirements from the EMC Control Plan and provide sufficient evidence the actions stipulated in the EMC Control Plan have been carried out to mitigate against EMI sources.

Table 9: Compliance to the requirements in the EMC Control Plan

| Item No.         | Recommendation/Good Practices                                                                                                                                                                                                  | Actions Completed                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|-----------|-----------------------|---------------|-------------------|-----------------|-------------------|------------------|------------------------|---------------|-------------------|--------------|------------------------------------|
| 1                | All new equipment procured for use within the boundaries of the applied railway shall be procured with consideration to the EMC standard framework presented in the EMC Zoning principles.                                     | <p>See section 8.2.1 of this EMC project file for the system level analysis. The construction contractor shall apply the zoning principles (as per the EMC Control Plan) when performing equipment/installation assessments.</p> <p>Note at this stage, an EMC register has been developed with only the available information at the time of writing. As further information becomes available in the next project stages, the EMC register shall be updated accordingly.</p>               |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| 2                | Confirmation of compliance with the requirements to the respective scope of works concerning EMC, will be sought from the nominated CREs responsible for installing new assets on the railway.                                 | <p>The nominated CREs are as follows:</p> <table><tr><th>Name</th><th>Function</th></tr><tr><td>Max Bryan</td><td>M&amp;E CRE (Futureserve)</td></tr><tr><td>Graham Divers</td><td>E&amp;P CRE (Arcadis)</td></tr><tr><td>Thomas Nicholas</td><td>OLE CRE (Arcadis)</td></tr><tr><td>Dominic Osbourne</td><td>Telecoms CRE (Arcadis)</td></tr><tr><td>Phillip Lodge</td><td>M&amp;E CRE (Arcadis)</td></tr><tr><td>Martin Smart</td><td>Project Design Authority (Hitachi)</td></tr></table> | Name | Function | Max Bryan | M&E CRE (Futureserve) | Graham Divers | E&P CRE (Arcadis) | Thomas Nicholas | OLE CRE (Arcadis) | Dominic Osbourne | Telecoms CRE (Arcadis) | Phillip Lodge | M&E CRE (Arcadis) | Martin Smart | Project Design Authority (Hitachi) |
| Name             | Function                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Max Bryan        | M&E CRE (Futureserve)                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Graham Divers    | E&P CRE (Arcadis)                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Thomas Nicholas  | OLE CRE (Arcadis)                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Dominic Osbourne | Telecoms CRE (Arcadis)                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Phillip Lodge    | M&E CRE (Arcadis)                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| Martin Smart     | Project Design Authority (Hitachi)                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |
| 3                | Cable route layouts shall be designed in accordance with relevant standards, ensuring adequate segregation and separation of sensitive and/or safety critical cabling (e.g signalling and comms) from potential sources of EMI | <p>The EMC Control Plan details the required parameters for installation and cable termination to facilitate a controlled EMC environment.</p> <p>Post construction, these guidelines shall be examined as part of the post construction survey.</p>                                                                                                                                                                                                                                         |      |          |           |                       |               |                   |                 |                   |                  |                        |               |                   |              |                                    |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                               |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | Undertake an EMC Hazard analysis for the RIBA 4 design stage and maintain a live version to ensure all hazards are closed out until post construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | EMC Hazard Matrix added to the EMC Control Plan<br><br>EMC HAZID workshop has been planned for and shall be undertaken at the RIBA 4 stage.                                                                                                                                                                                                   |
| 5 | Apply the zoning principle to the EMC Hazard analysis and when performing the equipment / Installation assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | EMC Hazard Matrix added to the EMC Control Plan.                                                                                                                                                                                                                                                                                              |
| 6 | Points machines DC supply circuits cables to points machines and clamp locks should be restricted to lengths of no more than 200 m in accordance with NR/L2/SIG/11201.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | There are no changes envisaged to the existing points machine cables.                                                                                                                                                                                                                                                                         |
| 7 | <p>Segregation of telecoms and LV power cables must be applied in any compartment of CMS with the following distances:</p> <ul style="list-style-type: none"> <li>• <math>\geq 150</math> mm;</li> <li>• <math>\geq 50</math> mm, where the separation is provided and maintained by a partition in the cable tray/duct as specified in BS 7671</li> <li>• 50 mm, where one or more of the following conditions are met: <ul style="list-style-type: none"> <li>o The LV supply cables are enclosed in a separate conduit or trunking which, if metallic is bonded as per BS 7671.</li> <li>o The LV supply cables are of mineral-insulated type</li> <li>o The LV supply cables are of an earthed armoured construction</li> <li>o The LV supply cables are of a flexible, insulated and sheathe type supplying LV mains power</li> </ul> </li> </ul> <p>to telecommunications equipment cabinet</p> | The invert level CMS comprises of 2 No. cable trays. 1 No. 300x50 mm cable tray for the LV services (mounted on the invert front wall) and 1 No. 600x50mm cable tray for the Telecoms services (mounted on the invert front wall). Both services are segregated by individual CMS partition. – Please refer to 16012-ARC-BRY-ZZZ-D-EE-000010. |
| 8 | Undertake the EMC actions listed in the EMC Action list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | See section 10 of this document                                                                                                                                                                                                                                                                                                               |

## 11 EMC Documentation

According to the EMC Assurance process, EMC evidence shall be provided within this EMC project file and shall include the following documents:

- EMC Management Plan
- EMC HAZID Matrix
- EMC Test and Verification Plan
- MEC Declaration of Conformity Certificates
- Test reports

## 12 EMC Evidence – Component Level

The installation contractors shall collect the DoCs of the items of equipment (if available) that will be installed as part of the project and shall forward them to JMS. The EMC Declaration of Conformity certificates of the key items of equipment that will be installed on the project shall be included in a zip file attached to this EMC file

All certificates and their associated equipment shall be logged in an Excel file enclosed within the .zip file that will be issued after construction/installation activities are completed.

## 13 EMC Evidence – System Level

If an EMC site survey is undertaken, all photos are to be provided within the .zip file that shall be attached to this EMC Project File near completion of the project. A list of key locations to be surveyed will be based on the table created as per requirements in Section 8.2.1.

## 14 Conclusion

This EMC Project File sets up the key recommendation to be followed to enable a satisfactory demonstration of EMC compliance until completion of the project and shall be updated at further design stages once the project matures, and as more EMC evidence becomes available.

## Appendix A

### EMC Register

The EMC Register as well as other forms of documentation as part of the Bury Interchange EMC assessment shall remain “Live” through to RIBA 5 – to enable the addition of information to bolster the level of evidence for EMC compliance.

| Discipline | Location                                | System                                           | Product Details                                                                |                       |                    |                              | Issue Date    | Comment                                                                                                                                                                                                                                                                                                       | Priority | ARCADIS Assessment   |              |     |        |       |             | Comment                                                                                                                                                    |
|------------|-----------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------|-----------------------|--------------------|------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------|--------------|-----|--------|-------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |                                         |                                                  | Description                                                                    | Manufacturer          | Model No.          | EMC/TGM Certificate No.      |               |                                                                                                                                                                                                                                                                                                               |          | Documentary Evidence | Gap Analysis | Sum | Zoning | Total | Open/Closed |                                                                                                                                                            |
| Mechanical | Electrical cupboard (Southern Entrance) | Ventilation                                      | Vent Axia ACM100 4" inline Fan                                                 | Vent Axia             | ACM100 4           |                              |               |                                                                                                                                                                                                                                                                                                               | Low      | 5                    | 6            | 11  | 7      | 18    |             |                                                                                                                                                            |
|            | Tram Stop Electrical Plant Room         | Bury Tram Stop Fire Alarm Control/Dection System | 1-4 Loop Fire Alarm Control Panel                                              | Advanced Electronics  | MePro5             |                              |               |                                                                                                                                                                                                                                                                                                               | Low      | 5                    | 6            | 11  | 7      | 18    |             |                                                                                                                                                            |
|            | Tram Stop Electrical Plant Room         | Bury Tram Stop Fire Alarm Control/Dection System | Intelligent I/O Unit                                                           | Apollo Fire Detectors | SA4700-102APO      |                              |               | EMC Directive 2014/30/EU                                                                                                                                                                                                                                                                                      | High     | 2                    | 3            | 5   | 7      | 12    |             | Database states Declaration of Conformity Certificate can be delivered upon request. To be updated at RIBA 5 stage.                                        |
|            | Tram Stop Electrical Plant Room         | Bury Tram Stop Fire Alarm Control/Dection System | XP95 Zone Monitor with Isolator                                                | Apollo Fire Detectors | S5000-845          |                              |               | EMC Directive 2014/30/EU                                                                                                                                                                                                                                                                                      | High     | 2                    | 3            | 5   | 7      | 12    |             | Database states Declaration of Conformity Certificate can be delivered upon request. To be updated at RIBA 5 stage.                                        |
|            | Tram Stop Electrical Plant Room         | Bury Tram Stop Fire Alarm Control/Dection System | XP95A Smoke Detector                                                           | Apollo Fire Detectors | SA5050-250         |                              |               |                                                                                                                                                                                                                                                                                                               | High     | 5                    | 6            | 11  | 7      | 18    |             |                                                                                                                                                            |
| Fire       | Tram Stop Electrical Plant Room         | Bury Tram Stop Fire Alarm Control/Dection System | Intelligent Manual Call Point                                                  | Apollo Fire Detectors | SA5900-908APO      |                              |               | EMC Directive 2014/30/EU                                                                                                                                                                                                                                                                                      | High     | 2                    | 3            | 5   | 7      | 12    |             | Database states Declaration of Conformity Certificate can be delivered upon request. To be updated at RIBA 5 stage.                                        |
|            | Tram Stop Electrical Plant Room         | LV Distribution                                  | Powerpact 4 - panelboard - 630A - 18 ways - 3P - Style D                       | Schneider Electric    | MG6C18             |                              |               | <ul style="list-style-type: none"> <li>• IEC 61557-12</li> <li>• IEC 61010-1</li> <li>• IEC 61010-2-630</li> <li>• IEC 61326-1 (Industrial Environment)</li> <li>• IEC 62311</li> <li>• ETSI EN 300 328</li> <li>• ETSI EN 301 487-1</li> <li>• ETSI EN 301 489-17 (Radiated EMC)</li> </ul>                  | Low      | 3                    | 2            | 5   | 7      | 12    |             |                                                                                                                                                            |
|            | Under Platform - Central                | Lighting                                         | Angled Vandal Resistant Luminaire                                              | Linlux                | LLX-G1-4-1700N-TB  | N/A                          | 08/04/2024    | BS EN IEC 60598-1:2021+A11:2022<br>BS EN IEC 60598-2-1:2021<br>BS EN 60598-2-22:2022 (Emergency luminaires suffix E3/E5)<br>BS EN 50121-4:2016+A1:2019<br>BS EN IEC 55015:2019+A11:2020<br>BS EN IEC 61000-3-2:2019+A1:2021<br>BS EN 61000-3-3:2013+A2:2021<br>BS EN 61547:2009                               | Low      | 1                    | 0            | 1   | 8      | 9     |             | Suite of Standards (including railway specific Standards) listed in the Declaration of Conformity certification - although there is no certificate number. |
|            | Platform Canopy Outer                   | Lighting                                         | L589mm Asymetrical Lighting                                                    | Stromma               | STR-G2-2-L-W-MS-DA |                              | 08/04/2024    | BS EN IEC 60598-1:2021+A11:2022<br>BS EN IEC 60598-2-1:2021<br>BS EN 60598-2-22:2022 (Emergency luminaires suffix E3/E5)<br>BS EN 50121-4:2016+A1:2019<br>BS EN 50121-5:2017+A1:2019<br>BS EN IEC 55015:2019+A11:2020<br>BS EN IEC 61000-3-2:2019+A1:2021<br>BS EN 61000-3-3:2013+A2:2021<br>BS EN 61547:2009 | Low      | 1                    | 0            | 1   | 8      | 9     |             | Suite of Standards (including railway specific Standards) listed in the Declaration of Conformity certification - although there is no certificate number. |
|            | Platform Column                         | Lighting                                         | Outdoor Pole Mounted Luminaire                                                 | iGuzzini              | EQ54.15            | 5169-24                      | 05/09/2024    |                                                                                                                                                                                                                                                                                                               | Low      | 0                    | 0            | 0   | 7      | 7     |             |                                                                                                                                                            |
| Electrical | Platform Lift Shaft                     | Lighting                                         | Zelex Wall mounted                                                             | Stromma               | TL5W-1100W-X-MT    |                              | 08/04/2024    | BS EN IEC 60598-1:2021+A11:2022<br>BS EN IEC 60598-2-1:2021<br>BS EN 60598-2-22:2022 (Emergency luminaires suffix E3/E5)<br>BS EN 50121-4:2016+A1:2019<br>BS EN 50121-5:2017+A1:2019<br>BS EN IEC 55015:2019+A11:2020<br>BS EN IEC 61000-3-2:2019+A1:2021<br>BS EN 61000-3-3:2013+A2:2021<br>BS EN 61547:2009 | Low      | 1                    | 0            | 1   | 7      | 8     |             | Suite of Standards (including railway specific Standards) listed in the Declaration of Conformity certification - although there is no certificate number. |
|            | Tram Stop Electrical Plant Room         | Lighting                                         | L589mm Asymetrical Lighting                                                    | Stromma               | STR-G2-2-L-W-MS-DA |                              | 08/04/2024    | BS EN IEC 60598-1:2021+A11:2022<br>BS EN IEC 60598-2-1:2021<br>BS EN 60598-2-22:2022 (Emergency luminaires suffix E3/E5)<br>BS EN 50121-4:2016+A1:2019<br>BS EN 50121-5:2017+A1:2019<br>BS EN IEC 55015:2019+A11:2020<br>BS EN IEC 61000-3-2:2019+A1:2021<br>BS EN 61000-3-3:2013+A2:2021<br>BS EN 61547:2010 | Low      | 1                    | 0            | 1   | 7      | 8     |             | Suite of Standards (including railway specific Standards) listed in the Declaration of Conformity certification - although there is no certificate number. |
|            | Lift Canopy bridge Level                | Lighting                                         | Lighting Tuscan 89 Angled                                                      | Design Plan           | DB93-5-5000W-X-TB  |                              | 08/04/2024    | BS EN IEC 60598-1:2021+A11:2022<br>BS EN IEC 60598-2-1:2021<br>BS EN 60598-2-22:2022 (Emergency luminaires suffix E3/E5)<br>BS EN 50121-4:2016+A1:2019<br>BS EN 50121-5:2017+A1:2019<br>BS EN IEC 55015:2019+A11:2020<br>BS EN IEC 61000-3-2:2019+A1:2021<br>BS EN 61000-3-3:2013+A2:2021<br>BS EN 61547:2010 | Low      | 1                    | 0            | 1   | 5      | 6     |             | Suite of Standards (including railway specific Standards) listed in the Declaration of Conformity certification - although there is no certificate number. |
|            | Tram Stop Electrical Plant Room         | LV Distribution                                  | Act9 Isober P A - distribution board - 14 way SP+N                             | Schneider Electric    | SEAGMPN14          | Bury Lighting DB             | Not Available | No DoC. Data sheet provides no compliance.                                                                                                                                                                                                                                                                    | Low      | 5                    | 5            | 10  | 7      | 17    |             |                                                                                                                                                            |
|            | Tram Stop Electrical Plant Room         | LV Distribution                                  | Powerpact 4 - panelboard - 250A - 5 ways - 3P - Style C                        | Schneider Electric    | MG2C5              | Bury Panelboard (Data Sheet) | Not Available | No DoC. Data sheet provides no compliance.                                                                                                                                                                                                                                                                    | Low      | 5                    | 5            | 10  | 7      | 17    |             |                                                                                                                                                            |
|            | Tram Stop Electrical Plant Room         | LV Distribution                                  | Act9 Isober B P - split metered distribution board - 125A - B + B + split TP+N | Schneider Electric    | SEAGMPN125B58      | Bury B+H DB (Data Sheet)     | Not Available | No DoC. Data sheet provides no compliance.                                                                                                                                                                                                                                                                    | Low      | 5                    | 5            | 10  | 7      | 17    |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF01                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF02                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF03                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF04                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF05                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF06                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF07                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF08                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF09                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF10                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF11                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF12                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF13                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF14                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF15                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF16                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF17                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF18                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF19                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | CCTV SYSTEM                                      | CAMERA_BRY-TCF20                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | SOUTH END - LIFT SHAFT                  | CCTV SYSTEM                                      | CAMERA_BRY-TCF21                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | SOUTH END - LIFT SHAFT                  | CCTV SYSTEM                                      | CAMERA_BRY-TCF22                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | SOUTH END - LIFT SHAFT                  | CCTV SYSTEM                                      | CAMERA_BRY-TCF23                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | SOUTH END - LIFT SHAFT                  | CCTV SYSTEM                                      | CAMERA_BRY-TCF24                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | SOUTH END - LIFT SHAFT                  | CCTV SYSTEM                                      | CAMERA_BRY-TCF25                                                               | Bosch                 | NDE-8702-RX        | B-VS 2024-O-129              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 0                    | 1            | 1   | 6      | 7     |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK01                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK02                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK03                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK04                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK05                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |
|            | PLATFORM                                | SPEAKER_BRY-TSPK06                               | ASL                                                                            | CLWT-135T             | Not Available      |                              | Not Available | EU Declaration of Conformity                                                                                                                                                                                                                                                                                  | High     | 5                    | 5            | 10  | 6      | 16    |             |                                                                                                                                                            |

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|          |                        |                     |                                 |         |                    |                                          |                 |                                                                                                                                                                                                       |      |   |   |    |   |    |  |
|----------|------------------------|---------------------|---------------------------------|---------|--------------------|------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|----|---|----|--|
| Telecoms | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK07              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK08              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK09              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK10              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK11              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK12              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK13              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | SPEAKER,BRY-TSPK14              | ASL     | CLWT-135T          | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | SOUTH END - LIFT SHAFT | PA SYSTEM           | SPEAKER,BRY-TSPK15              | ASL     | SPPR-P-20W-50-EN54 | Not Available                            |                 |                                                                                                                                                                                                       | High | 5 | 5 | 10 | 6 | 10 |  |
|          | PLATFORM               | PA SYSTEM           | AMBIENT NOISE SENSOR,BRY-TANS01 | ASL     | ANS04              | PA ANS - EMC (Data Sheet)                | Not Available   | No DoC provided. Data sheet refers to 2014/30/EU Directive compliance.                                                                                                                                | High | 3 | 3 | 6  | 6 | 12 |  |
|          | PLATFORM               | PA SYSTEM           | AMBIENT NOISE SENSOR,BRY-TANS02 | ASL     | ANS04              | PA ANS - EMC (Data Sheet)                | Not Available   | No DoC provided. Data sheet refers to 2014/30/EU Directive compliance.                                                                                                                                | High | 3 | 3 | 6  | 6 | 12 |  |
|          | PLATFORM               | PID SYSTEM          | DISPLAY,BRY-TPID01              | INFOTEC | FM32W-DW           | PID DISPLAY_EMC declaration (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN61000 compliance.                                                                                                                                             | High | 3 | 2 | 5  | 6 | 11 |  |
|          | PLATFORM               | PID SYSTEM          | DISPLAY,BRY-TPID02              | INFOTEC | FM32W-DW           | PID DISPLAY_EMC declaration (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN61000 compliance.                                                                                                                                             | High | 3 | 2 | 5  | 6 | 11 |  |
|          | PLATFORM               | PID SYSTEM          | DISPLAY,BRY-TPID03              | INFOTEC | FM32W-DW           | PID DISPLAY_EMC declaration (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN61000 compliance.                                                                                                                                             | High | 3 | 2 | 5  | 6 | 11 |  |
|          | PLATFORM               | PID SYSTEM          | DISPLAY,BRY-TPID04              | INFOTEC | FM32W-DW           | PID DISPLAY_EMC declaration (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN61000 compliance.                                                                                                                                             | High | 3 | 2 | 5  | 6 | 11 |  |
|          | PLATFORM               | PID SYSTEM          | DISPLAY,BRY-TPID05              | INFOTEC | FM32W-DW           | PID DISPLAY_EMC declaration (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN61000 compliance.                                                                                                                                             | High | 3 | 2 | 5  | 6 | 11 |  |
|          | PLATFORM               | PEC SYSTEM          | PEC,BRY-TPP01                   | COMMEND | SP102D/IP          | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | PLATFORM               | PEC SYSTEM          | PEC,BRY-TPP02                   | COMMEND | SP102D/IP          | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | PLATFORM               | PEC SYSTEM          | PEC,BRY-TPP03                   | COMMEND | SP102D/IP          | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | PLATFORM               | PEC SYSTEM          | PEC,BRY-TPP04                   | COMMEND | SP102D/IP          | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | SOUTH END - LIFT SHAFT | PEC SYSTEM          | PEC,BRY-TPP05                   | COMMEND | SP102D/IP          | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | PLATFORM               | EVC SYSTEM          | EVC,BRY-TEVC01                  | COMMEND | Y-UK-SP401D        | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | SOUTH END - PLATFORM   | EVC SYSTEM          | EVC,BRY-TEVC02                  | COMMEND | Y-UK-SP401D        | PEC-EMC                                  | 22nd May, 2014  | CE Declaration of Conformity                                                                                                                                                                          | High | 0 | 1 | 1  | 6 | 7  |  |
|          | BURY SER               | NEW TELECOM CABINET | AMPLIFIER,BRY-TAMP01            | ASL     | V2000              | PA AMPLIFIER - EMC (Data Sheet)          | 8th April, 2024 | No DoC provided. Data sheet refers to EN61000 series and EN50130-4 compliance.                                                                                                                        | High |   |   | 0  | 6 | 6  |  |
|          | BURY SER               | NEW TELECOM CABINET | ROUTER,TPRT01                   | ASL     | VIPEDIA-12         | PA ROUTER - EMC DECLARATION (Data Sheet) | Not Available   | No DoC provided. Data sheet refers to EN55103, EN50121, ENV50204 compliance.                                                                                                                          | High | 3 | 2 | 5  | 6 | 11 |  |
|          | BURY SER               | NEW TELECOM CABINET | NETWORK SWITCH, BRY-TGS504      | ALCATEL | OS6465-P28         | Network Switch - EMC                     | Not Available   | No EMC DoC provided - however datasheet provides reference to EMC Industrial Railway Specific standards:<br><br>EN 50121-4, - EN 50155:2017, - EN 61373, - EN 62236-4, - EN 61000-6-4, - EN 61000-6-2 | High | 3 | 2 | 5  | 6 | 11 |  |
|          | BURY SER               | NEW TELECOM CABINET | NETWORK SWITCH, BRY-TGS505      | ALCATEL | OS6465-P28         | Network Switch - EMC                     | Not Available   | No EMC DoC provided - however datasheet provides reference to EMC Industrial Railway Specific standards:<br><br>EN 50121-4, - EN 50155:2017, - EN 61373, - EN 62236-4, - EN 61000-6-4, - EN 61000-6-3 | High | 3 | 2 | 5  | 6 | 11 |  |

## Appendix B

### EMC HAZID Matrix

The matrix considers all probable sources within Bury Interchange boundary, to the equipment installed and/or sources generated externally from third party or neighbouring locations. All systems potentially impacted by the proposed works within and external to Bury Interchange will also be considered as victims.

The HAZID matrix shown below should be read as follows:

- A “✓” means that there is potentially an EMC interface between a given source and a given victim.
- A “✗” means that no plausible EMI interaction should occur between two systems, either because the equipment is not sensitive to the source of disturbance, or the source of interference is too far from the victim to exceed the immunity test levels required to place the product on the market.

|                                                       | DC Traction<br>System (750 V<br>DC OLE) | Bus Station<br>Systems | Protection &<br>Control | CCTV, PA<br>Systems | Signaling<br>Power<br>Supplies | LV DNO,<br>other DNOs | Passenger<br>Information<br>Displays<br>(Platform) | Telecoms<br>FTN, WAN,<br>Copper,<br>SCADA | Radio,<br>Wireless<br>Comms | 3 <sup>rd</sup> Party<br>Radio<br>Stations | Rolling<br>Stock | Lightning<br>Protection | Vertical<br>Transportation<br>(Lifts &<br>Escalators) | PV Array | Fire<br>Protection<br>Control<br>Systems | Staff | Public |
|-------------------------------------------------------|-----------------------------------------|------------------------|-------------------------|---------------------|--------------------------------|-----------------------|----------------------------------------------------|-------------------------------------------|-----------------------------|--------------------------------------------|------------------|-------------------------|-------------------------------------------------------|----------|------------------------------------------|-------|--------|
| DC Traction<br>System (750 V<br>DC OLE)               |                                         | ✗                      | ✓                       | ✓                   | ✓                              | ✓                     | ✓                                                  | ✓                                         | ✓                           | ✓                                          | ✓                | ✗                       | ✓                                                     | ✓        | ✓                                        | ✓     | ✓      |
| Bus Station<br>Systems                                | ✗                                       |                        | ✗                       | ✓                   | ✗                              | ✗                     | ✗                                                  | ✗                                         | ✓                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✓                                        | ✓     | ✓      |
| Protection &<br>Control                               | ✓                                       | ✗                      |                         | ✗                   | ✓                              | ✓                     | ✗                                                  | ✓                                         | ✓                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✓        | ✓                                        | ✓     | ✓      |
| CCTV, PA<br>Systems                                   | ✓                                       | ✓                      | ✗                       |                     | ✓                              | ✗                     | ✗                                                  | ✓                                         | ✗                           | ✗                                          | ✓                | ✗                       | ✗                                                     | ✗        | ✓                                        | ✗     | ✗      |
| Signalling Power<br>Supplies                          | ✓                                       | ✗                      | ✓                       | ✓                   |                                | ✓                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| LV DNO, other<br>DNOs                                 | ✓                                       | ✗                      | ✓                       | ✗                   | ✓                              |                       | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✓                                                     | ✗        | ✓                                        | ✗     | ✗      |
| Passenger<br>Information<br>Displays<br>(Platform)    | ✓                                       | ✗                      | ✗                       | ✗                   | ✗                              | ✗                     |                                                    | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| Telecoms FTN,<br>WAN Copper<br>SCADA                  | ✓                                       | ✗                      | ✓                       | ✓                   | ✗                              | ✗                     | ✗                                                  |                                           | ✓                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| Radio Wireless<br>Comms                               | ✓                                       | ✗                      | ✗                       | ✗                   | ✗                              | ✗                     | ✗                                                  | ✓                                         |                             | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| 3 <sup>rd</sup> Party Radio<br>Stations               | ✓                                       | ✓                      | ✗                       | ✗                   | ✗                              | ✗                     | ✗                                                  | ✗                                         | ✓                           |                                            | ✓                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| Rolling Stock                                         | ✓                                       | ✗                      | ✗                       | ✓                   | ✗                              | ✗                     | ✗                                                  | ✗                                         | ✓                           | ✗                                          |                  | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| Lightning<br>Protection                               | ✗                                       | ✗                      | ✗                       | ✗                   | ✗                              | ✓                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                |                         | ✗                                                     | ✗        | ✗                                        | ✗     | ✗      |
| Vertical<br>Transportation<br>(Lifts &<br>Escalators) | ✓                                       | ✗                      | ✓                       | ✗                   | ✗                              | ✓                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       |                                                       | ✗        | ✗                                        | ✗     | ✗      |
| PV Array                                              | ✓                                       | ✗                      | ✓                       | ✗                   | ✗                              | ✓                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     |          | ✗                                        | ✗     | ✗      |
| Fire Protection<br>Control Systems                    | ✓                                       | ✓                      | ✓                       | ✓                   | ✗                              | ✓                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        |                                          | ✗     | ✗      |
| Staff                                                 | ✓                                       | ✓                      | ✗                       | ✗                   | ✗                              | ✗                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        |       | ✗      |
| Public                                                | ✓                                       | ✓                      | ✗                       | ✗                   | ✗                              | ✗                     | ✗                                                  | ✗                                         | ✗                           | ✗                                          | ✗                | ✗                       | ✗                                                     | ✗        | ✗                                        | ✗     |        |

## Appendix C

### EMC Hazard Log

| RISK DEFINITION |             |                                                                                         |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                           |                       |                                                                                                                                                                                                                                                                                                                                                                     |                      | RATING   |            |      | MITIGATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |            | RATING |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          | RISK MANAGEMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |
|-----------------|-------------|-----------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------|------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Ref ID          | Hazard Type | Hazard Owner                                                                            | Source                                      | Victim                                                                 | EMC Hazard Description                                                                                                                                                                                                                                                                                                                                                 | Consequence                                                                                               | Primary Bus objective | Comments<br>(From HAZID Workshop)                                                                                                                                                                                                                                                                                                                                   | ROGS<br>Significant? | SEVERITY | LIKELIHOOD | RISK | Mitigation Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SEVERITY | LIKELIHOOD | RISK   | Applicable Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Design Hazard Open/Close | Closure Comment & Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |
| 1               | EMC         | Transport for Greater Manchester (TfGM)<br>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.<br><br>Long parallel runs increased magnetic coupling into unshielded or poorly bonded cables.<br><br>Common mode noise enters via equipment I/O, power or reference conductors.<br><br>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.<br><br>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 reevaluation of all EMC related activities.<br><br>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.<br><br>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 .<br><br>Circuit lengths must be kept to permitted limits:<br><br>•Cable lengths should not exceed 1 km and Return Screen Conductor installed in cable troughs<br><br>•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.<br><br>•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.<br><br>•Ensure equipment has Declaration of Conformity EMC Certificates<br><br>•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<br><br>BS EN 50121-4: Electromagnetic compatibility - Emission and immunity of the signaling and telecommunications apparatus<br><br>BS EN 50121-5: Railway applications. Electromagnetic compatibility - Emission and immunity of fixed power supply installations and apparatus<br><br>IEC 61643: Low-voltage surge protective devices - General Requirements and test methods<br><br>BS IEC 61000-5-2: Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling<br><br>BS EN 50174-2: Information technology. Cabling installation - Installation planning and practices inside buildings | CLOSED                   | No cable runs exceed 1km as part of the Telecoms Design.<br><br>EMC Project File includes the EMC documentation for Telecoms equipment. Risk to calculated as per Gap Analysis scoring.<br><br>300x50 mm cable try for LV and 600x50 mm cable tray for Telecoms Services mounted to the front wall of the platform void with 100 mm clearance. See Bury Tram Stop Below Platform CMS: 16012-ARC-BRY-ZZZ-T-EP-000001.                                                                  |  |  |
| 2               | EMC         | Transport for Greater Manchester (TfGM)                                                 | DC Traction System (OLE)                    | Third Party Telecommunications                                         | Electrical Noise on station and neighbouring telecommunications circuits:<br>•Analogue phone lines<br>•GSM cell towers                                                                                                                                                                                                                                                 | Reputational Issues                                                                                       | PERFORMANCE           | Annual EMC Baseline Testing conducted<br><br>Theres no existing information on the location of 3rd-party comms. As Source the source DC - Immunisation testing should've been carried out prior to Tramstop commission. Additional 3rd-party infrastructure should've been subjected to a full EMC assessment.                                                      | YES                  | 3        | 3          | 6    | Third party telecommunications towers and landlines to be identified as being at risk during surveys (RIBA 5)<br><br>TfGM to liaise with the owners.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3        | 1          | 4      | BS IEC 61000-5-2: Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling<br><br>BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments<br><br>BS EN 50174-2: Information technology. Cabling installation - Installation planning and practices inside buildings<br><br>BS EN 50121-2:2017: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world                                                                                                                                                                                                                                                       | CLOSED                   | Theres no existing information on location of 3rd-party comms. Source is DC - Immunisation testing should've been carried out prior to Tramstop commission. Additional 3rd-party infrastructure should've been subjected to a full EMC assessment.<br><br>TfGM to provide results from annual EMC Baseline Testing as well as any desktop survey's conducted as part of this assessment. Refer to Actions No.5 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005. |  |  |
| 3               | EMC         | Transport for Greater Manchester (TfGM)                                                 | 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<br><br>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<br><br>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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CLOSED                   | Dedicated 50x25mm fire alarm tray mounted on the soffit, 2850mm above platform level - Segregation at void area to be detailed at RIBA 5 - Add reference to drawing: 16012-ARC-BRY-CNY-D-EE-000007 & 16012-ARC-BRY-TRK-D-EE-000011.                                                                                                                                                                                                                                                   |  |  |
| 4               | EMC         | Transport for Greater Manchester (TfGM)                                                 | DC Traction System (OLE)                    | 3 <sup>rd</sup> 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).<br><br>Equipment must show evidence of conformity to ensure emission levels are compliant to BS EN 50121-2:2017.<br><br>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.<br><br>BS EN 50121-2:2017: Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CLOSED                   | Theres no existing information on location of 3rd-party comms. Source is DC - Immunisation testing should've been carried out prior to Tramstop commission. Additional 3rd-party infrastructure should've been subjected to a full EMC assessment.<br><br>TfGM to provide results from annual EMC Baseline Testing as well as any desktop survey's conducted as part of this assessment. Refer to Actions No.5 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005. |  |  |
| 5               | E&B         | Transport for Greater Manchester (TfGM)                                                 | DC Traction System (OLE)                    | Lineside Conductors (e.g. long fences)                                 | Higher Induction levels to long (> 1km) conductors                                                                                                                                                                                                                                                                                                                     | Risk of Electric Shock                                                                                    | SAFETY                |                                                                                                                                                                                                                                                                                                                                                                     | YES                  | 3        | 2          | 5    | E&B Design in accordance with ITS 3003 & BS EN 50122-1/2.<br><br>Lengths of other conductors to be minimised as much as possible, using appropriate segregation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3        | 1          | 4      | ITS 3003: Earthing & Bonding<br><br>BS EN 50122-1: Fixed installations for railway applications. Electrical safety, earthing and the return circuit - Protective provisions against electric shock<br><br>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<br><br>BS EN 61140:Protection against electric shock. Common aspects for installation and equipment.                                                                                                                                                                                                                                                                   | CLOSED                   | End of platform gates/fence/handrail which are within the OCLZ and exceed small conductive parts dimensions shall be of non-conducting material. Earthing & Bonding implemented as in the Bury Interchange Earthing & Bonding Strategy: 16012-ARC-BRY-ZZZ-T-EP-000001.                                                                                                                                                                                                                |  |  |
| 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.<br><br>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.<br><br>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 signaling and telecommunications apparatus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CLOSED                   | 300x50 mm cable try for LV and 600x50 mm cable tray for Telecoms Services mounted to the front wall of the platform void with 100 mm clearance. See Bury Tram Stop Below Platform CMS: 16012-ARC-BRY-ZZZ-T-EP-000001.                                                                                                                                                                                                                                                                 |  |  |

|    |     |                                                   |                                            |                                              |                                                                                                                                                                   |                                                                                                                                                                                      |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |   |   |   |                                                                                                                                                                                                                                                                                 |   |   |   |                                                                                                                                                                                                                                                        |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|-----|---------------------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.<br>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                                                                                                                                                                                                                                                                                                                                                                                       | YES | 5 | 3 | 8 | LV cables and fire circuits are segregated.<br>Use dry contacts / voltage free contacts.<br>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                                                                                                                                | CLOSED | Dedicated 50x25mm fire alarm tray mounted on the soft 2850mm above platform level - Segregation at void area to be detailed at RIBA 5 - Add reference to drawing: 16012-ARC-BRY-CNY-D-EE-000010 & 16012-ARC-BRY-TRK-D-EE-000011.<br><br>EMC Project File includes the EMC documentation for M&E equipment. Risk to calculated as per Gap Analysis scoring.<br><br>M&E Fire Alarm Control System shows evidence of Dry Contact, ensuring no power is supplied by the switch. Allowing control circuits to be unaffected by LV-distribution circuit. See Bury Tram Stop Platform Fire Alarm Schematic: 16012-ARC-BRY-PFM-D-EE-000004.                             |
| 8  | EMC | M&E - Bridge and Tramstop                         | LV Distribution                            | Station SISS                                 | LV system interferes with CCTV system                                                                                                                             | Loss of Service<br>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.<br><br>From each fire interface unit, an individual cable will run back to the system                                                                                                                                                                                                                                                                                                                          | YES | 5 | 3 | 8 | Separation and segregation of cable routes.<br>CCTV system is IP based, circuits surge protected.<br>Cables are fully shielded<br>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<br><br>BS EN 61000-6-2:Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments    | CLOSED | PEC cable as part of the PHP is segregated from the LV distribution in segregated CMS. 2x20 mm conduit providing segregation for power and data cables. Reference from LV CMS layout 16012-ARC-BRY-TRK-D-EE-000011 & 16012-ARC-BRY-TRK-D-EE-000007.<br><br>Network switch has integrated max power draw for each port (15W) as per UPS design. Current design scope does not include SPD due to assessment of LPS as the comms equipment is mounted on the canopy.<br><br>Shielded twisted pair - especially for long range cabling. CAT 6A cables are being used in the telecoms system:<br><br>Refer to Telecoms RIBA 4 Report: 16012-ARC-BRY-ZZZ-T-TC-400010 |
| 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<br><br>Loss of service, noise in the systems.<br>Safety risks: to be operational in emergency scenario | PERFORMANCE          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | YES | 4 | 3 | 7 | Separation and segregation of LV cables from the AFILS<br>Use approved and EMC compliant products (DoC)<br>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                                                                                                                   | CLOSED | Separation and segregation of LV cables from the AFILS.2x20mm conduit providing segregation for power and data cables. Reference from LV CMS layout 16012-ARC-BRY-TRK-D-EE-000011 & 16012-ARC-BRY-TRK-D-EE-000007.<br><br>EMC Project File:16012-ARC-BRY-ZZZ-T-EC-000003 includes the EMC documentation for Telecoms Equipment. Risk calculated as per Gap Analysis scoring.<br><br>Telecoms uses shielded twisted pair cabling for added rust protection. Not Foil twisted pairs (FTP) for the CAT6A cabling.<br><br>Refer to the Telecoms RIBA 4 report:16012-ARC-BRY-ZZZ-T-TC-400010                                                                         |
| 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.<br>Safety risks as the PA system to be operational in emergency scenario                                                                      | PERFORMANCE / SAFETY |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | YES | 4 | 3 | 7 | Separation and segregation of cable routes.<br>Use approved and EMC Compliant Equipment for PA system.<br>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                                                                                                                                | CLOSED | 2x20mm conduit providing segregation for power and data cables. Reference from LV CMS layout 16012-ARC-BRY-TRK-D-EE-000011 & 16012-ARC-BRY-TRK-D-EE-000007.<br><br>EMC Project File:16012-ARC-BRY-ZZZ-T-EC-000003 includes the EMC documentation for Telecoms Equipment. Risk to calculated as per Gap Analysis scoring.                                                                                                                                                                                                                                                                                                                                        |
| 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.<br><br>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.<br><br>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.<br><br>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   | 600mm cable has been provided to support the signalling cables within the platform area. Signalling scope of works to incorporate the movement of signalling cables to the dedicated cable tray as part of RIBA 5 works. Risk to remain open until completion of works.                                                                                                                                                                                                                                                                                                                                                                                         |
| 12 | EMC | 3rd Party/TIGM (Transport for Greater Manchester) | 3 <sup>rd</sup> Party Equipment/Operations | Railway/Station Systems                      | "Malfunction of the railway and station equipment due to the operation of 3rd party systems such as:<br>- Laboratories<br>- Power systems<br>- Airports<br>-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<br><br>Coordinate with asset owners where required.<br><br>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.<br><br>BS EN 61000-6-4:Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments. | CLOSED | Theres no existing information on location of 3rd-party comms. Source is DC - Immunisation testing should've been carried out prior to Tramstop commission. Additional 3rd-party infrastructure should've been subjected to a full EMC assessment.<br><br>TIGM to provide results from annual EMC Baseline Testing as well as any desktop survey's conducted as part of this assessment. Refer to Actions No.5 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005.                                                                                                                                                                           |

|    |     |                                                                  |                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                               |             |                                                                                                                                                                                                                                                                                                                                              |     |   |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| 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 | <p><b>BS EN 61000-6-3:</b> Adjustable speed electrical power drive systems - EMC requirements and specific test methods for PDS and machine tools.</p> <p><b>BS EN 61000-6-2:</b> Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments.</p> <p><b>BS EN 61000-6-4:</b> Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.</p>                                                                                                                                                                                                                                                                                                                                                                                                                               | OPEN   | <p>KONE lifts are designed to EN 12015 for electromagnetic Emissions &amp; EN 12016 for electromagnetic immunity. Modern KONE drives such as the VSF25 utilise specific modules such as KN780180G01 which are designed to handle high-power filtration (up to 22 kV/ 40 A).</p> <p>These drives help to prevent HF noise generated by the VFDs from entering into the station systems via LV distribution network. There is currently no specification for the lift to be installed at Bury Interchange. Hazard to be closed out once available at RIBA 5.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 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 | <p><b>BS 7671:</b> Requirements for Electrical Installations. IET Wiring Regulations</p> <p><b>BS EN 50310:</b> Telecommunications bonding networks for buildings and other structures</p> <p><b>BS EN 50121-4:</b> Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p> <p><b>BS EN 50121-2:</b> Railway applications. Electromagnetic compatibility - Emission of the whole railway system to the outside world Tolerable</p>                                                                                                                                                                                                                                                                                                                                                                            | OPEN   | <p>An assumption has been made that the cables utilised for motor power (which contain HF noise from the VFD) are shielded. There is currently no specification for the lift to be installed at Bury Interchange.</p> <p>Whilst it is expected, it cannot be proven that lifts are designed to railway specific standards such as BS EN 50121-1 until Declaration of Conformity certification is made available. Hazard to be closed out once available at RIBA 5.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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<br>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 | <p><b>BS EN 61543-11:</b> Low-voltage surge protective devices - Surge protective devices connected to low-voltage power systems. Requirements and test methods.</p> <p><b>BS EN 61000-3-12:</b> Electromagnetic compatibility (EMC) - Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current &gt; 16 A &lt;= 75 A per phase.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | CLOSED | <p>Transient Over-Voltage protection is provided in accordance with BS EN 62305-4. Consisting of a combination of Type 1 &amp; 2 surge protection devices for Level III systems (Furse ESP415/III/TNS or equal, and Type 3 Devices for each Distribution Board.</p> <p>Refer to Clause 5.16.1 of the Electrical Particular Specification: 16012-FUT-BRY-XXX-T-BV-000007.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 16 | EMC | M&E - Bridge                                                     | Lift Control System            | DNO Supplies               | <p>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.</p> <p>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.</p> | Harmonic Distortion of Power Supply<br>Voltage Fluctuations and Transients                                                    | PERFORMANCE | <p>Confirm and record the authority or approval basis for using the same LV source for both primary and secondary lift supplies.</p> <p>Ensure DNO interface and duct routes are fully documented. Assess whether any additional mitigation is needed for harmonic distortion and earthing impacts.</p>                                      | YES | 2 | 3 | 5 | <p>The lifts must be equipped with harmonic filters to mitigate against the generation of harmonic filters.</p> <p>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 &amp; BS EN 50174-2 &amp; BS 7671.</p> <p>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.</p> | 2 | 2 | 4 | <p><b>BS IEC 61000-5-2:</b> Electromagnetic compatibility (EMC). Installation and mitigation guidelines - Earthing and cabling</p> <p><b>BS EN 50310:</b> Telecommunications Bonding Networks for buildings and other structures</p> <p><b>BS EN 50174-2:</b> Information technology. Cabling installation - Installation planning and practices inside buildings</p> <p><b>BS 7671:</b> Requirements for Electrical Installations. IET Wiring Regulations</p> <p><b>BS EN 81-76:</b> Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts - Part 76. Evacuation of persons with disabilities using lifts</p> <p><b>BS EN 81-72:</b> Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts - Firefighters lifts</p> | CLOSED | <p>Transient Over-Voltage protection is provided in accordance with BS EN 62305-4. Consisting of a combination of Type 1 &amp; 2 surge protection devices for Level III systems (Furse ESP415/III/TNS or equal, and Type 3 Devices for each Distribution Board.</p> <p>Refer to Clause 5.16.1 of the Electrical Particular Specification: 16012-FUT-BRY-XXX-T-BV-000007.</p> <p>For lifts used for evacuation purposes, a separately fused circuit from the main switchboard is intended primary power supply shall be derived from the main switchboard whilst the secondary supply is taken from the live side of the main switchboard. Refer to clause 5.15 of the Electrical Particular Specification: 16012-FUT-BRY-XXX-T-BV-000007.</p> <p>The lifts considered for the design (at RIBA 4) are confirmed to be Class A lifts (refer to the Bury Interchange Fire Strategy. ) which as per BS EN 81-76 do not require a secondary supply or a dedicated secondary supply. Should a Class B lift used as a fire fighter lift, the secondary supply must be independent to mitigate against common mode failure as per clause A.4 of BS EN 81-72.</p> |
| 17 | EMC | Transport for Greater Manchester (TIGM)                          | Handheld Radios                | Railway Systems            | Radiated RF interference, particularly when used close to vulnerable devices                                                                                                                                                                                                                                                                                                                                                                                                            | Maloperation of Equipment and Possible delays of Trams                                                                        | PERFORMANCE | <p>Confirm whether any RF restricted zones currently exist on the system.</p> <p>Verify compliance with EN 50401 and include evidence in the EMC project file.</p> <p>Assess whether any additional RF protection (gasketing, mesh, restricted areas) is required for vulnerable cabinets.</p>                                               | YES | 1 | 3 | 4 | <p>Determine distance from handheld radios where fields levels of BS EN 50401 are met.</p> <p>Compliance of Metrolink tram detection &amp; signalling systems with EN 50121-4</p> <p>Mark restricted zones; fit additional RF gasketing/mesh to vulnerable cabinets; brief staff and contractors.</p> <p>Measurements and tests, or alternatively documentary evidence to be provided (EMC Project File) from equipment suppliers and/or from other UK projects.</p>                                                                  | 1 | 2 | 3 | <p><b>BS EN 50401:</b> Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when put into service</p> <p><b>EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | CLOSED | <p>Current mitigation involves investigating existing handheld radios currently operational at Bury Tramstop.</p> <p>An assumption has been made that the existing radios used by staff are compliant. This does not need to be evidenced unless EMC historical issue has been logged previously. If still open then EMC documentation will need to be reviewed to understand level of compliance/non-compliance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 18 | EMC | Transport for Greater Manchester (TIGM) - 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 | <p>Identify O &amp; M lead responsible for RF management on the project.</p> <p>Confirm whether existing RF control measures or restricted zones are in place for train-borne systems.</p> <p>Verify transmitter compliance with licence requirements. Update the EMC file accordingly.</p>                                                  | YES | 1 | 3 | 4 | <p>Use radio transmitters within their license requirements</p> <p>Mark restricted zones; fit additional RF gasketing/mesh to vulnerable cabinets; brief staff and contractors.</p>                                                                                                                                                                                                                                                                                                                                                   | 2 | 1 | 3 | <p><b>BS EN 50121-3-1:</b> Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle</p> <p><b>BS EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CLOSED | <p>Current mitigation involves investigating existing on board tram radio transmitters currently operational at Bury Tramstop.</p> <p>An assumption has been made that the existing radios used by staff are compliant. This does not need to be evidenced unless EMC historical issue has been logged previously. If still open then EMC documentation will need to be reviewed to understand level of compliance/non-compliance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 19 | EMC | Transport for Greater Manchester (TIGM) - 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 | 1 | 3 | 4 | <p>Maloperation of Equipment and Possible delays of Trams</p> <p>Determine distance from handheld radios where fields levels of BS EN 50401 are met.</p> <p>Compliance of Metrolink tram detection &amp; signalling systems with EN 50121-4.</p> <p>Re-site sensitive equipment away from the platform edge; RF sealing; signage for separation.</p> <p>Measurements and tests, or alternatively documentary evidence to be provided (EMC Project File) from equipment suppliers and/or from other UK projects.</p>                   | 2 | 1 | 3 | <p><b>BS EN 50401:</b> Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when put into service</p> <p><b>EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p> <p><b>BS EN 61000-6-2:</b> Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments.</p> <p><b>BS EN 61000-6-4:</b> Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.</p>                                                                                                                                                                                                                    | CLOSED | <p>Current mitigation involves investigating existing on board tram radio transmitters currently operational at Bury Tramstop.</p> <p>An assumption has been made that the existing radios used by staff are compliant. This does not need to be evidenced unless EMC historical issue has been logged previously. If still open then EMC documentation will need to be reviewed to understand level of compliance/non-compliance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 20 | EMC | Transport for Greater Manchester (TIGM)                          | Rolling Stock                  | Signalling Equipment       | <p>Train interference induced onto S&amp;T cables cause Right Side Failure of Lineside systems.</p> <p>Sources from the rolling stock such as traction transformers, auxiliaries &amp; inverters/converters generate magnetic leakage, harmonics, transients and HF power supply noise.</p>                                                                                                                                                                                             | False operation of Train System causing Wrong Side or Right Side Failure affecting safety and reliability.<br><br>Tram Delays | SAFETY      | <p>Hitachi signalling is engaged directly by TFGM. Meeting notes will need to be shared with TFGM so that they can pass them to Hitachi.</p> <p>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.</p> | YES | 5 | 2 | 7 | <p>Moderate</p> <p>Confirm compliance with specific signalling design standards/specifications.</p> <p>Signalling system to follow immunity limits specified in BS EN 50121-4</p> <p>Use of Optic Fibre for telecoms and apply EMC Good practices</p>                                                                                                                                                                                                                                                                                 | 5 | 1 | 6 | <p><b>EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p> <p><b>BS EN 50121-3-1:</b> Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle</p> <p><b>BS EN 50238-3:</b> Railway applications. Compatibility between rolling stock and train detection systems - Compatibility with axle counters</p>                                                                                                                                                                                                                                                                                                                                                                                                                      | OPEN   | <p>Hazard to remain open as there is no record of existing or proposed redesign of signalling assets.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 21 | EMC | Transport for Greater Manchester (TIGM)                          | Rolling Stock                  | Station Fire Alarm Systems | <p>PWM edges and braking events radiate wideband noise;</p> <p>vehicle antenna/RF systems raise local field strength;</p> <p>Near-field H-fields inductively couple to the loop wiring along platform edge.</p>                                                                                                                                                                                                                                                                         | False Alarms due to induced voltages/noise<br><br>Missed or delayed alarms if signals are corrupted.                          | SAFETY      | <p>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.</p>                                                                                                | YES | 5 | 2 | 7 | <p>Keep FAS loops back-of-shelter; minimize parallelism with track; use twisted, shielded Low Smoke Zero Halogen cables; correct shield termination.</p>                                                                                                                                                                                                                                                                                                                                                                              | 5 | 1 | 6 | <p><b>BS EN 50121-3-1:</b> Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle</p> <p><b>EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | OPEN   | <p>All Rolling Stock EMC hazards to remain open until confirmation from TIGM that hazards have been reviewed with TIGM Rolling Stock Lead, as per EMC Actions ID No.10 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|    |     |                                        |                         |                                                                                   |                                                                                                                        |                                                        |                      |                                                                                                                                                                                                                                                                                      |     |   |   |   |                                                                                                                                                                                                                                                                                                             |   |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |                                                                                                                                                                                                                                                                                                                                                                 |
|----|-----|----------------------------------------|-------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22 | EMC | Transport for Greater Manchester (TGM) | 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).<br><br>Apply EMC Good practices, follow the applicable standards: Improve cabinet shielding  | 4 | 2 | 6 | <b>EN 50121-3:</b> Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle<br><br><b>BS EN 50388-1:</b> 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<br><br><b>BS EN 50317:</b> Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line<br><br><b>BS EN 50121-5:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of fixed power supply installations and apparatus<br><br><b>EN 50121-4:</b> Railway applications. Electromagnetic compatibility - Emission and immunity of the signalling and telecommunications apparatus | OPEN   | All Rolling Stock EMC hazards to remain open until confirmation from TGM that hazards have been reviewed with TGM Rolling Stock Lead, as per EMC Actions ID No.10 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005.                                                                                                                        |
| 23 | EMC | Transport for Greater Manchester (TGM) | 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).<br><br>Apply EMC Good practices, follow the applicable standards.                            | 4 | 2 | 6 | <b>EN 50121-3:</b> Railway applications. Electromagnetic compatibility - Rolling stock. Train and complete vehicle<br><br><b>BS EN 50388-1:</b> 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<br><br><b>BS EN 50317:</b> Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line<br><br><b>BS EN 61000-6-2:</b> Electromagnetic compatibility (EMC) - Generic standards. Immunity standard for industrial environments.<br><br><b>BS EN 61000-6-4:</b> Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments.                                      | OPEN   | All Rolling Stock EMC hazards to remain open until confirmation from TGM that hazards have been reviewed with TGM Rolling Stock Lead, as per EMC Actions ID No.10 in the EMC HAZID Workshop Output Report: 16012-ARC-BRY-ZZ-T-EC-000005.                                                                                                                        |
| 24 | EMC | Transport for Greater Manchester (TGM) | 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.<br><br>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 | <b>EN A REEC G5/B:</b> Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom<br><br><b>BS EN 61643-11:</b> Low-voltage surge protective devices - Surge protective devices connected to low-voltage power systems. Requirements and test methods<br><br><b>BS EN IEC 61000-3-12:</b> 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   | Telecoms utilises UPS as primary power supply to the racks via bypass panel. The secondary power supply comes from the LV distribution board within the SER. Refer to the LV Distribution schematic: 16012-ARC-BRY-FFM-D-EE-000001.<br><br>Currently a 10 kW existing UPS which will be maintained as usual by the current O&M routine.                         |
| 25 | EMC | Transport for Greater Manchester (TGM) | 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.<br><br>Type 1/2 SPDs coordinated; bonded per 50122-1; route sensitive cables away from strike-prone paths; ensure shield bonding.                                                                 | 4 | 1 | 5 | <b>BS EN 50122-1:2022+A1:2025:</b> Fixed installations for railway applications. Electrical safety, earthing and the return circuit - Protective provisions against electric shock<br><br><b>BS EN IEC 62305-1:2024:</b> Protection against lightning - General principles<br><br><b>BS EN IEC 61643-11:</b> Low-voltage surge protective devices - Part 11: Surge protective devices connected to AC low-voltage power systems – Requirements and test methods<br><br><b>IEC 61643-21:</b> Low voltage surge protective devices - Surge protective devices connected to telecommunications and signalling networks. Performance requirements and testing methods                                                                                                                                                                                                                    | CLOSED | Transient Over-Voltage protection is provided in accordance with BS EN 62305-4. Consisting of a combination of Type 1&2 surge protection devices for Level III systems (Furse ESP415/III/TNS or equal, and Type 3 Devices for each Distribution Board.<br><br>Refer to Clause 5.16.1 of the Electrical Particular Specification: 16012-FUT-BRY-XXX-T-BV-000007. |
| 26 | EMC | Transport for Greater Manchester (TGM) | 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 | <b>BS EN IEC 61851-21-2:</b> 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<br><br><b>BS EN IEC 61000-6-4:2019:</b> Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CLOSED | Closure due to mitigation by design. Bus Interchange & Tramstop are to be segregated as part of tramstop upgrade.                                                                                                                                                                                                                                               |



Bury Interchange Metrolink  
EMC Project File  
Doc Ref: 16012-ARC-BRY-ZZZ-T-EC-000003 - Revision: P02

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