**IN THE MATTER OF AN APPLICATION TO**

**AN BORD PLEANALA**

**For Approval of the Railway (MetroLink – Estuary to Charlemont via Dublin Airport) Order [2022]**

**ABP-314724-22**

# ORAL HEARING

# STATEMENT OF EVIDENCE

**on**

**Overview of fire safety, emergency, and evacuation strategies**

**By**

**Sandeep Upadhya**

**19 February 2024**

**MetroLink Oral Hearing**
**Brief of Evidence of Sandeep Upadhya**
**Overview of fire safety, emergency, and evacuation strategies**

## 1 Qualifications and Role on the MetroLink Project

1.1 My name is Sandeep Upadhya. I am employed by Jacobs as the European Head of Technology, Tunnel Ventilation and Fire Life Safety for Tunnels and Underground Infrastructure. I lead a team of other tunnel ventilation and fire safety specialist within my team and manage all of Jacobs design work within the UK, Europe, Australia, Canada, Middle East, and other regions as needed.

1.2 I hold a Bachelor of Engineering (BEng) degree in Civil Engineering from the University of Swansea, Wales, and a Masters (MEng) degree in Civil Engineering from the University of Windsor, Ontario, Canada.

1.3 I have 16 years of experience in the industry with key experience in Ventilation and Fire Safety design for Transportation Infrastructure and Tunnels. During this time, I have developed several fire strategies, carried out calculation and analysis using various industry recognised tools, Tunnel Ventilation system design and lead and supervised a team of technical experts. My role on the Metrolink project is as a Subject Matter Expert (SME) and liaison with emergency services.

1.4 My personal experience with fire safety and ventilation matters in surface and underground railway and metro projects are as follows.

- Northern Line Extension, London, Transport for London, United Kingdom
- Dubai Metro Red Line Extension, Dubai, UAE
- Rio Metro Line 6 Extension, Rio de Janeiro, Brazil
- Los Angeles Metro Extension, Purple Line, USA
- London Underground Heathrow Terminal 5, London, United Kingdom
- Stansted Express People Mover, Stansted Airport, United Kingdom
- Etihad Rail, Abu Dhabi, UAE
- Trafikverket High Speed Rail Rolling Stock Fire Safety Study, Sweden
- High Speed 2 Phase 1, United Kingdom
- Irish Rail Hybrid Trains Battery Fire Study

1.5 The purpose of this witness statement is to set out an overview of the fire safety, emergency, and evacuation strategy, as requested by the Inspector in the Oral Hearing Agenda. I note that the Inspector has requested that this include (i) the basis for, and location of, 1 No. intervention shaft at Albert College Park as proposed and (ii) the need for separate fire brigade/emergency services lifts at each underground station.

1.6 This witness statement is divided into the following sections.

A. Section 2 - Overview of Fire Strategy

B. Section 3 - Emergency and Evacuation Strategy

C. Section 4 - Need for Separate fire brigade lifts at each underground station.

D. Section 5 - Justification/Need for an Intervention Shaft at Albert College Park

## 2 Overview of the Fire Strategy

2.1 The risk of fire in any part of the MetroLink infrastructure is low, nevertheless the fire safety strategy for MetroLink comprises four successive layers of defence built into the design:

- Fire Prevention – to identify fire risk and to implement actions that will lead to a reduction of these risks.
- Fire protection – to install suitable systems for the detection and suppression of fire incorporating active and passive measure to separate smoke and fire from people.
- Fire Planning – to develop procedures and ensures process are in place for them to be enforced, to provide for safe evacuation of people ad facilitation of fire brigade operations; and
- Firefighting – to provide suitable systems to assist the fire brigade, as well as protection for emergency personnel.

2.2 In explaining the fire safety strategy for the project, it may be helpful to first provide context on the legislative requirements and standards and guidance documents that underpin the fire strategy of the project. This will provide an insight into how fire safety was factored into the project from the very outset and help to demonstrate that the adopted requirements form the basis of fire safety design of the rolling stock, stations, and tunnels. An overview of the fire safety strategy for each of these elements (rolling stock, stations, and tunnels) are also included in this witness statement.

### 2.3 Legislation, Standards and Guidance Documents

2.4 The design of the MetroLink project involves large subterranean Infrastructure in which different regulations and standards related to safety (and fire safety) are applicable. As such, a hierarchical approach was adopted at the outset of the project, comprising the following three steps.

- **Step 1** - Irish Building Regulation SI No 115/2006 notably Part B relating to Fire Safety.
- **Step 2** – In the absence of applicable Irish Regulations or Design Standards, European Standards are applied to the design.
- **Step 3** – In the absence of applicable Irish and European Regulations or Design Standards, other international standards and regulations are considered. For example, British Standards, National Fire Protection Association (NFPA) USA, and other international standards.

### 2.5 Adoption of Fire Safety Standards for MetroLink

2.6 In the absence of applicable Irish Regulations and/or design standards directly related to Fire and Life Safety in Tunnels and Underground Metro Stations, it was necessary to examine the requirements of the Commission Regulation (EU) No 1303/2014 of 18 November 2014 concerning the technical specification for interoperability relating to safety in railway Tunnels of the rail system European Union (SRT-TSI).

2.7 During the review of TSI SRT, it was identified that the TSI 1303/2014 regulations are targeted at heavy rail infrastructure, meaning that they were not specifically suited to be used for an urban Metro System. For instance, the regulation does not identify tunnel ventilation system as a

requirement, as they are not a requirement for heavy rail tunnels but are extremely critical for underground Metros.

2.8 Therefore, to maintain a robust fire safety strategy for the project, the decision was taken through consultation with key stakeholders to adopt NFPA 130 2020 standard "Standard for fixed guideway transit and passenger rail systems" to develop the fire strategy for the Tunnels and Stations. In instances, where NFPA 130 mandates a requirement, but both Irish Building Regulation and European Regulation/Standards also show relevant requirements, a comparative assessment has been made and where possible the most stringent fire safety requirement has been followed.

2.9 NFPA 130 is a comprehensive design standard that deals with fire safety and fire protection requirements for fixed guideway transit rail systems, including (among other topics) underground stations and tunnels safety, emergency ventilation systems, emergency procedures and communications.

2.10 NFPA 130 has been prepared by a prestigious Technical Committee of fire safety experts from USA, Canada, Singapore, Germany, and Australia. NFPA 130 standard was first developed in 1983 and has since been adopted and consulted for the use of various Metro Systems worldwide including modern European Metro lines in Copenhagen, Canada, USA, Singapore, Malaysia, UK, Brazil, Saudi Arabia, UAE, Qatar and is extensively referred to for most Metro System Fire safety and Ventilation design around the world.

2.11 **Other Best Practice Standards and Guidance Documents**

2.12 The following other standards and best practice guidance has also been consulted and referenced by the project.

- BS 9999: Code of Practice for fire safety in the design of design, management, and use of buildings.
- BS 9992: Fire Safety in the design, management, and use of rail infrastructure. Code of Practice
- S1080 A3 London Underground Standard Guidelines (LU). Transport for London
- Ireland National Disability Authority's Centre, Building for Everyone and Access Handbook Guidance 2005
- International Tunnelling Association (ITA) guideline 'Engineering Methodology for Performance-Based Fire Safety Design of Underground Rail Systems'

2.13 **Rolling Stock Fire Strategy**

2.14 The rolling stock proposed for Metrolink will be autonomous and electrically powered. The platform height and train floors will be at the same level to provide step free access onto and off the trains. Each train will have three or four cars and are approximately 64m long. There are wheelchair spaces allocated within the trains. The trains have an estimated maximum capacity for up to 500 passengers and for fire evacuation purposes, the train considers crush loaded scenarios of 600

people. The trains proposed for MetroLink trains will be very similar to the ones shown in figure below.

Figure 1 Example of a Rolling Stock like MetroLink

2.15 All MetroLink trains shall be fully compliant with EN 45545 (European railway standard for fire safety of Rolling Stock); this compliance is a key aspect of the Fire Strategy related to rolling stock. Rolling Stock are to be designed to Design Category A and Operation Category 4 and, therefore, Hazard Level 3 (the maximum level defined by EN 45545). The above requirement stipulates that material construction of the rolling stock shall be of low combustibility and the risk of propagation of fire within the vehicle is low meaning that the trains are extremely unlikely to catch fire in the first instance and fire does not propagate within the trains.

2.16 The fire resistance of rolling stock and traction system will ensure that, in the highly unlikely event of a train catching fire, it will keep moving for at least four minutes at an average speed of 80 km/h (EN 50553 requirements for running capability in case of fire on board of rolling stock), which is sufficient to enable it to arrive at the next station. Most stations are within one to two kilometres of each other and therefore the likelihood of trains not reaching the stations during a fire event is extremely low.

2.17 A minimum fire compartmentation of 15 minutes of all on board systems including cables and technical cabinets is required by the EN standards which ensure that fire arising within housing and cabinets are contained and do not spread. For the underfloor of the carriage, the fire compartmentation requirement has been increased from 15 minutes as per standards to 30 minutes. This means that a fire starting at the underfloor shall not propagate into the passenger compartments for up to 30 minutes, which is well beyond the timeline required for evacuation from the trains.

2.18 An extensive range of fire safety systems compliant to relevant European Standards is proposed for the Metrolink Rolling Stock. These are Lateral and Emergency front/rear doors, Fire Detection Systems, Emergency Lighting, Signage, On-Board Smoke Exhaust System, On-Board Water Mist System, On-Board Extinguishing System, Public Address and Voice Alarm (PAVA), Public Information System (PIS), Passenger Emergency Alarms and Emergency Two-way Intercom, Door Unlocking Device, Close Circuit Television (CCTV), Derailment Detectors and Disconnection from Overhead Lines. An image of the proposed systems is provided in Figure 2.

2.19 To ensure the safety of the systems and the devices associated, the devices and equipment with a safety related functions shall be monitored and able to send warnings to the Operation Control

Centre (OCC) located at Dardistown Depot. Detailed description of each of the safety systems for the Rolling Stock can be supplemented or discussed further with the Inspector if required.

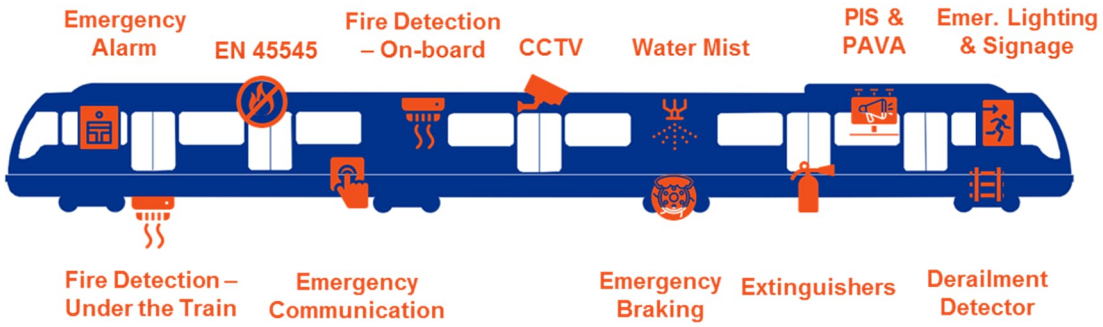


Figure 2 Overview of the Fire Safety Systems on the Proposed Rolling Stock

2.20 **Station Fire Strategy**

2.21 The station infrastructure is designed to the relevant fire safety standards namely NFPA 130 and with considerations of the Irish Building Regulations, European and International Best Practise Standards where appropriate.

2.22 All materials and finishes proposed for internal finishes are proposed to be either non-combustible and/or of limited combustibility to ensure fire spread within the station building is minimised. All materials proposed shall comply with NFPA standards for the class of material described with respect to fire integrity and insulation. It is mandated by the Fire Strategy that all fire safety products used by the project is tested by a European accredited laboratory and to European Testing Standard. It is a requirement of the fire strategy that this shall be implemented robustly during the procurement phase of the project.

2.23 All Stations are designed with more than one evacuation routes from the Public Front of House (FOH) areas. Two alternative routes are defined at platform level, one by the normal standard station entrance and the other towards the emergency stairs provided at the opposite end of both platforms. The design provides for two alternative exits on both platforms with the distance between the evacuation point and egress being less than 100m. Access to the emergency stairs is provided at all levels.

2.24 All Back of House rooms containing plant and equipment are arranged to limit common path of travel to distance: not exceeding 15m and where two exits, exit accesses, or exit discharges are required, they shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exits, exit accesses, or exit discharges. The travel distances for escape from each room within the BOH areas is compliant with the requirements of NFPA 130.

2.25 All stations are comprised of normal circulation stairs and emergency stairs of adequate width and escalator capacity that aid in evacuating passengers from platform level within 4 minutes and to reach a Point of Safety in the station within 6 minutes. The calculations demonstrating emergency evacuations timelines using the methodology stipulated by NFPA 130 standard were carried out for this project at all the stations and this demonstrated that evacuation timelines are met. Similarly, for evacuations of Persons of Restricted Mobility, the station design provides emergency communication systems, lifts on each platform for escape and refuge areas for three wheelchairs separated by fire resisting construction to allow PRM occupants to wait for assistance should they not able to self-evacuate.

2.26 The station structure is designed to provide the necessary intervention facility for the emergency services (Dublin Fire Brigade). Each station comprises of a minimum of two intervention lifts/stairs (further detail in Section 4) from surface level to platforms to aid fire service intervention either in the stations or the tunnels. All emergency stairs and firefighting shafts shall be mechanically pressurised to prevent the ingress of smoke into the evacuation or rescue paths. Each station will also include a station incident room where the emergency control panels will be located for operation during an incident.

2.27 Where reasonably practicable, an assembly area shall be identified at the surface for escaping passengers and for attendance by emergency services. However, in central Dublin due to space constraints it is likely that pavements and roads will be used for assembly or alternative solutions will be considered in consultation with Dublin Fire Brigade and other emergency responders. Considerations shall be given to the likelihood that evacuating passengers will immediately carry on their journeys using alternative routes.

2.28 The principle of compartmentation is adopted within the station design to ensure public areas (platforms, concourse, Intermediate circulation levels, and vertical circulation routes such as escalators, stairs, and lifts) are sufficiently segregated from non-public areas (technical rooms, staff accommodation and welfare, offices, and storage room). As per the requirement of relevant NFPA standards, the compartmentation provided from the back of house areas is 60 minutes, firefighting shaft 120 minutes, Plant rooms with a high fire risks 120 mins and ESB sub-station is 240 minutes.

2.29 In addition to the above passive systems incorporated into the design, the station fire safety strategy considers several active systems compliant with relevant standards. These are Fire Detection Systems, Station Emergency Lighting, Evacuation Signages, Portable Fire Extinguishers, Fire Hose Reels, Automatic Sprinkler Systems covering station operation rooms, administrative areas, storage, cleaning facility and mechanical rooms, Gas Extinguishing Systems, Escalator Suppression Systems, Firefighting Water Tanks and Pumps and Standpipes, CCTV, PAVA, and Emergency Help Points.

2.30 Mechanical ventilation systems are provided within the underground stations to extract smoke arising from a fire within the station structure or when a train on fire arrives at the station. The ventilation system has been designed to overcome a Fire Heat Release Rate (FHRR) of 14.3 MW (Mega Watts) from a train. The smoke extract systems aid in smoke clearance and maintaining tenable evacuation conditions for occupants escaping from the stations.

2.31 **Tunnel Fire Strategy**

2.32 Design of the rolling stock aims to reduce the likelihood that a fire in the passenger compartment or underfloor could prevent the train from continuing to the next station. As described in earlier sections, the following mitigation measures are designed in to prevent a train stopping in a tunnel with a fire onboard.

- compartmentation between the train systems and the passenger carriage (to separate the passenger compartment from onboard systems),
- redundancy of onboard locomotion and control systems and construction of materials with favourable fire performance,
- onboard automatic fire detection and water mist suppression.

2.33 In the unlikely event that a train is stopped within the tunnel with a fire on board and is not able to continue, the tunnel section one side of the fire will be kept tenable by the operation of the tunnel ventilation system. This aids in the evacuation of passengers and staff, and for firefighting intervention. Firefighters can access the tunnel via shafts at stations, intermediate shafts, and portals.

2.34 The equipment along the track is required to operate the line and provided for the safety of passengers. Much of this equipment is made of metal and plastics which are non-toxic and flame retardant. Examples include the catenary system, the rails wiring and trays, lighting, jet fans in the tunnels, CCTV, and small sensors. The structures along the alignment including those in the tunnel sections have fire structural integrity and have been designed to be passable by evacuating passengers in between the rails or in between two tracks. Tracks are designed to be traversed horizontally at station ends or when approaching a station-end emergency stairs or an intervention shaft.

2.35 There are two means of egress for all occupants from the tunnels. These are spaced at 1km from each other as permitted by NFPA 130 standards. The EU TSI Safety in Railway Tunnels 2014 also supports an Intervention distance spacing of 1km as indicated in the EIAAR. Escape and Intervention points (Station End Shafts or others) provide ventilation, safe egress for passengers from the tunnel to the surface in an emergency, and access for the emergency services to the tunnel. At the intervention shafts and tunnels, the exits will be via emergency doors leading to the stairs and lifts. Most of the intervention points are integrated within the station layouts and incorporate the following elements.

- Stairs which are designed as two-way stairs sized for 28 persons/m/min.
- Firefighters' lifts for equipment and personnel and for the evacuation of people with reduced mobility. Ventilation system to maintain clean air in the shaft; and
- A specific refuge area for people with reduced mobility to assemble for access to the fire lift.

2.36 The tunnels are also equipped with a comprehensive range of fire safety systems compliant with standards that are used to assist with evacuation and intervention. These are Linear Heat Detection system, Tunnel ventilation Fans, Emergency and Maintenance Lighting, Emergency Signage, Standpipe for the Fire Service with sufficient flowrate and pressure, CCTC, PAVA and Voice Alarm, Emergency Help Points and Communication System, Blue Light Stations, Light Emergency Rail Vehicles for the fire service, differentiation between two sides of the tunnels, Electrical Isolation Equipment and Ambient Sensors such as Anemometers and Opacimeters. Detailed description of each of the safety systems for the Rolling Stock can be supplemented or discussed further with the Inspector if required.

## 3 Emergency Evacuation Strategy

3.1 The following section provides an overview of the emergency evacuation strategy from Stations and Tunnels as requested by the Inspector.

3.2 In the event of an incident, the staff working at the Operation Control Centre will primarily be able to direct the response through controlling aspects of the train service (such as opening and closing trains doors, and controlling lifts and escalators), monitor events through CCTV in the stations and on the trains, respond to fire detection systems and anti-intrusion alarms, direct staff working at the stations and present on the trains to mobilise to the incident site, and liaise with the emergency services. The main OCC facility is located at Dardistown depot while a back up OCC is provided at Estuary Station.

3.3 At each station, there will be also a station incident room located along the concourse level, which will be typically unattended during normal operation. The station incident room can be staffed locally to operate and control station systems, including associated sections of tunnel, without connection to the OCC during any emergencies or incidents. Dublin Fire Brigade staff or other emergency services staff shall be able to use the Station Incident Room during a fire emergency at any of the stations or tunnels.

### 3.4 Emergency Evacuation Strategy from Stations

3.5 The following section describes the steps that shall be followed during a fire emergency evacuation required at the stations. The evacuation strategy is supported by the station fire safety infrastructure and systems design provided within the project.

3.6 The train doors and platform screen doors are sized to enable rapid evacuation from the train onto the platform. The number and location of escape routes in the station have been designed to evacuate the station platforms in 4 minutes and to a Point of Safety (concourse level) within 6 minutes. This has been demonstrated through extensive emergency evacuation calculations carried out for each of stations. The station architecture varies slightly between stations but in general, there are three evacuation routes from both platforms, via the escalators and the stairs to the mezzanine and the emergency stairs platform-mezzanine-concourse-street.

3.7 The emergency exits consist of automatic openings at street level, provided with an electric or hydraulic opening system, as well as manual opening. The top of the hatches will be covered in pavement sets to match the surrounding streetscape.

3.8 The facilities available to the Dublin Fire Brigade will include the station incident room, a storage room and a mustering room located at the concourse level and at at the platform level next to the lift and emergency stairs. There are also lift and stairs provided for DFB for the purposes of intervention in the stations and tunnels.

3.9 A station fire could be identified in multiple ways, for example from fire detectors used in the stations, a passenger activating a push button, an OCC operator detecting a fire on CCTV or a passenger reporting a fire by station emergency phones or intercoms. Both the fire detectors and the activation of a push button alarm link to the OCC and the SCADA system will request confirmation to launch an evacuation. If an evacuation is required for causes other than a fire, the OCC operator will need to activate the evacuation scenario manually.

3.10 The following describes the protocol during a station fire.

i. OCC will be aware prior to train arriving at the station that a fire emergency protocol shall be activated which encompasses the below actions to be implemented.

ii. Release of security-controlled doors to facilitate evacuation from the station e.g., unlocking accesses and the doors to the technical rooms in the BOH.

iii. Escalators operating in the opposite direction to the egress will be smooth stopped.

iv. The PAVA system will broadcast pre-recorded messages to guide the evacuation.

v. Any equipment which can interfere audibly or visually with the alarm will be deactivated.

vi. All emergency lighting will be activated to provide maximum visibility for evacuation.

vii. The emergency exits for sub-surface stations consist of automatic openings at street level, provided with electric or hydraulic opening system, as well as with manual opening.

viii. MetroLink operational personnel will be moved to the affected station to guide and supervise the evacuation.

ix. Surface Roads shall be closed upon arrival of GARDA and Emergency Services.

3.11 If the incident is due to a fire in the station such as a baggage fire or any other electrical fire, then additional automatic procedures are as follows.

- Immediate notification to the emergency services (DFB, Ambulances and An Garda Siochana).
- Alarm transmission to the station used by means of visual and audible alarms.
- Activation of the gas extinguishing system if the fire starts in a technical room equipped with this feature.

3.12 Additional actions required in Underground station is additional to the above is as follows.

- The sprinkler system will be activated in the area in specific areas (BOH, escalators) where the fire has been detected.
- Normal HVAC operation will be stopped except in the technical rooms.
- The emergency smoke exhaust system inside the station will be activated; and
- The over-pressure system in the emergency stairs will be activated to keep them smoke-free.

3.13 Incidents will be managed from the OCC, with all incident-related information and a meeting and incident room made available for use by the Dublin Fire Brigade and other emergency services. If the emergency only affects one station and train movement along the system is not affected, the emergency services could decide to go directly to the affected station where they can use the local station incident room where the main information from SCADA will be mirrored, and all station systems can be controlled.

3.14 Extensive 3-Dimensional Computational Fluid Dynamics (CFD) modelling as well as 3D Emergency Evacuation Simulations have been carried out to study the movement of smoke and passengers during a fire. The simulations modelled comprise a train on fire arriving at the station or a fire within the station structure itself both of which demonstrate that passengers and staff can escape the stations safely in tenable conditions. The ventilation systems are demonstrated to be of adequate sizes and ensure that tenable egress routes are available at all stations for evacuation of passengers and staff.

3.15 **Emergency Evacuation Strategy from Tunnels**

3.16 The primary response in any tunnel fire scenario is for the train to continue to the next station. This will also be supported by visual signs/notes on the train for passengers which states that “safest point of evacuation is always achieved at the next station.”. This strategy is consistent with all other metros around the world. The probability of a train fire disabling the train and stopping within the tunnels is extremely low. Nevertheless, the fire strategy considers all events within its system design including the eventuality of train evacuation in the tunnels during a fire scenario.

3.17 In the tunnels, the operational procedures will ensure that there will be a maximum of two trains in each ventilated section, one facing each direction (i.e., that is either between two stations or a station and a ventilation shaft), so the maximum number of occupants that need to be evacuated would be two train loads. However, due to the operational capability of the automatic trains, in most instances, the non-incident trains can be reversed back out into the station. Two trains travelling in the same direction will not be within the same sections of a tunnel at a given time. Therefore, the likelihood of evacuation required from a non-incident train is very low.

3.18 In the unlikely event that a train stops on the track and must be evacuated, passengers will leave the trains via the front and/or rear doors, with ramps leading to the track slab as shown in Figure 3. Passengers will then move towards the nearest intervention shaft or station as directed by the OCC. The affected section of track will be declared unsafe to the signalling system so that other trains will avoid entering the section.

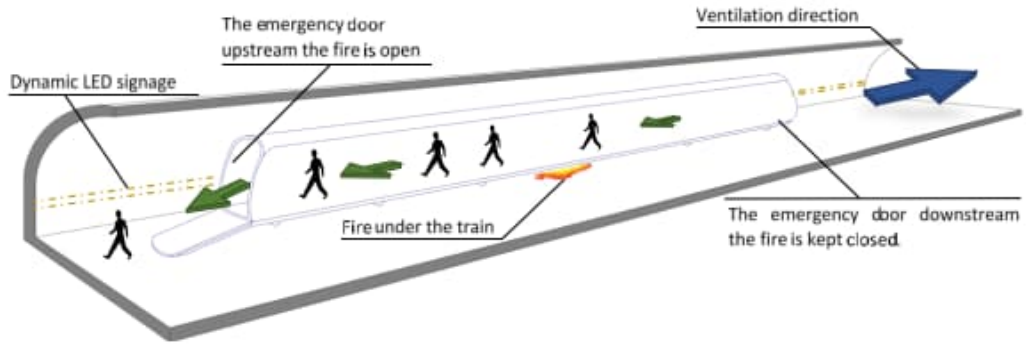


Figure 3 Evacuation from Train via Ramps

3.19 Forced ventilation will blow smoke in the opposite direction to the evacuation of passengers. Like in the case of a station fire, extensive 3-Dimensional Computational Fluid Dynamics (CFD) modelling as well as 3-D Evacuation Simulations have been carried out to analyse the movement of smoke and passengers during a fire in the tunnels. All the results obtained from the simulations demonstrate that passengers and staff can escape the tunnels safely in tenable conditions during this event thereby confirming a robust tunnel fire strategy.

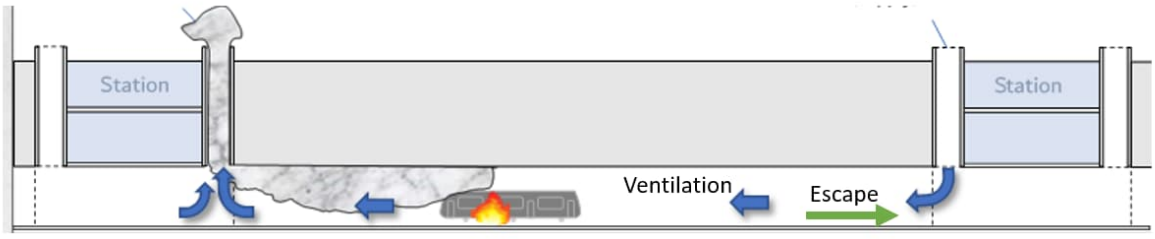


Figure 4 Tunnel Ventilation System that aid in escape and intervention.

3.20 The following describes the detailed emergency protocol during a train fire in the Tunnel sections.

- If a fire is perceived by passenger on board, they can trigger the alarm in the train, which enables OCC to contact the passengers via a two-way intercom.
- The OCC will be able to immediately investigate the problem through the CCTV and provide information to all passengers through the PAVA and Passenger Screen displays.
- If the fire is not perceived by anyone, the train has two detection systems: aspirating smoke detection (VESDA) and optical point-type detectors. A detection will be immediately report to the OCC.
- The train HVAC will stop, and the on-board Exhaust and Water Mist system will start dependent on the location of fire (on-board or outside car).
- Lighting will be reinforced inside the train by activation of the emergency lighting.

- The train is declared unsafe to the signalling system and the incident train will stop in the next station and will not move until allowed by the OCC operator. Other trains coming from behind, on the same track, will stop in pervious stations.
- Passengers will be informed that they need to evacuate from the next station and fire brigade, emergency services and Metrolink Staff will be informed accordingly.
- The train will then continue to move to the next station and begin immediate evacuation.
- If due to any unforeseen reasons, the train breaks down in the tunnel, all tunnel lighting will be evacuated indicating an evacuation direction pointing towards the nearest exit.
- The train will be isolated from the catenary and traction current disconnected and earthed.
- Tunnel ventilation system will be turned on to support ventilation.
- The evacuation doors will be opened while PAVA and PIS are used to inform passengers of the evacuation protocols.
- It is expected to take between 5 to 10 minutes to evacuate the train and up to 20-40 minutes to reach stations and evacuation shafts dependent on the incident proximity to stations.
- OCC will supervise the evacuation via on-board and tunnel CCTV.
- Metrolink personnel will arrive on site to assist with the emergency procedures.
- Surface Roads shall be closed upon arrival of GARDA and Emergency Services.

3.21 **Considerations for People of Restricted Mobility in the Fire Strategy**

3.22 The design of the fire strategy for the project fully considers requirements for People of Restricted Mobility. Chapter 6.8 of the EIAR “Access for all” elaborates on the features considered in the Station Architectural Design.

3.23 The design has been developed to meet all legislative requirements relevant to accessibility including the Disability Act 2005 and in turn the Sectoral Plan for Accessible Transport under the Disability Act 2005 (DTTAS 2012). The design shall also comply with Part M to the Second Schedule of the Building Regulations. The provisions hereby also assist in safe manoeuvre and access/egress of People of Restricted Mobilities (PRMs) both during normal and emergency operations.

- The floor of the train will be at same level as the platform.
- There will be a very narrow gap between the train and the platform.
- The interior is designed to ensure maximum visibility of grab rails and other features.
- Audio-visual information is provided on board and at platforms.
- All platforms incorporate ramps or lifts for access purposes.
- All platforms feature help points, which incorporate induction loops for people with hearing. impairments.
- Changes in level, platform edges and crossing points are highlighted using tactile paving.

- Audio and Braille guides are available as well as a tactile map of the system.

3.24 The evacuation protocol for PRMs for a train fire arriving at the station will be like other passengers. However, for those that are unable to use escalators or stairs, the station design considers evacuation lifts from each of the platform including refuge area for any occupants awaiting the lift cycle or unable to self-evacuate. The refuge area is fire compartmented from the platform.

3.25 The design of the tunnel tracks is based on the principle of an embedded trackway. As such, wheelchair users can travel either in between the rails or between two tracks in the tunnels. Where the tracks transitions on to crossings or intervention points, ramps and level surfaces are provided across tracks.

3.26 The fire Strategy makes provision for PRMs in the design by accounting for the following elements within the system design.

- Emergency doors within trains have ramps that enable alighting of PRMs (wheelchair bound) from the trains.

- PIS and user guidance systems along the line and inside the trains are designed so that they are clearly visible, even with their own lighting where possible. In addition, all egress routes (trains, tunnels, shafts, station stairs) are equipped with PAVA systems.

- Emergency panels on trains, which allow communication with the OCC, will have Braille text.

- Visual systems (displays, LED strips) will inform both inside the train and outside, in the trackway, on how to evacuate.

## 4 Fire Brigade/Emergency Services Lifts at Underground Station

4.1 The inspector has requested to include an explanation for the need for separate fire brigade/emergency services lifts at each underground station.

4.2 The problems associated with reaching a fire, and working near the fire, merit the provision of additional facilities to avoid delay and to provide a sufficiently secure operating base for the fire service to allow effective action to be taken. A firefighting shaft includes firefighting lifts, firefighting stairways, and firefighting lobbies which are combined in a protected shaft. In the case of a train fire arriving at the station or during a platform fire, the Fire Service require a smoke free path to enter the stations and provide rapid intervention, suppression, and rescue. The firefighting shaft is pressurised to prevent smoke ingress and allow smoke-free intervention routes for the fire service.

4.3 There are a total of two fire service intervention shafts (lift, stairs) that originate from street level and onto the platform and under-platform areas of the underground stations. The requirements for this are stipulated in Section 5. “Access to Buildings for Firefighting” of the Irish Building Regulations 2006 – Technical Guidance Document for Fire Safety. Section 5.3.2 states that all buildings with a basement more than 10m below ground, should be provided with firefighting shafts containing firefighting lifts.

4.4 Further to the above, BS 9999 and BS 9992 both of which provide extensive details on firefighting shafts stipulate the same requirement as the Irish Building Regulations. A minimum of two firefighting lift is required from the surface serving the lowest floors. The provision of this enhances rapid intervention of the stations and tunnels as described above. For Metrolink, an additional lift firefighting lift is also provided that connects the concourse level to the platform level as this provides further flexibility for the fire service to approach a fire. The provision of intervention lifts

serving the platforms are standard practice for design of modern metros most notably the Elizabeth line recently brought into service by the London Underground.

## 5 Intervention Shaft at Albert College Park

5.1 The inspector has also requested to include an explanation on the basis for, and location of 1 No. Intervention shaft at Albert College Park.

5.2 **Basis for and location of the ACP Shaft is as follows.**

- The Albert College Park Intervention Shaft is required to comply with the tunnel fire strategy for the MetroLink project. It is determined by the need to reduce the travel distance and thus time needed for occupants to escape from an incident in the tunnels and emergency services to reach an incident on foot carrying breathing apparatus and other equipment. The ACP shaft also assists in providing pressure relief during the normal operation of the line, and for ventilation for passenger comfort in normal day-to-day operations.

- The Fire Safety strategy for the single bore tunnels limits the length of the incident (train on fire) tunnel sections to a maximum distance of 1km.

- Most underground stations with the AZ4 section are within 1km of each other. As the distance from Collins Avenue Station to Griffith Park Station is approximately 1500m, this requires an Intervention Shaft to be inserted in between such that the intervention distance is less than 1000m from each of these adjoining stations. ACP Intervention shaft is within 500m from Collins Avenue and 100m from Griffith Park Station.

- The rationale and optioneering for the choice of this specific location from a constructability and Environmental perspective is provided in the EIAR and a chapter on ACP is provided in Appendix A8.16 of the EIAR submission. The current location of the shaft is complaint with the tunnel fire strategy developed for this project.

- The ACP shaft comprises of Tunnel Ventilation equipment like that provided in the stations, a firefighting and emergency staircase within a secure building and a fire brigade storage room. This dictates the footprint of the shaft and the associated ventilation buildings.

- The footprint of the shaft is comparable to other Metros in Europe and worldwide (Madrid Metro, Dubai Metro, Elizabeth line London). The compound for the shaft has been appropriately sized to accommodate vehicular access to maintain, service and if required replace tunnel ventilation and emergency access equipment.

## 6 Conclusion

6.1 The witness statement included above provides a comprehensive overview of the fire safety, emergency and evacuation strategy developed for the MetroLink project. It highlights that the fire safety provisions are developed in accordance with all the relevant legislation, standards, and International best practise guidelines. The design of the Rolling Stock, Stations and Trainway take due consideration of the requirements of the fire strategy which are robust and have been developed to be achieve the four pillars of the safety which are prevention, protection, planning and firefighting.

6.2 The probability of fire anywhere within the project is low, however, the safety systems provided can overcome the effects of fire should this ever occur. All fire safety systems provided by the design aid in rapid evacuation of passengers and staff as well as intervention from the emergency services. Fire Detection Systems, Fire Extinguishing Systems, Tunnel Ventilation Systems, Emergency Lighting, and all other Emergency Communication Systems have been designed to aid in the rapid evacuation of all passengers and staffs including People of Restricted Mobility (PRM).

6.3 TII have been and will continue to engage with Dublin Fire Brigade if the Railway Order is granted to ensure that the fire safety of the MetroLink project continues to be give the highest importance throughout the subsequent design and construction stages.