Manchester City Council

Our Town Hall

Building Services Design Summary

OTH-ARU-ZZ-ZZ-RPT-B-0047

Issue | 4 October 2019



OUR TOWN HALL PROJECT

ARUP

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Introduction

This report is provided in support of the Listed Building Consent application for the Our Town Hall project. The report provides a summary of the new building services systems and how the design of these systems has been influenced by the existing building. The outcomes of these designs are captured in the full building services documentation; however, the final technical documents do not always capture the reasoning that such approaches have been taken. The intention of this report is to provide commentary on the new systems and the reasons for such designs. The report includes references to the various detailed technical reports, specifications and drawings and which can be provided if required.

The design of the building services systems has been guided by Purcell in their role as Lead Designer, Architect and Heritage Architect. Their feedback regarding the heritage considerations has informed the development of the technical solutions through the design of the project. This report is intended to be a summary of the technical solutions that are being implemented. The appearance, visual and heritage impact of the overall solutions are addressed by others in various reports as follows:

- For overall approach and/or visual impact of the proposals refer to Purcell report OTH-PUR-XX-XX-RPT-A-0100 '*Design & Access Statement'*
- For heritage impact relating to the building services refer to Section 4 of the Purcell report OTH-PUR-XX-XX-RPT-Z-0103 'Heritage Impact Assessment: Manchester Town Hall' and the Purcell Existing Heritage Significance plan drawings.
- For layout of new exposed services in very high significance spaces refer to Purcell drawings series OTH-PUR-TH-ZZ-DWG-A-57xx

The works will require various samples to be submitted for approval as well as careful management of workmanship. This process will be managed by the Management Contractor, Lendlease. For further details of their approach please refer to Lendlease report OTH-LLC-XX-XX-RPT-W-0005 '*LBC Method Statement: Management of Construction Works*'.

This report should also be read in conjunction with the following documents relating to the building services:

- '*Heritage Lighting Strategy'* document reference OTH-ARU-ZZ-XX-RPT-E-0001, Arup
- *'Façade Lighting Strategy'* document reference OTH-ARU-ZZ-XX-RPT-E-0003, Arup
- '*Audio Visual Strategy'* document reference OTH-ARU-ZZ-XX-RPT-B-0002, Arup.

Refer to the full Planning Application and Listed Building Consent application for all supporting documentation.

2 Existing Building

This section briefly describes the technical building services strategy for the existing building. Please refer to the Purcell report '*Heritage Impact Assessment: Manchester Town Hall*' for the formal heritage assessment of the existing building. Also refer to Purcell for details of any heritage items that are being retained.

2.1 Existing Heating & Ventilation

Heating was provided by three hot-water boilers (one always being kept as reserve) located in the large sub-basement. The smoke from the furnaces passed through two wrought iron tubes placed within ventilating shafts with an intervening air-space for the extraction of vitiated air.

From the boilers, hot water pipes traverse the main rooms and corridors in channels below the floors and throughout the window side, with coils being placed in all convenient and desirable positions. On the inner side of the corridors, there are corresponding channels, covered with gratings, in which the gas pipes and other services were placed. The prisoners' cells were also warmed by the hot-water service.

Manchester Town Hall was originally designed for natural ventilation. Air bricks located on the principal floors (Ground Floor, Level 1 and Level 2) and the internal rising stacks within the chimney breasts were the two main parts of this ventilation strategy in winter.

On all principal floors, ventilation was provided by fresh air admitted behind the hot water pipes and coils, brought in through geometrical patterned apertures in the masonry under the window sills. Each room was ventilated into a shaft or flue running up to the roof between the various smoke flues, and by a ventilator placed over the corridor doors, which could be opened or closed at will. Rooms also had operable windows.

Other ducts for fresh air inlet were under the coils at the bottom of the wells of the circular staircases for the supply of warmed fresh air to the corridors.

The Police Office and other rooms in the central block were ventilated into two large shafts which all contained the smoke flues for the heating boilers.

Currently, a number of the ventilation openings and internal rising stacks are blocked and not all existing windows can be opened.

Although some of the existing heating pipework was replaced in the mid 70's, it is understood that most of the pipework is in poor condition due to corrosion on the internal walls of the pipework. There are leaky joints, some of which have been replaced while some branches are isolated and capped off due to this reason. It is apparent that this is an ongoing maintenance issue due to joint failure on remaining sections of old cast/ductile iron pipework.

It is understood that the distribution routes have been changed or isolated and blocked within time. As a result, the current heating distribution routes are difficult to follow, access and maintain. The existing heating pipework is uninsulated and therefore not efficient.

2.2 Existing Lighting

The Town Hall was originally lit by gas lights. The Town Hall was advanced in its technical developments with it being one of the first buildings in Manchester to be electrified and adopting the rare externally frosted lamps. When luminaires were electrified, the 'light bulb' often remained bare, in no housing, to create a showcase of the technological advancements of the building.

Refer to the Heritage Lighting Strategy document (OTH-ARU-ZZ-XX-RPT-E-0001) for more information on the existing lighting.

The Town Hall first began the electrification process in 1893 and was completed circa 1920 with a phased electrification process. A few gas lanterns were never converted to electric (Tier 1A). The most significant heritage luminaires are those that were installed during the original building construction as gasoliers / gas burners and those that were added during the electrification process.

The existing lighting has been categorised with a tier rating; Tier 1A and 1B are original gas lights, original electric lights or gas lighting converted to electric. Tier 2A and 2B are lights that were installed up until 1938. Tier 3A and 3B are lights that were installed after 1939. All Tier 1 and 2 luminaires will be restored, and all Tier 3 luminaires will be removed.

Recently the Town Hall converted some of their lamps to retrofit LEDs. There are a number of issues surrounding the retrofit lamp solution including; colour shift, maintenance frequency, flicker, minimal controls, poor colour rendering.

2.3 Existing Power, Comms & ICT

The building was originally not electrified, and we understand that the building sourced power for lifts, ventilation equipment, the organ and clock workings etc. from the Manchester hydraulics network - there is also mention of a pneumatics network / vacuum network, however we are unsure where Manchester Town hall was connected to these. One of the existing hydraulic pump-sets can be found at Lower Ground Floor on the Lloyd Street elevation – we believe this was for hydraulic coal lifts.



Figure 1 - Existing hydraulic pumpset at Lower Ground Floor



Figure 2 - Existing hydraulic pipework at Lower Ground Floor

The building does have original battery-powered bell systems, elements of which still exist.



Figure 3 - Existing bell pushes, in Level 1 Committee Room



Figure 4 - Existing bell mechanism, in Ground Floor outside Room 134 (**caution this is potentially dangerous**)

The building was home to Manchester Corporation and as such the Electricity Board and the Electricity Showroom. It was therefore a very early adopter of electricity in Manchester, sourcing its power from a local power station on Dickinson Street – the building still exists, and is a bulk supply point to the city, and also home to Electricity Northwest's control centre.

We understand that the building originally received low voltage direct-current supplies, these changing to low-voltage alternating current supplies (some of which are still present entering the building, and live, in a somewhat dangerous arrangement!). In the early 1960s a 6.6kV high voltage supply was sourced from what is now Electricity Northwest, and a substation integrated in to the Lloyd Street side of Lower Ground Floor, in a manner which not only blocked the original corridor but has smashed large holes in existing walls and destroyed some of the existing arches.

There were no in-built pathways in the Town Hall for electrical services. We understand the building was electrified in phases, and in some cases the electrical services have been installed relatively sympathetically in existing pathways, including existing coal lift shafts (Central Block), existing gas pipework distribution trenches and within existing gas pipework which is embedded in to mosaic floors and surface mounted on walls in staircases etc. Within areas of higher significance, with stone, papered or tiled finishes, surface-mounted mineral insulated copper clad cabling installations have been utilised, and installed very sympathetically, with great care and attention – whilst it is not proposed to re-use this cabling due to its age, the fixings will be re-used where feasible. However, the vast majority of electrical installations have been added in a very much haphazard an unsympathetic manner.

Whilst it is not thought any of the electrical services are original from the late 19th Century, there is certainly evidence of some wiring systems which are over 60 years old (i.e. prior to the introduction of PVC cabling in the 1970s) including vulcanised Indian rubber (VIR) cabling and some instances of fabric covered cabling – this is totally at the end of its life, and potentially a great fire and electric shock risk.

There have been numerous re-wires of the building, including substantial re-wiring in the 1980s and also more recently within the last 5 years, where very dangerous installations were found, particularly at Lower Ground Floor. However, the electrical distribution equipment (distribution boards etc.) is totally at the end of its life, non-compliant with modern standards and poses a potential fire risk – asbestos is also commonplace in switchgear of this age.

Telecoms and ICT installations have been installed over the years. Due to the nature of such installations, and the numerous advancements in technology and greater requirements, these installations have been added to numerous times, with the original installations left in place. In many cases, the telecoms cabling is installed on existing joinery, which has in turn been painted over numerous times, and as such is challenging to remove without causing damage.

2.4 Existing Water & Drainage

It is unclear from the historic information available, but it is very likely that the Town Hall will have originally been supplied with cold water direct from the mains, or from gravity tanks at the highest levels which were supplied directly from the mains.

Over the years (partly due to water companies reducing the pressure in the mains) this has been modified and the current system includes a storage tank and pumpset at Lower Ground level which supplies multiple tanks at higher levels which subsequently feed fittings via gravity.

Hot water is generated local to the fittings that require a hot water supply. This has led to multiple hot water systems being installed within the building.

The drainage design was carried out at a time where it was common to combine foulwater (sanitary) and rainwater together above ground. This practice has since been amended and modern buildings attempt to keep foulwater and rainwater separate above ground.

The Town Hall was originally designed with limited sanitary drainage provision compared to modern day standards. It is clear that the existing above ground sanitary drainage system in the Town Hall has been continually amended and extended throughout its working life as the current installation is quite different to that shown on the Waterhouse drawings. There is a mixture of pipework materials used throughout the building including lead, cast iron, HDPE and PVCu.

The Town Hall has an extensive rainwater disposal system which includes decorative rainwater pipework on the external façades around the perimeter of the building and within the courtyard. There are over 100 existing rainwater downpipes. Each downpipe discharges to the below ground surface water drainage system either via a direct connection or by discharging over a grated gulley within the moats which are connected to the below ground surface water system. When the Town Hall was designed, the rainwater design standards

would have recommended a peak rainfall intensity of 75mm/hr, which is a lot lower than modern day standards (208mm/hr).

2.5 Existing Fire Suppression and Natural Gas

The Town Hall is currently served with a natural gas system from the main in Princess Street. The gas currently serves the boilers, the kitchen block, hot water generation plant and gas fires. It is assumed that the gas distribution pipework to old gas fires has been isolated and purged - this needs to be verified during the strip out works.

2.6 Existing Life Safety Systems

The Town Hall is currently served by three wet rising mains. This is an old type of fire suppression system that has been superseded in the majority of buildings by wet risers or dry risers.

A wet rising main is connected directly to the town main to ensure that the firefighting rising main within the building is constantly charged with water. This is dependent on the town mains being able to deliver enough pressure to provide adequate water supply to the outlets at the top of the building. With water companies reducing the pressure that they deliver to buildings, wet rising mains are becoming increasingly rare to install.

Within each firefighting core the wet rising main includes distribution pipework with a landing valve located at each floor level, excluding the entry level. The landing valve is an outlet from the rising main which allows the fire brigade to connect their hoses in order to obtain the water they require to fight a fire.

There have been numerous fire detection & alarm system installations over the years, with the most recent installation being installed in the early 2000s. The existing installations have in general not been removed, leading to some spaces have three different fire alarm installations!

Emergency lighting and exit signage has been added in more recent times, in some cases in a sympathetic manner, and in some cases in a very unsympathetic manner. The installations are somewhat substandard compared to modern requirements.

Automatic opening vents are provided at the top of the Centre Block stairs and also to the top of the three spiral staircases. These make use of the original Waterhouse strategy for ventilating the building through these stacks, to provide smoke ventilation in the event of a fire. This strategy will be re-used in the proposed design, alongside additional smoke ventilation systems required to comply with modern standards.

2.7 Existing Lifts

As far as we are aware, the building was not designed with passenger lifts, however, there were small goods lifts provided, primarily for the movement of coal within the building – these are thought to have been powered from the Manchester hydraulics network.

Lifts have been added to the building over the years, and include the following:

- Lord Mayor's lift – thought to have been introduced soon after the building was electrified in the early 20th Century.
- Dumb waiter adjacent to the Lord Mayor's lift – unclear when this was introduced but replacing what was likely a coal chute.
- Goods lifts serving the flying kitchen – thought to have been installed in the last phase of the kitchen installation in the 1970s.
- Central Block and Albert Square passenger lifts – installed in the 1980s.

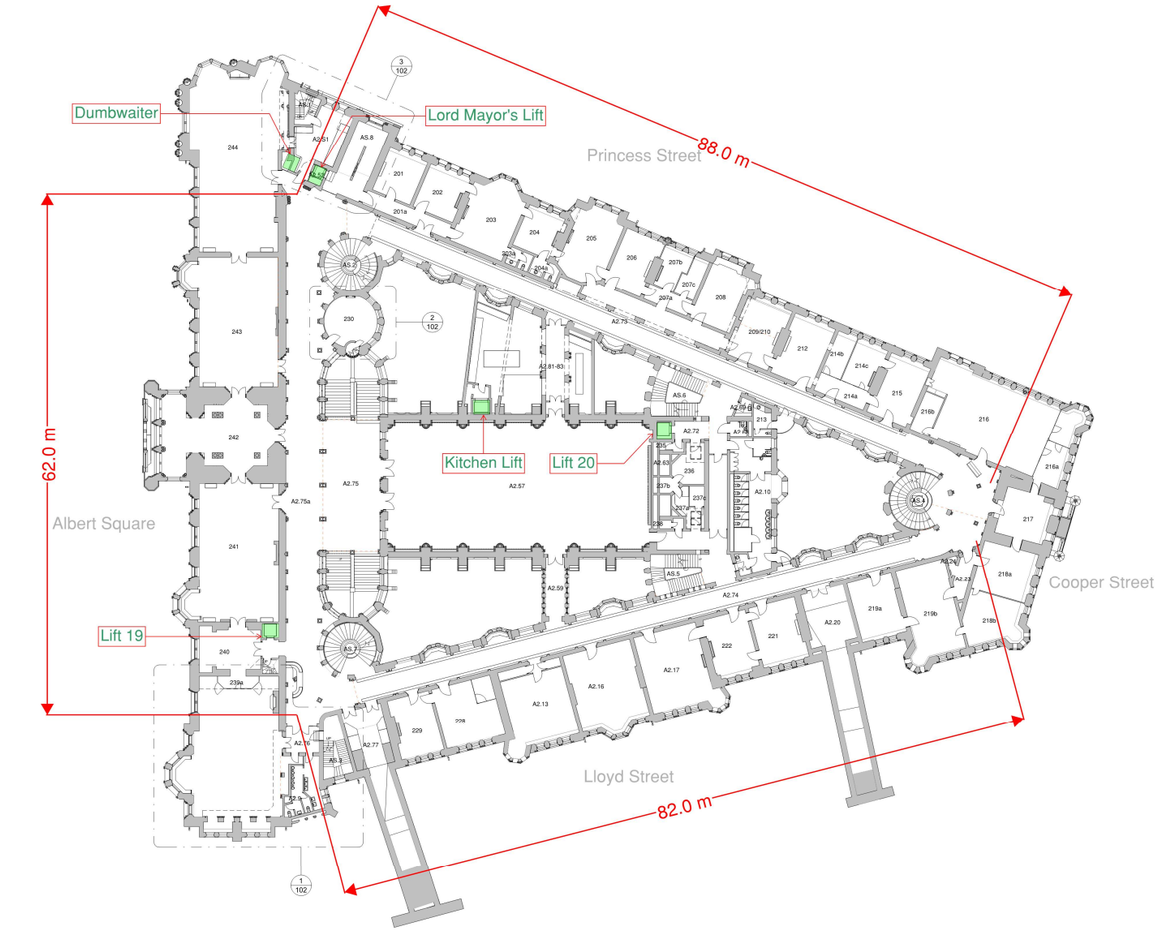


Figure 5 - Existing lifts

3 Strip Out of Existing Services

The building construction dates back to the 1870s and it is thought that there has been no wholesale replacement of the building services in its lifetime. A key goal of this project is for the complete replacement of all building services installations. It is intended, where possible, that the new building services installation re-use the existing building services routes and penetrations. This requires the removal of the existing services in order to facilitate this approach.

The existing building services are installed in a haphazard manner with limited or no labelling (or where provided it cannot be relied upon) and no record information is available. Strip-out works will not commence until it can be confirmed without any reasonable doubt that all services within the space have been traced, isolated and proven dead.



Figure 6 - Example of existing services within an old gas distribution trench within the main circulation corridors

The intention of the project is for the complete strip-out of all existing services in the building, except where the services are embedded in the building fabric and removal would cause excessive damage to the building.

The exceptions to this are leased areas such as the Metrolink SER. These areas will not be stripped out - they will be protected and retained.

The strip out will include the isolation, strip-out and disposal of building services including primary plant, primary and secondary distribution systems, in-room installations, fixtures and fixings. The strip-out of services will be carried out in a way that is sympathetic to the historic nature of the building, so as not to cause damage to the existing fabric or finishes. Lendlease will be responsible for the management of trade contractors and their development of method statements for approval. Refer to Lendlease report OTH-LLC-XX-XX-RPT-W-0005 '*LBC Method Statement: Management of Construction Works*' for details of how works will be managed.

All existing lifts and associated building services will be stripped out.

Existing services which are affixed to stone / brick / tile / ornate plaster will be unscrewed so as to minimise damage to the building fabric. Existing plugs or similar will be retained within the building fabric for re-use where appropriate. Existing cabling and pipework which is embedded in the fabric of the building will be cut back as close as possible, terminated so it could never become live and labelled accordingly as dead at both ends.

Existing cabling and pipework which is over-painted to items such as joinery shall have the paintwork cut prior to the services removal, so as to minimise damage to the joinery.

It is proposed that non-structural floors will be carefully lifted in areas where building services are thought to have been installed, so as to allow the services to be removed in their entirety. These areas will be identified through identification of service penetrations in to floor trenches, conduits / trunking emanating from the floor, floor boxes etc.

The heritage significance of the existing building services has been considered. The significance has been reviewed with the Purcell team and items which are to be retained have been identified. Refer to Purcell for details of heritage items to be retained. Existing building services which are of heritage significance generally fall in to three categories:

- Building services which are to be carefully removed from the building, put in to safe storage, and then returned to the building as a non-functional device – such examples are the radiators at the base of the spiral staircases.



Figure 7 - Existing heat emitter at the base of the Cooper Street spiral staircase

- Building services which are to be carefully removed from the building, put in to safe storage, repaired and refurbished and then returned to the building as a functional device – such examples are heritage luminaires.



Figure 8 - Existing luminaire which has been electrified

- Building services which are to remain on site, but are to be protected during the works, and then re-used as a functional or non-functional device – such examples are the existing gas pipes on the spiral staircases.



Figure 9 - Existing gas pipe, now used as conduit

All requirements for making good of the building fabric following removal of the building services are specified by Purcell.

4 Requirements for new Building Services

As described in the MCC project brief *"Our Town Hall was built in an era when internal lighting was achieved by gas mantles and heating was by coal fired boilers. Whilst the building benefits from some natural talents, such as large, exposed thermal mass and inherent ventilation characteristics, it is fair to say that its design does not easily accommodate a modern MEP [*Mechanical, Electrical & Public Health*] installation.*

In order to equip the building to serve the future needs of its many visitors, users and ultimately Manchester City Council, it is essential that reliable and energy efficient building services installation is provided.

The building services installation must be designed to be easily adaptable to the future needs of the City, whilst carefully respecting the important heritage of this magnificent Grade I facility."

The scope of the building services strategy is for a complete replacement of all building services systems. The design of these new systems aims to address the following objectives.

- *replacement and upgrade of electrical systems;*
- *replacement and upgrade of existing heating system;*
- *replacement and upgrade of ICT infrastructure;*
- *design solutions and interventions to enable inclusive access and use;*
- *provision of physical fire safety and security solutions;*
- *upgrade of existing drainage systems for Albert Square and Town Hall;*
- *provision of power, data and water to Albert Square;*
- *upgrade of street lighting to 4 elevations;*
- *upgrade of existing lift provision; All lifts are replaced in their entirety – and existing lift shafts are not utilised to house new lifts (but will be re-purposed as service risers etc.).*
- *provision of additional lifts in new locations;*
- *provision of new production and delivery kitchens;*
- *provision of visitor exhibition space;*
- *provision of new welfare facilities (WC's and break-out/brew point areas);*
- *provision of signage and wayfinding;*

4.1 Delivery objectives

The MCC project brief identified the following delivery objectives for the building services systems:

*The building services installation will meet the following objectives in a **reliable and energy efficient manner**:*

- *provide **a comfortable environment**, suitable for the task or function being carried out;*
- *ensure delivery of all necessary sanitation provisions, including cold water, hot water and sewage systems;*
- *ensure the distribution of electrical energy to point-of-use areas in a structured, and adaptable manner;*
- ***illuminate the general building** and, specifically, all work surfaces to an appropriate lux level;*
- *ensure compliance with statutory requirements for emergency lighting provision;*
- *allow local and centralised regulation of lighting levels and settings via digital control system; Specific requirements for centralised lighting control requires further discussion with MCC.*
- ***naturally ventilate the building wherever possible**, but provide mechanical ventilation, broadly in-line with Building Regulation Part F (2010), where required;*
- *provide building fire detection and alarm facilities to a minimum standard of BS589:2013 Part 1, L2; A BS 5839-1 Category L1 automatic fire detection and alarm system will be provided.*
- ***create a safe environment** through use of technology, including CCTV cameras and access control;*
- *provide **high-speed connectivity** to the ICT systems, through a robust structured cabling / Wi-Fi system; and*
- *allow comprehensive environmental and energy consumption monitoring through sophisticated control systems.*

4.2 Considerations

The MCC project brief identified the following considerations for the building services systems*:*

- *Systems will be selected from **standard product ranges** wherever possible; bespoke solutions should be avoided unless specific building or heritage constraints dictate.*
- ***Use of low energy fittings and appliances** wherever possible, including high efficiency motors and light-emitting diode (LED) lighting technology.*
- *System commissioning will be undertaken in a thorough and comprehensive manner, with **all key systems fully witness tested** by an independent commissioning manager.*
- *Building services technology systems such as the BMS systems and security management platform will be capable of **full integration with the site-wide solutions** deployed with the Town Hall Extension and Central Library.*
- *The installation will be designed to allow an interface to the planned district heating network and to benefit from the supply of electricity generated by the network, via a private wire arrangement.*
- *Accurate, electronic asset data and operation and maintenance documentation will be provided to allow the efficient on-going operation of the building. In order to achieve this objective, a comprehensive update of all documentation will be undertaken at the end of the defect liability period.*
- *Operational staff familiarisation is key to ensuring that systems are managed correctly. Suitable training programmes will be developed which incorporate design process involvement and hands-on engagement in the commissioning process.*

Sustainability Objectives

With regards to meeting the sustainability agenda, the designer should embrace the following hierarchy which has been developed through experience gained from wider complex development:

***Lean, green, mean** – the designer should look to minimise the energy footprint of the building by innovative design, introduction of insulation materials and specification of high efficiency equipment. In simple terms, the lower the energy demands of the building, the less reliance on generation techniques.*

***Keep it simple –** whilst sustainability is high on the agenda, Manchester City Council have to consider the operational and commercial issues of operating a complex building services installation. Therefore, all solutions developed to serve the Town Hall's lean energy footprint will be simple to operate and maintain.*

***Innovate** – Manchester City Council are keen to embrace innovation and new technologies.*

4.3 Heritage Management Plan requirements

The Heritage Management Plan makes reference to specific requirements for Building Services provision. Refer to the Purcell report 'Building & Environs Heritage Impact Assessment' for details of the specific response to heritage requirements.

4.4 Technical Requirements

The installed services will comply with the latest versions of all relevant British, European and International standards summarised below. There are no relevant Manchester City Council installation specifications for use on this project.

- Requirements of Statutory Authorities
- Local Byelaws and requirements of Local Authorities
- British, European and International Standards
- The Institute of Engineering and Technology documents
- The Institute of Electrical and Electronic Engineering documents
- Building Regulations
- The Health and Safety at Work Act 1974
- Chartered Institute of Building Services Engineers (CIBSE) Codes / Guides / Memorandums and Practice Notes
- Society of Light and Lighting (SLL) documents
- The Building Services Research and Information Association (BSRIA) documents.
- The British Research Establishment (BRE) documents
- Requirements of local utility providers
- Manchester City Council Design for Access 2
- The requirements, if any, of Manchester City Council Licensing Department.

The detailed requirements for specific spaces have been defined by the Functional Advice Notes provided by MCC and agreed by the technical responses provided by the design team.

4.4.1 Heating, Cooling & Ventilation

The design is based on appropriate environmental design criteria from CIBSE. This considers external design temperatures (including future anticipated temperatures), permissible overheating criteria, occupancy of spaces and ventilation rates.

Outdoor air supply and ventilation rates will be provided to ensure compliance with the requirements of Part F of the Building Regulations. Air change rates will be provided to satisfy as a minimum:

- Outside air 10 l/s minimum per person (or equivalent air quality via natural ventilation)
- Ventilation, cooling and heating strategies.

Kitchen ventilation and extract rates are increased to suit the specific use of the catering spaces.

Mechanical equipment and systems will be selected to ensure the room noise ratings achieve acceptable criteria for the use and function of each room. In addition, the mechanical equipment will be selected to ensure that external noise levels do not exceed a level to be agreed with the local planning and building control authorities.

4.4.2 Power & Electrical distribution

The electrical installations will be completely replaced as part of the works. Where feasible, existing services pathways will be utilised.

The electrical systems will be designed, installed and constructed in accordance with the latest edition of the IET Requirements for Electrical Installations (BS 7671: 2018) and all guidance notes.

Consideration will be given to reduction in the likelihood of fire emanating from electrical installations through the choice of cabling and containment systems and where deemed necessary through the introduction of residual current devices (RCDs) and arc fault detection devices (AFDDs).

4.4.3 Life safety systems

A BS 5839-1 Category L1 automatic fire detection and alarm system will be provided. Detection is provided to suit the fire strategy for the building.

A combined disabled refuge emergency voice communication system / disabled toilet alarm system compliant with BS 5839-9 will be provided within the building to suit the proposed disabled refuge locations and the

proposed facilities for mobility impaired persons including accessible toilets, accessible showers and Changing Places.

An emergency lighting and exit signage installation compliant with the requirements of BS 5266, BS EN 50171 and BS EN 1838. Where feasible within areas of higher significance, emergency lighting will be provided from the general lighting luminaires, so as to avoid providing dedicated emergency luminaires.

Smoke ventilation and staircase pressurisation systems will be provided as required by the fire strategy and as outlined in BS 9999 and Building Regulations Approved Document B.

A diesel life safety generator will be provided at Lower Ground Floor, with an exhaust flue routed to the roof. Refer to Arup report OTH-ARU-ZZ-XX-RPT-M-0001 '*OTH Ventilation Statement'* for ventilation layouts.

4.4.4 ICT

The ICT cabling will comply with current ratified standard EN 50174-1 - Information technology – Cabling Installation Specification and Quality Assurance, and relevant standards introduced through contextual relationships of the standards series. Also the latest ratified standard BS EN 50575 - Power, control and communication cables, cables for general applications in construction works subject to reaction to fire requirements.

The cabling design and installation will adhere to the current ratified version of BS EN 50173 and BS EN 50174 standard series and all inter-related standards documents referenced.

Fixed cables will meet the requirements of Euro Class Construction Product Regulations (Cca rating).

All other cables within the external fire barrier including patch cords shall meet the minimum requirements of BS EN 60332-1-2.

4.4.5 Electronic Security Systems

Electronic Security is captured separately, as part of the overall Security Strategy report. Distribution of this will be managed in accordance with Manchester City Council's Security Aspects Letter. A brief precis of the systems in use, mounting methodologies and images of indicative products are provided within this document.

Electronic security designs will adhere to the following guides and standards:

- Secured by Design
- BS EN 62676-4: Video surveillance systems for use in security applications.
- BS EN 50131-1: Alarm systems – intrusion and hold-up systems.
- BS EN 60839-11: Alarm and electronic security systems. Electronic access control systems – application guidelines.

4.4.6 Audio-Visual (AV)

MCC have signalled a desire to have induction loops where possible to minimise differentiation which can be associated with neck loop receivers. Induction loops are not possible in all spaces due to interference between vertically stacked rooms, and provision of installed loops will be prioritised for larger rooms where high background noise levels are expected and a greater number of unplanned public attendees are expected.

All designs will adhere to the following standards:

- Relevant BS standards and relevant health and safety regulations
- Technical Standards for Places of Entertainment. As published by: The Institute of Licensing, The District Surveyors Association and The Association of British Theatre Technicians. Entertainment Technology Press Ltd, 2015
- BS 7671: 2018 Requirements for electrical installations - IEE Wiring Regulations - Eighteenth edition
- BS 9999: 2017 Code of Practice for Fire Safety in Buildings
- BS 8300: 2018 Design of buildings and their approaches to meet the needs of disabled people – Code of practice.

Products will be CE marked and comply with relevant European directives, including:

- Machinery Directive 89/392/EEC
- Electro Magnetic Compatibility Directive 89/336 EEC
- Electrical Equipment Directive 73/23/EEC
- Building regulations and Local Authority Building Control requirements
- Construction design and Management Regulations 2015 (CDM)
- Relevant EIA-TIA, IEEE and ETSI data standards.

4.4.7 Lighting

The following design objectives have been adopted in the lighting design:

- Heritage significant luminaires will be retained and restored
- Where a space is to be restored and there is 'compelling evidence' of a pre-1938 lighting installation, a replica will be installed
- Any new luminaires will be clear as a modern intervention
- Lighting treatment will emphasise and define architectural features and monuments
- Lighting installations will be sympathetic to the architectural aspirations, heritage and building fabric
- Flexibility and controls will be incorporated into the lighting scheme appropriately via a wireless control system
- Light sources will assist in 'future-proofing' the building, have high energy efficiency and intelligent controls
- The lighting strategy will minimise maintenance burden and operational costs where possible by using high efficiency light sources and rationalising the range of luminaire types.

The lighting will be designed with reference to with the following guides and standards:

- CIBSE SLL Code for Lighting
- CIBSE SLL Lighting Guide 6: Exterior environment
- CIBSE SLL Lighting Guide 7: Lighting for museums and art galleries
- CIBSE SLL Lighting Guide 8: Lighting for offices

- CIBSE SLL Lighting Guide 12: Emergency lighting
- CIBSE SLL Lighting Guide 14: Control of electric lighting
- CIBSE SLL Lighting Guide 16: Lighting for stairs
- British Standard EN 12464-1: Light and Lighting - Lighting of indoor work places
- British Standard EN 12464-2: Light and Lighting- Lighting of outdoor work places
- British Standard EN 5489-1: Code of practice for the design of road lighting
- British Standard EN 5266-1: Emergency Lighting
- British Standard EN 1838: Lighting Applications- Emergency Lighting.

There are a number of areas where lower illuminance levels and uniformity values to those proposed in the guidance documents listed above will be provided. This is in response to the unique characteristic of the internal spaces, where excess light would be detrimental to the visual experience. These areas are highlighted in the lighting drawings and will be applicable to the main corridors, spiral staircases and main staircase. This strategy has been informed by the existing baseline conditions, the project aspirations to maintain the and restore the original character of the building, and the following principles:

- Glare

  Glare is a key existing problem within the corridors due to the high levels of contrast between the current luminaires and their backdrop. One objective of the new design will be to minimise glare which will enable easier visual adaptation and comfort and therefore improve orientation in the space.

- Lighting Quality

  The lighting quality will be improved. An improved colour rendering index (CRI) will help to accurately depict the colours in the mosaics and other interior finishes and assist in orientation around the circulation routes.

- Baseline Lighting Levels

  The recommendations for the proposed lighting levels will be above the baseline lighting levels. There will be an improvement to the current conditions.

- Historical Aspirations

  The Town Hall was originally designed to have the appearance and feel of ‘gloomth’, appropriate levels of shadow and contrast will be maintained to define the sense of volume and modelling of the architecture, wherever possible, to protect the historical aspirations of the building.

- Heritage Limitations

  The heritage fabric of the Town Hall will provide limitations to possible additional mounting locations in a number of areas. The addition of new luminaire positions will be limited to reduce the potential damage to the heritage fabric.

- Emergency Lighting

  Relaxation of the general lighting illuminance levels and uniformity was presented to Building Control during an engagement session. It was agreed that if the emergency lighting levels are achieved, then the general lighting levels can be relaxed.

4.4.8 Lifts

The key objectives from the MCC project brief for lifts are as follows:

- *Develop a robust strategy for lifts which is integral to the overall building access strategy and is appropriate to the Grade I building and the anticipated uses.*
- *Lifts proposals should be co-ordinated and contribute to the fire strategy, particularly for evacuation.*
- *Lifts proposals and the detail of the lift design should contribute to compliance with the Equality Act and improve accessibility.*
- *Lift positions and prominence should improve building circulation and orientation.*
- *The lift proposals will need to be coordinated with the catering, event servicing and operational strategy to ensure that all building operations are accommodated for, e.g. for lift provision to be sufficient between a production kitchen and a finishing kitchen.*
- *There is a strong desire for all building visitors to be able to use the ‘front door’ equally, i.e. the entrance from Albert Square. The vertical transport strategy must therefore address this issue.*
- *The new vertical transport strategy should seek to provide mechanical access to all levels of the building (up to Level 7 – renumbered floor level from the original brief document).*
- *Initial studies have indicated that the existing provision should be upgraded to current day standards (where practical).*
- *Consideration shall be given to the introduction of new lift provision within the Town Hall in order to enable diverse and flexible future use of the building entrances. If the team considers that new provision is required, they shall develop a strategy accordingly.*
- *Lift cars shall be suitably robust for the application, whilst presented in a manner which reflects the significant status of the building.*
- *Lift motor technology shall be energy efficient, in keeping with the sustainability strategy for the refurbished facility.*
- *All lifts must incorporate reliable communication technology for emergency situations and must provide comprehensive fault reporting capabilities.*

The OTH design team conducted a review of the existing lift provisions and noted the following:

- Universal access is only provided to the Lloyd Street entrance, with all other entrances being inaccessible for mobility-impaired persons.
- There is no lift access available to existing Level 7 or 8.
- The movement of goods within the building is very challenging due to the absence of any reasonably sized goods lifts, meaning the majority of goods have to be manhandled up the stairs – potentially causing damage along the way.
- The Lord Mayor’s lift provides little benefit, since it doesn’t go down to the entrance level, and it would require invasive work to alter this to make it reach the entrance level.
- The dumb waiter could be considered useful for movement of small goods – but this depends on the adjacencies of the spaces.
- The goods lift has been non-operational for some time and is detrimental to the building.
- The Central Block and Albert Square passenger lifts are far too small to comply with modern requirements, and their positions lead to confusing navigation within the building (the Central Block lift

connects to existing Level 0, 1, 2, 3 and 5 whilst the Albert Square lift connects to existing Level 0, 1, 2, 4 and 6. The Central block lift blocks one of the entrances to the Great Hall.

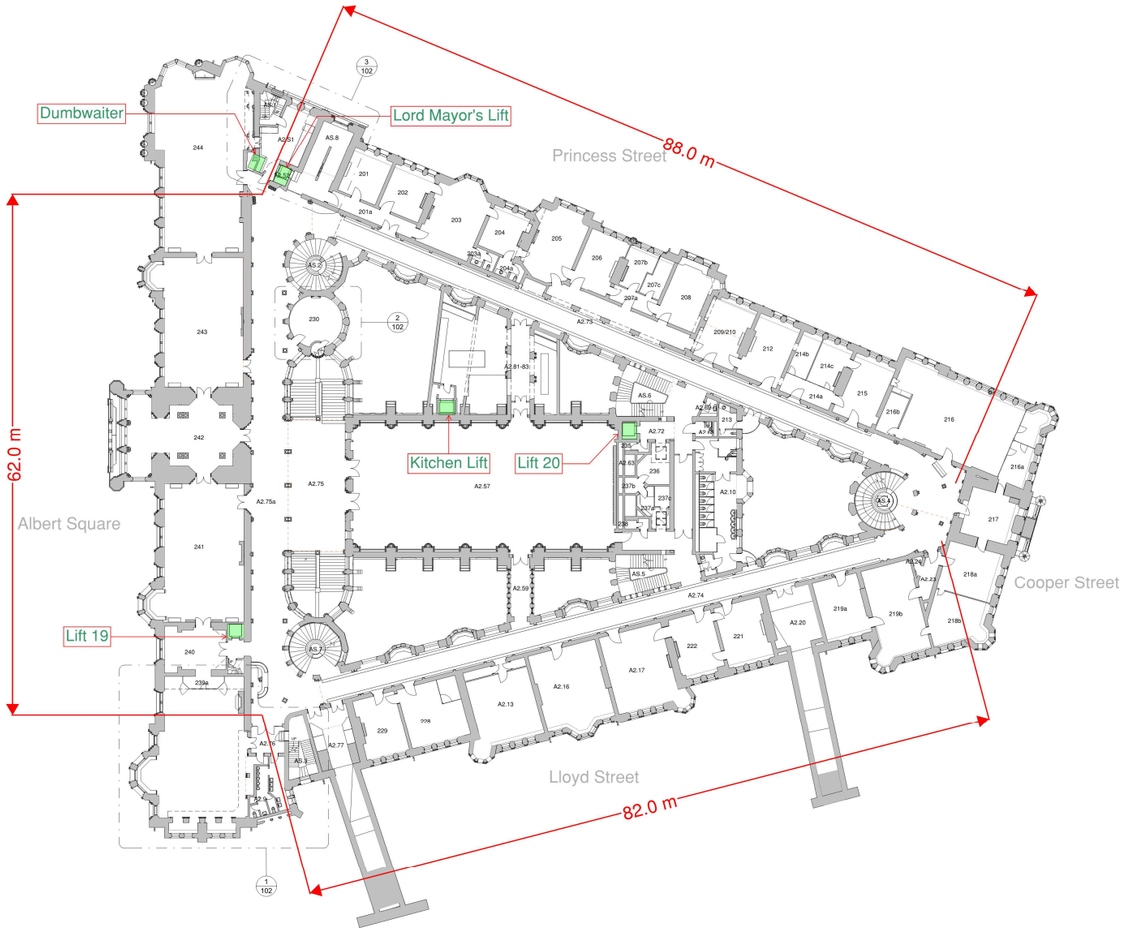


Figure 10 - Existing lifts

The team considered the key drivers for vertical transportation within the building:

- To provide universal access to more than one entrance.
- To provide universal access within the building for wheelchairs and electric mobility vehicles to all occupied levels.
- To provide the ability for the safe movement of goods within the building.
- To provide, where feasible, fire-fighting and evacuation lifts, compliant with modern standards.
- And, at MCC's request, to provide the ability for the safe removal of a person by stretcher from the main occupied levels.

The team carefully considered the potential locations for new lifts shafts, noting that none of the existing were suitable for re-use, because of their size of position. Key considerations in sighting new lift shafts were as follows:

- Minimising the impact on building fabric which is of heritage significance.
- Providing the minimum quantity of lifts needed, whilst not adversely affecting the operation of the building, but while locating them in positions which provide the best connectivity, acknowledging the building's split levels.
- Locating lifts where they do not detract from the heritage nature of the building (locations developed by Purcell).
- Locating lifts alongside new / upgraded staircases, so as to provide evacuation and fire-fighting facilities which are where feasible compliant with modern standards.
- Avoiding having lift motor rooms, where feasible.

It is commonplace in new buildings to complete a lift traffic analysis to determine the required quantity, capacity and velocity of lifts to suite the required building occupancy and arrival / departure rates. However, such a methodology is not feasible for a heritage building, and an inverse lift traffic analysis was carried out, to determine the average waiting time which would be present at each lift which is proposed. This in turn fed in to the architectural stacking of the building, driving the need for areas of the building with high arrival (or departure) rates such the Registrars Ceremony Room to be at lower levels, where people are more likely to utilise the stairs (which are very well positioned and inviting) or where they can be accessed quicker by lifts. The lift provision has been developed taking into consideration the recommendations of CIBSE Guide D, 2015.

Lifts will comply with the following standards:

- EN 81 'Safety rules for the construction and installation of lifts. Electric lifts'
- BS 9999 'Fire safety in the design, management and use of buildings. Code of practice'
- Approved Document M 'Access to and use of buildings'
- MCC Design for Access 2 – where relevant.

4.4.9 Water & Drainage

The water and drainage systems will comply with all typical requirements as well as the following specific standards:

- Approved Document G 'Sanitation, hot water safety and water efficiency';
- Approved Document H 'Drainage and waste disposal';
- The Water Regulations Guide (WRAS)
- The Institute of Plumbing – 'Plumbing Engineering Services Design Guide';
- BS EN 806 part 1 to 5 – 'Specifications for installations inside buildings conveying water for human consumption';
- HSE Approved Code of Practice and Guidance 2013 "Legionnaires" disease- the control of legionella bacteria in water systems.
- BS 12056 parts 1 to 5 – 'Gravity drainage systems inside buildings';
- BS 9990 – 'Non-automatic fire-fighting systems in buildings – Code of practice'
- Gas Safety (Installation and Use) Regulations
- IGEM-UP/2 – Installation pipework on industrial and commercial premises.

4.5 Courtyard and external services

The existing surface finishes within the courtyard are proposed to be carefully lifted so as to replace below-ground drainage, which is at the end of its life. As part of this, the following works are proposed to be completed:

- Installation of new lightning protection electrodes, to replace the current lightning protection electrodes, a number of which are currently failing.
- Installation of new drainage connections to existing rainwater downpipes, so as to resolve current issues with blockages.
- Installation of new service trenches, in the locations of existing service trenches, plus in some new locations, so as to minimise the visual impact of services within the courtyards.
- Provision of a set of buried ducts around the perimeter of the courtyards within the edging strip, to facilitate the installation of additional emergency lighting and exit signage, in a sympathetic manner which minimises the visual impact of services and avoids interfacing with the façade.

The moats, in particular the Albert Square moat, have become increasingly cluttered with services, a lot of which are redundant. As part of the OTH project, it is planned to remove these, and provide new services only where absolutely necessary, and in a manner where there is minimal visual impact / damage to heritage fabric.

Within the public realm, extensive works are planned to provide new utility connections to the Town Hall as well as providing external services installations to Albert Square and other parts of the public realm, so as to mitigate the ongoing need for provision of temporary services for events from the Albert Square moat, which is causing fabric damage.

4.6 Lightning Protection

The Town Hall building currently has an operational structural lightning protection system, however the existing lightning protection system is outdated, not compliant with modern standards, likely coming towards the of end of its life and does not offer any protection for the electrical systems within the building.

It's proposed that a completely new lightning protection system is provided for the Town Hall to address the following issues:

- The age of the existing lightning protection system is coming towards the end of the average lifespan of the component parts making up the system.
- The existing lightning protection system is designed and installed to a standard which is not current – this could have insurance implications.
- A range of remedial works would have to take place in order to make the existing lightning protection system fit for purpose.
- Some of the existing down conductors stand out from the façade of the Town Hall and would benefit from being fixed more neatly and using other components (e.g. rainwater pipework) to hide the conductors as much as possible to create a solution that is as sympathetic to the historic building as possible.
- Significant repairs are proposed to the roof, stonework, rainwater drainage system etc. as part of the Town Hall project as well as new plant decks, plant, roof walkways etc. – this will have an impact on the existing system.
- The project provides an opportunity for the works associated with upgrading/replacing the lightning protection system to be carried out safely, timely and economically. The life cycle cost of having to replace or upgrade the lightning protection system at a later date comes with significant Health & Safety risk and would involve costly / disruptive access arrangements.

A lightning protection system designed and installed in accordance with BS EN 62305 is defined as falling into one out of four classes; class I, II, III, or IV, where class I system offers the greatest amount of protection against the effects of a lightning strike and class IV offer the least amount of protection against the effect of a lightning strike. The required lightning protection system class is based on a risk assessment accounting for the likelihood of a lightning strike and the potential damages caused by a lightning strike.

A lightning protection risk assessment has been completed and has identified a requirement for a Class I system to BS EN 62305.

5 Refurbishment of Heritage Lighting

Across the Town Hall project 97 luminaires have been identified as heritage luminaires requiring restoration and 117 original / historic luminaires requiring replication on the basis of compelling evidence. Compelling evidence has been collated in the form of the following:

- Manchester Souvenir Programme 1901
- Hart, Son and Peard Lighting Catalogue (Alfred Waterhouse approved manufacturer)
- Archive imagery
- Existing historic infrastructure such as gas pipes
- Close inspection of 10 sample heritage luminaires which demonstrates traditional workmanship and materiality
- Metalwork Vol. 1 Master OTH-MCC-TH-XX-HIS-K-0034.

Refer to the Arup report OTH-ARU-ZZ-XX-RPT-E-0001 '*Heritage Lighting Strategy'* for more information on the restoration and replica luminaires.

6 Summary of New Building Services proposals

A key principle in the design of the building services systems in the Town Hall is the need to embrace the original servicing features of the building and to retain and re-use these aspects in the future servicing of the building where appropriate. The servicing routing has been developed to ensure that original features are protected wherever possible.

The key aspects intended to be used, reinstated or developed in the servicing strategy include:

- Façade air bricks
- Internal rising stacks
- Floor trenches
- Perimeter joinery
- Natural ventilation hoppers
- Window top and bottom panes
- Existing shafts such as internal rising stacks, dumbwaiter, chimneys.

In general, the design life of building services will be less than that of the building fabric. Careful consideration has been made as to how building services installations will be repaired and replaced without wholesale alterations to the building fabric.

Plant and building services distribution systems are installed in locations which are accessible, or access is provided through removable panels, access hatches, trench covers etc. Plant will be sized so that it can be repaired, removed and replaced through existing openings. In cases where services installations are buried in building fabric, such as cast-in conduit systems, facilities will be provided to allow the existing services to be removed and new services to be installed without damage to the building fabric such as through provision of draw wires and pull boxes.

It is known that the MEP systems will likely have a lower design life than the building fabric, and therefore, will require replacing again (potentially multiple times) before the building's next major refurbishment.

6.1 Plant Areas

In general, the proposed plant areas have been located so that minimal alterations are made to the existing building superstructure. However, this doesn't necessarily result in the most efficient use of space, and as such there are areas around these plant rooms which could be utilised for other purposes such as storage.

The required gross internal floor area required for plant spaces is approximately 1,250m^2. This compares to an existing provision of approximately 935m^2. However, the building will be more highly serviced than originally, and the percentage of building area taken up by plant (approximately 6%) is typical for a building of this type.

Primary plant is in general proposed to be located at Lower Ground Floor level, on the Princess Street elevation and rear of the central block. These locations have been selected since they are in general adjacent to the incoming utilities and are located on ground-bearing slab. These areas are also understood to be of less commercial value, due to the absence of daylight or access from the street.

The incoming district heating plant is located on the Lloyd Street / Albert Square corner of Lower Ground Floor level to simplify the installation of district heating pipework. This is a change from the initial Stage 2 design, to avoid the need for district heating pipework to interface with the link tunnel. Refer to Arup report OTH-ARU-ZZ-ZZ-RPT-B-0046 'Civic Quarter Heat Network Interface with OTH Proposals – Technical Note' developed in support of the previous application for these works.

Where plant is provided at Lower Ground level, consideration has been given to minimise the potential impact of damp or water ingress from localised flooding. Typical proposals are as follows:

- Not installing plant directly on external walls.
- Providing plant which is more susceptible to water ingress such as switchboards and control panels on plinths - minimum 300mm.
- Installing sensitive equipment such as ICT comms rooms in box-in-box construction.
- Providing mechanical ventilation and air conditioning to plant rooms which have more specific temperature or humidity requirements, such as comms rooms and battery rooms.

Primary plant for ventilation and cooling is also proposed to be located on new roof plant decks located at Level 6 and Level 7. These have been located in spaces that would have no visual sightlines from the street and minimal sightlines from the courtyards. The main plant deck on the Central Block, which accommodates the kitchen ventilation plant, chiller and outdoor cooling units will be concealed behind an acoustic screen.

Chilled water plant is proposed to be located in the old water tank room at Level 4, which is directly under the new roof plant deck with the proposed chiller.

These have been designed in a manner which would allow the plant to be removed in the future with minimal damage to the existing building fabric. Full access, maintenance and CDM provisions have been considered for the roof plant including crane access from Lloyd street.

6.2 Routes and Risers

There is a requirement for vertical distribution routes to safely & efficiently distribute all building services to serve all floors of the building. All risers are to have sufficient level access via lockable doors, minimum 2,100mm high, and standing platforms for safety.

The design team have developed a coordinated strategy for providing primary plant, service risers and primary service distribution, whilst being sympathetic to the heritage nature of the building and minimising interventions to the existing building.

A hierarchy has been adopted for provision of vertical risers as follows:

- Re-use of existing vertical distribution routes wherever possible.
- Expansion of existing vertical distribution routes.
- Provision of new vertical distribution routes where necessary.

In summary:

- Primary services, which emanates from the plant rooms, will be routed to the risers in the corridors at Lower Ground level or at roof level. The services will then rise/drop in the new services risers, from where they will branch off to serve each floor plate.
- Existing service risers are reused wherever possible and enlarged as necessary. New service risers are in general either provided in existing shafts such existing lift shafts and staircases, or as new interventions alongside new lift shafts and staircases. The exception to this is for drainage risers which are located adjacent to the extended toilet and welfare facilities. The design team have tried to locate these facilities close to existing risers where possible but due to the limited drainage provision in the building some new risers have also been required.

- Existing service trenches are reused wherever possible and adapted as necessary, with new trench covers, access hatches etc. as required. Where service trenches are extended or enlarged, these will be designed to be similar to the existing trenches.
- Services distribution at Lower Ground floor are proposed to be exposed and installed at high level or in the trenches. Lower Ground floor areas are in general considered of lower heritage significance and there is a precedence for trenches and exposed primary services at high level in these areas. Where required, new structure will be provided to support heavy services, e.g. pipework.
- During the surveys, it has been found that some service trenches will have to be expanded to accommodate the new services, providing future flexibility.
- The existing heating pipework and natural ventilation dampers are located in perimeter joinery. The existing perimeter boxing will be removed and replaced except where of high significance.
- The primary horizontal distribution of heating, cooling and ICT services will be routed in the new perimeter joinery. This is reinstating the existing horizontal distribution routes for heating to minimise number and size of new penetrations between the rooms. The new perimeter joinery will be expanded sizes to accommodate the services meeting the increasing occupational and functional demand from the spaces.
- Where provided, the perimeter joinery also houses ICT zone enclosures, door controllers, BMS control enclosures, natural ventilation and façade mechanical ventilation arrangements.
- Perimeter joinery finishes and the services inside will be fixed to specially designed support frames, minimising the fixings to the building fabric.
- The size of boxing-out details concealing the services in the vertical risers may be larger than the required builders' work penetration size in some instances. This is to accommodate requirements such as control valves. There may be some locations where these valves are located outside the riser enclosure.

Purcell will continue to develop the design of the boxing in consultation with the Conservation Officer to minimise the impact through appropriate scale and design – this approach will be tailored to the different spaces. This may result in changes being required to the building services proposals associated with the spaces.

Intrusive surveys have been carried out where possible to establish the viability of using existing services routes and plant space. These also include inspection of the floor voids for final distribution of services within voids.

The size of all new services and their associated distribution routes have been optimised against the service they need to provide. Spare capacity has been included to allow for flexibility in the use of some spaces to avoid having to introduce new service provisions in future. The spare capacity is incorporated only where there is no increase in the overall size of the service and is determined by the standard unit capacity available.

6.3 Builders' Work Penetrations

Significance damage has been created over the years through the introduction of services, often in an unsympathetic manner. The project gives the opportunity to remove existing services and repair damage to fabric created by service penetrations, whilst providing sympathetically-located services penetrations which are future-proof, so as to minimise ongoing fabric damage caused by the introduction of new services.

Substantial coordination has taken place with the Architect and Structural Engineer, so as to locate services penetrations in a manner to minimise the impact on existing building fabric (for example penetrating infilled arches rather than the arches themselves) and minimise the need for structural alterations, whilst providing penetrations which will allow flexibility for future services, without creating excessive penetrations.

Wherever feasible, existing penetrations will be utilised, and where necessary enlarged.

Horizontally, builders' work penetrations to the rooms will be located at low level through the perimeter joinery as a general principle.

Risers will be strategically located considering the existing shaft locations and controllability of different building zones. Existing lifts shafts, flues and hoistways are proposed to be utilised for risers.

Fire and acoustic stopping is a key consideration for all services penetrations.

6.4 Heating, Ventilation and Cooling

The mechanical services design strategy includes heating, ventilation and cooling systems. These have been developed to suit the wide range of accommodation proposed to be located within the Town Hall. The strategy also aims to optimise energy efficiency and to be flexible in operation while minimising the impact on the historic character of the building.

The challenge is to reinstate the original ventilation and heating strategies while answering today's expectations from a modern mix-use office building with a court, ceremony rooms, and event/catering spaces. Positioning sustainability at the heart of our design, we have implemented creative acoustically improved natural ventilation solutions where possible. A localised approach for the mechanical ventilation is provided where necessary.

The mechanical servicing strategy aims are:

- In line with the original design of the building, and to maintain the historic character of the building, incorporate natural ventilation using opening windows as the predominant means to minimise the risk of overheating in summer.
- Re-open and re-use existing low-level openings on the façade to provide ventilation in winter. These openings serve as air inlet points for either natural ventilation or localised mechanical ventilation.
- Provide mechanical ventilation in areas where odours and moisture are generated and to spaces with high heat gains exceeding the capability of natural ventilation system and/or to noise sensitive spaces.
- Provide mechanical cooling by a combination of direct expansion (DX), variable refrigerant flow (VRF) and chilled water systems. Mechanical cooling will be provided in the following areas:
  - Rooms where natural ventilation is deemed ineffective on inappropriate due to acoustic, security or heritage considerations.
  - Rooms with high heat gains beyond the capability of natural ventilation systems (i.e. event spaces, IT rooms)
- Provide space heating using the low temperature hot water (LTHW) system with heat generated from the new Civic Quarter Heat Network (CQHN). The CQHN central plant includes gas fired combined heat and power (CHP) units which will provide low carbon heating.
- Installation of a building management system (BMS) to provide automatic control, plant monitoring and metering of energy and water consumption.

6.4.1 Heating

Heating will be provided via Manchester City Council's district heating network to reduce the building's carbon footprint. Implementation of a new zoning strategy and BMS system will enable the FM team to control and maintain the heating systems more easily.

All spaces within the Town Hall will be provided with either space heating for comfort or frost protection.

The heating demand for the Town Hall will be minimised by fabric improvement (insulation and repairs) where appropriate and by the careful systems design and selection of high efficiency HVAC plant. However, there is still an appreciable heating demand for the building due to the scale of the building, the extent of natural ventilation and supply only façade mechanical ventilation systems which are chosen to minimise the fabric interventions.

The main heating plant room is located at lower ground floor level at corner of Albert Square & Lloyd Street where the Civic Quarter Heat Network (CQHN) district heating pipework enters the building. Heating pipework is fed from the plant room and distributes low temperature hot water (LTHW) around the building. LTHW will be distributed vertically in dedicated risers and horizontally within the floor trenches and perimeter boxing-in enclosure and at high level.

The existing riser locations are intended to be reinstated where possible. However, two new risers, which will be located in existing shafts, for Albert Square side of the building and one new riser for the Central Block (existing boiler chimney) is required for the new zoning strategy.

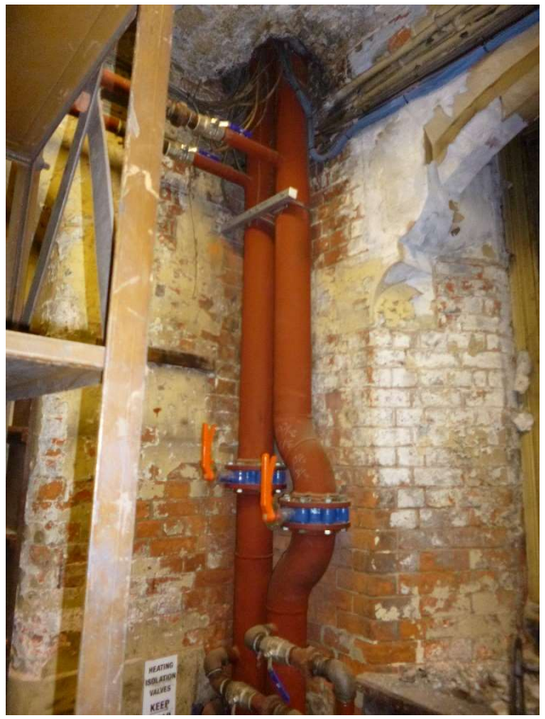


Figure 11 Existing heating riser 4

In total, seven main risers, whose approximate locations are shown in the figure below, are proposed for vertical heating distribution

Zoned heating systems provide energy efficiency, ensuring that rooms are heated as and when required. Zoning enables the building to be controlled effectively, and to be isolated for maintenance without causing any inconvenience to other users.

Nevertheless, there are restrictions to the zoning strategy in the Town Hall. The heating pipework is routed within the perimeter joinery. This strategy is reinstated to limit interventions to the building. Therefore, each side (Albert Square, Princess Street, Lloyd Street) of the building is split into two heating zones, the riser being in the middle, with a single zone for each corridor as shown in the figure below.

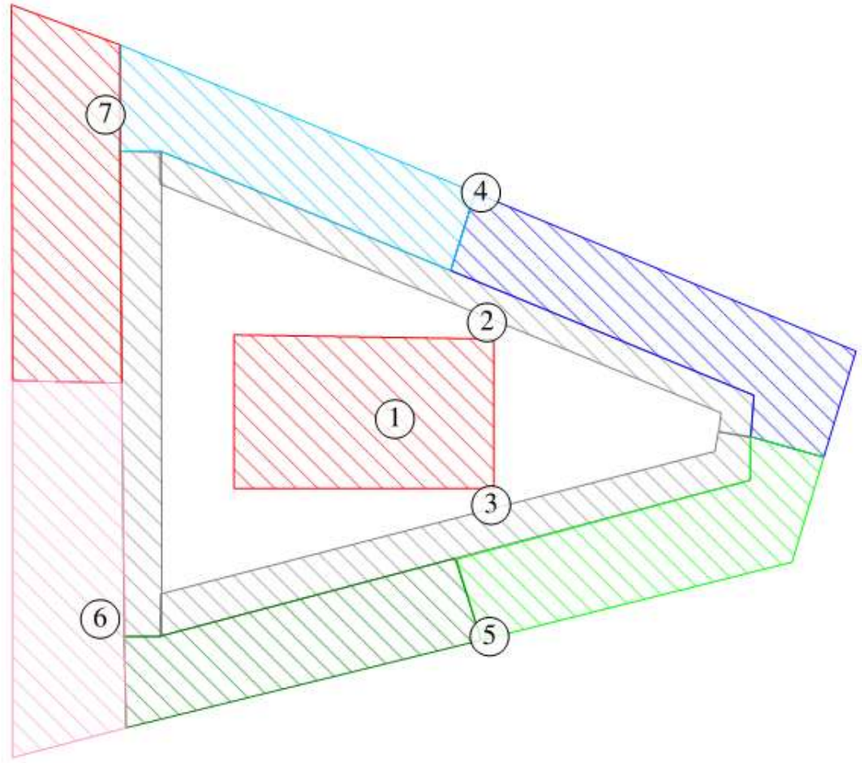


Figure 12 - Outline heating zones and riser locations

Heat emitters are provided in each space. The emitters are boxed in within rooms of higher significance. The emitters are left exposed in lower significance and less public spaces (for example plant rooms and storage areas). Radiators were proposed as heat emitters throughout. The final design incorporates finned tubes as these have a higher heat output, enabling the units to be smaller than equivalent radiators. This reduces the size of associated boxing in.

Purcell will continue to develop the design of the boxing in consultation with the Conservation Officer to minimise the impact through appropriate scale and design – this approach will be tailored to the different spaces. This may result in changes being required to the building services proposals associated with the spaces.

Different heating systems provided to key spaces to reflect use requirements as follows:

- Public reception & event spaces – heating provided via floor mounted variable refrigerant flow (VRF) units.
- Great Hall – underfloor heating to be provided along with radiators located behind existing wooden panels under the murals.
- State rooms – trench heaters in floors and radiators concealed within existing ornate radiator casings.
- Visitor centre – heating provided via floor mounted VRF units.
- Heritage storage areas – heating provided via VRF units located in the adjacent service corridors.
- Coroner's & Registrar's accommodation – heating provided via floor mounted VRF units.

- ICT and emergency lighting plant rooms – cooling will be provided to these spaces by means of refrigerant based direct expansion systems.

In order to minimise the heating demands where possible the following mitigation measures have been incorporated:

- Minimising fresh air provision to reduce heating load to spaces. This results in reduced sizes of heat emitters (radiators/finned tubes) and subsequent boxing in details.
- Agreement of temperature and humidity controls to storage spaces that are appropriate to the items to be stored and the range of control required. This has minimised the mechanical systems required (heating, cooling & ventilation).

6.4.2 Ventilation

Ventilation is provided to spaces to suit the use and occupancy of the space. The suitable ventilation strategy was assigned to each room in line with architectural, engineering and other considerations which are shown in the figure below. These strategies have then been further discussed with the project team & the client, and the preferred ventilation approach has been collectively agreed.

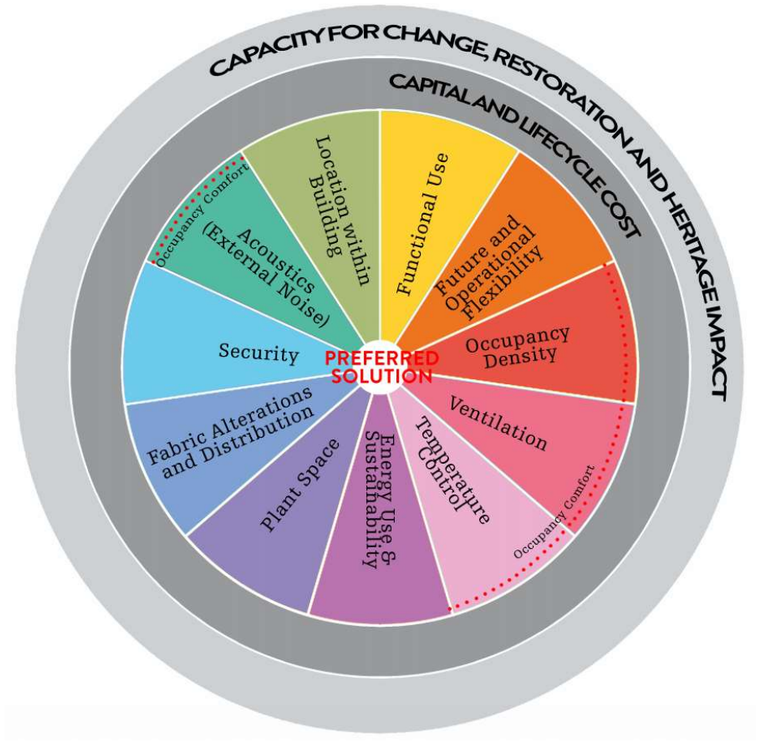


Figure 13 Criteria optimised to decide on the preferred environmental and window treatment solution for each space

All of these architectural, engineering and other considerations have been balanced and considered against each other so that the optimum solution is reached for each room.

During RIBA Stage 3 and 4, issues were raised regarding the agreed mechanical strategies in terms of:

- Heritage aesthetics of the vertical fans in mechanically ventilated spaces.
- Extent of mechanical solutions for the building and the required access and maintenance of multiple items of equipment.

The Consultant team reviewed the RIBA Stage 3 information on a room-by-room basis, aiming to reduce the facade mechanical ventilation spaces. These rooms had been proposed to be ventilated via vertically arranged local supply fans connected to air bricks.

A series of methods have been proposed to rationalise the ventilation approach, ranging from redistributing mechanical equipment, to the employment of management solutions by MCC.

Based on surveys and analysis of the building use, reduced mechanical equipment may result in non-compliance with CIBSE guidance and Building Regulation when densely occupied spaces such as meeting rooms and event spaces are continuously occupied. As such, management solutions for the building have been proposed to ensure safe and effective operational environments.

The proposals set out below eliminated all vertical room mounted mechanical ventilation equipment that were previously proposed:

- Relocating mechanical ventilation equipment to Lower Ground Floor
- Repositioning mechanical ventilation equipment (i.e. horizontal arrangement as part of the boxing-in)
- Rationalising mechanical ventilation through management methods: reduced occupancy
- Rationalising mechanical ventilation through management methods: reduced room usage
- Changing ventilation treatment to natural ventilation: changed room function.

Natural ventilation is provided wherever possible and appropriate to suit the use and occupancy of the space. Natural ventilation has inherent limitations including a limit on the amount of cooling effect it can provide during summer. An overheating assessment has been carried out to identify areas where natural ventilation may not be sufficient to meet agreed comfort criteria.

Natural ventilation in the Town Hall has some inherent consequences which are as follows:

- Increased maximum temperatures in spaces
- Exceedance of acoustic criteria
- Limits to internal gains including equipment and computers
- Limits to occupancy
- Windows and openings will need to be fully openable
- The openings under the windows on the façade are currently blocked and required to be re-opened to restore the means to provide ventilation to the rooms. The air will be exhausted via window top panes.

Where not sufficient, local mechanical ventilation strategies have been implemented where possible to limit the number and size of intervention to the building. In order to provide control of air quality (providing oxygen replenishment and air movement) the design incorporates a limited number of areas classed as “façade mechanical ventilation”. These spaces are provided with equipment capable of supplying minimum fresh air mechanical ventilation. This allows windows to remain shut during cold winter months in order to reduce draughts and maintain good air quality and appropriate CO2 levels.

Within the Town Hall, there are a number of spaces which cannot be ventilated naturally or by façade mechanical ventilation system due to occupancy densities. Mechanical ventilation and temperature control will be provided by supply and extract air handling systems which will incorporate high efficiency thermal wheels to maximise heat recovery from the extract air. Air distribution is provided via ductwork routed at

high level. The air handling units (AHUs) are located on lower ground floor and at roof level and ventilation supply and extract ductwork will be distributed from the AHUs to new vertical risers. The vertical risers allow the supply and extract ductwork to connect to the occupied zones at different levels of the building. For the conclusion of the heritage impact of these proposals refer to Purcell report OTH-PUR-XX-XX-RPT-Z-0103 '*Heritage Impact Assessment: Manchester Town Hall*'

In order to answer the demand from today's modern office requirements, a number of significant improvements have been made in the services design. However, due to several restrictions, mainly heritage, sustainability, and limited amount of space for plant and risers, there will be limitations to these improvements which are listed below as key considerations:

- Kitchen extract from the main production kitchen is proposed to be located on the new plant deck on level 06, which accommodates naturally ventilated offices with operable windows to the courtyard. The kitchen extract unit will include with carbon filters to minimise odours.
- A number of dedicated mechanical supply and extract units serving finishing kitchens will terminate at the moats due to the limited roof plant and riser spaces. Although particular attention has been paid to the separation distance between natural ventilation intake and these extract points, kitchen smells may be detected by the occupants of upper ground floor during intensive catering activities in the finishing kitchens.
- Three spaces, namely Visitor Centre, Staff Activity Room, Reception/Events Space (Room 127-130), are proposed to be mechanically ventilated by an air handling unit via high level ductwork. High level ductwork routing between the existing ornate arches will have a visual impact. Refer to Purcell reports OTH-PUR-XX-XX-RPT-A-0100 '*Design & Access Statement'* and OTH-PUR-XX-XX-RPT-Z-0103 '*Heritage Impact Assessment: Manchester Town Hall*' for further details of the visual and heritage impact.
- Natural ventilation is reliant on façade openings and window top panes being left ajar. Acoustic criteria are derogated to allow natural ventilation to be possible in some spaces.
- Relaxation of occupant comfort conditions and subsequent reduction in mechanical ventilation provision to respond to heritage constraints. Refer to Arup design note OTH-ARU-TH-ZZ-RPT-M-0008 and Purcell report OTH-PUR-XX-XX-RPT-A-0087.
- Agreed reduced occupancy densities in some public reception/event spaces to avoid requirement for mechanical ventilation and associated ductwork and damage to building fabric.
- Mechanical cooling is provided as detailed on the environmental treatment drawings.
- Relaxed environmental criteria for Visitor Centre and Heritage Storage agreed with MCC to reduce the plant and ductwork sizes.
- Reduction in ventilation to some welfare spaces. This is a derogation to the Part F of the Building Regulations to protect the sensitive building fabric by minimising the penetrations.

The following spaces have specific ventilation provision to suit their specific requirements:

- Stair pressurisation and smoke extract systems installed to suit fire strategy requirements for life safety.
- Visitor Centre – air handling unit with ductwork to provide fresh air requirements.
- Heritage storage – trickle ventilation to maintain certain temperature and humidity levels.
- Main production kitchen - Supply air unit & mechanical extract unit as required for removal of fumes and cooking odours with a balanced supply of replacement air.
- Staff Activity rooms - air handling unit with ductwork to provide fresh air requirements.
- Storage spaces - extract mechanical ventilation will be provided to some storage spaces with specific ventilation requirements, such as bin storage, COSHH storage.
- Toilets, showers & changing rooms - dedicated mechanical extract ventilation will be provided via supply and extract units with heat recovery, in general.
- Control Room - mechanical supply will be provided to the control room via an MVHR (mechanical ventilation with heat recovery) unit while extracting from the toilet and welfare spaces.

6.4.2.1 Smoke Extract and Stair Pressurisation

Lloyd Street and Cooper Street firefighting cores require smoke extract ventilation to comply with the Fire Strategy. Extract will be provided via mechanical smoke extract fans above the smoke extract shaft which is connected to each escape lobby via wall mounted grilles.

Princess Street and Central Block staircases are required to be pressurised to comply with the Fire Strategy. Staircase pressurisation will be provided via pressurisation shafts with injection points in every three levels.

6.4.3 Cooling

Current and future overheating studies have identified critical spaces which require comfort cooling. Mechanical cooling to these spaces will be provided by a combination of chilled water and refrigerant based systems to minimise the interventions in the Town Hall's historic character.

Services are not to be mounted onto the walls or ceilings in the rooms where cooling is required. Therefore, floor mounted fan coil units will be provided to limit visual impact to the spaces. Refer to Purcell reports OTH-PUR-XX-XX-RPT-A-0100 '*Design & Access Statement'* and OTH-PUR-XX-XX-RPT-Z-0103 '*Heritage Impact Assessment: Manchester Town Hall*' for further details of the visual and heritage impact. Refrigerant based systems are chosen to minimise the pipework sizes in the perimeter joinery

Cold air blown from these units may cause discomfort in the close vicinity of these units. In order to reduce occurrence of this issue, evaporation temperature of the fan coil units will be limited to minimum 9°C, which will increase the supply air temperature to the rooms when peak demand occurs. Further increase of the minimum evaporation temperature will reduce the cooling output of the internal units, causing an increase in the quantity of internal units and external condensers, and consequently, the required plant area.

Due to the limited plant area, the Town Hall will be served by a dedicated air-cooled chiller mounted externally on the new roof plant deck. The chiller will generate chilled water to serve cooling coils in air handling units.

The chiller will be supplied with acoustic treatment to the fans and anti-vibration mountings to ensure the external noise emission criteria are achieved and that vibration is not transmitted to the building.

6.5 Electrical distribution

6.5.1 OTH Project servicing strategy design principals

The following principals have been collectively developed for electrical services installations on the OTH project:

- Carefully remove all existing services which are not of heritage significance.
- Where feasible, re-use existing service routes for new service installations.
- Minimise the use of surface-mounted cabling / containment installations – except where existing precedent exist.

- Future-proof services installations, so that services can be replaced at the end of their working life (circa 25 years) with minimal damage to fabric.
- Avoid mounting electrical accessories (socket outlets etc.) to existing building fabric where possible. In some cases this will not be feasible therefore items such as fire detection etc. will be fixed to the building.

6.5.2 Incoming Utilities

Electrical supply will be provided via the private wire network from the Civic Quarter Heating Network. A life safety generator will be provided to serve life safety loads which cannot be generator backed. Uninterruptable power supplies (UPS) will be provided to serve critical equipment so as to ride over brown-outs, provide backup for short-term power failures and to allow safe shutdown of ICT equipment in the case of a longer-term power failure.

6.5.3 Primary Electrical Distribution

The distribution of primary electrical services from the substations at lower ground floor level to electrical risers is proposed to be via a raceway of high-level primary electrical containment at Lower Ground Floor level. This will be supplemented with the use of existing / new service trenches at Lower Ground Floor level to access the Centre Block and on other corridoes for separating life safety services. Services will be neatly grouped on modern support structures, which use the minimum fixings to the building fabric, whilst providing a future-proof services installation.



Figure 14 - Example of existing (left) and proposed (right) service distributions at Lower Ground Floor

Separate metallic containment systems are provided for each distribution system, segregated as required so as to reduce the impact of Electromagnetic compatibility (EMC) and where required by specific standards. Containment systems will be supported by rigid metallic supports, with metallic anchor points. Specific containment systems are provided for services which require segregation, such as audio-visual system cabling.

Six primary electrical service risers are provided within the building – these have been positioned so that each major area of the building can be served from two electrical risers, so as to provide necessary diverse routing for life safety systems and those systems requiring additional resilience.

Wet services such as water and drainage are not routed in electrical risers.

Electrical risers have been sized so as to allow safe access for operation, maintenance and replacement of equipment within. Rising busbars are provided within electrical risers to serve general power and lighting distribution boards, as well as those serving specific spaces such as small catering areas.

Three phase distribution boards and single-phase consumer units will be provided to serve final circuits. Distribution boards / consumer units are in general be located within electrical risers or plant rooms. Isolators will be provided to serve specific items of fixed equipment such as mechanical plant.

6.5.4 Electrical Services distribution within Service Trenches

On Ground Floor up to Level 5, a hybrid approach is proposed to suit the existing building fabric / finishes. In general, existing service trenches are provided on the outer side of the circulation corridors – this previously housed gas pipework. These will be used to route final circuit containment stemming from the risers into each room.



Figure 15 - Typical existing floor trench showing existing service penetrations in to perimeter rooms

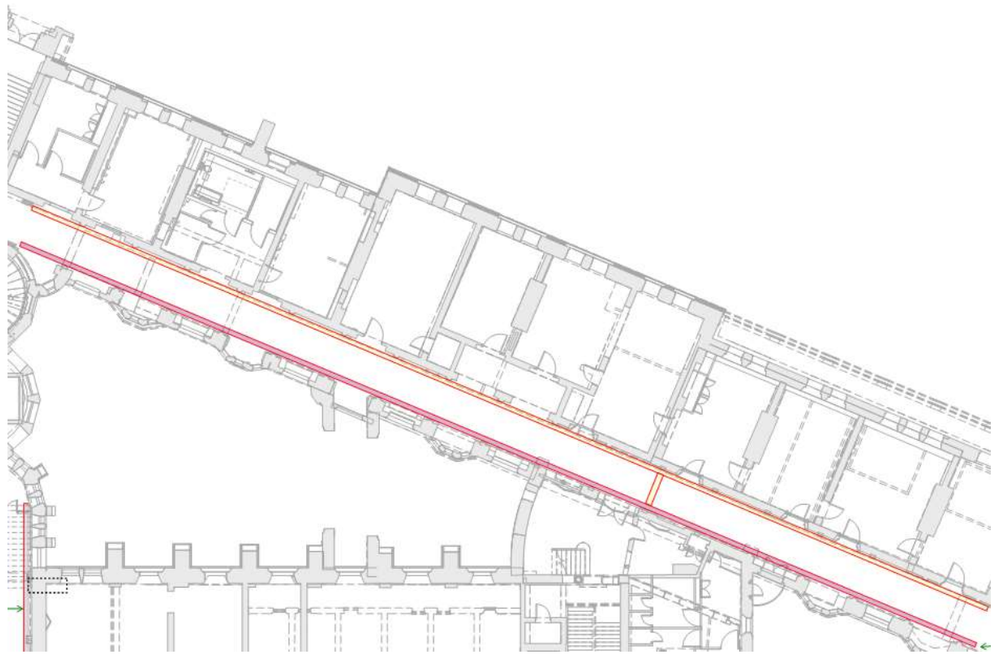


Figure 16 - Existing floor trenches on Lloyd Street corridor at Ground Floor (pink - heating, yellow - electrical)

Note in some instances, services need to cross existing mosaic / terrazzo floors, to get connectivity from the risers to existing service trenches / the perimeter spaces, an example is shown in the image above. These have been located in spaces where there is existing banding in the mosaic, so that the mosaic can be removed in a manner where it is easier to re-lay. An example of this was completed as part of the intrusive surveys.



Figure 17 - Example mosaic floor removal from intrusive surveys

Within these mosaic floor crossings, ducts will be cast in to the floor running form one trench to another. These will be provided with craw wires, to allow future services to be installed without the floors having to be lifted. The design team had previously proposed the use of in-screed trunking, which is commonly used for such applications, however this has been changed to ducts, so as provide maximum support to the mosaic floor finish, to minimise the risk of future cracking.

Refer to Lendlease documents for management of construction works.

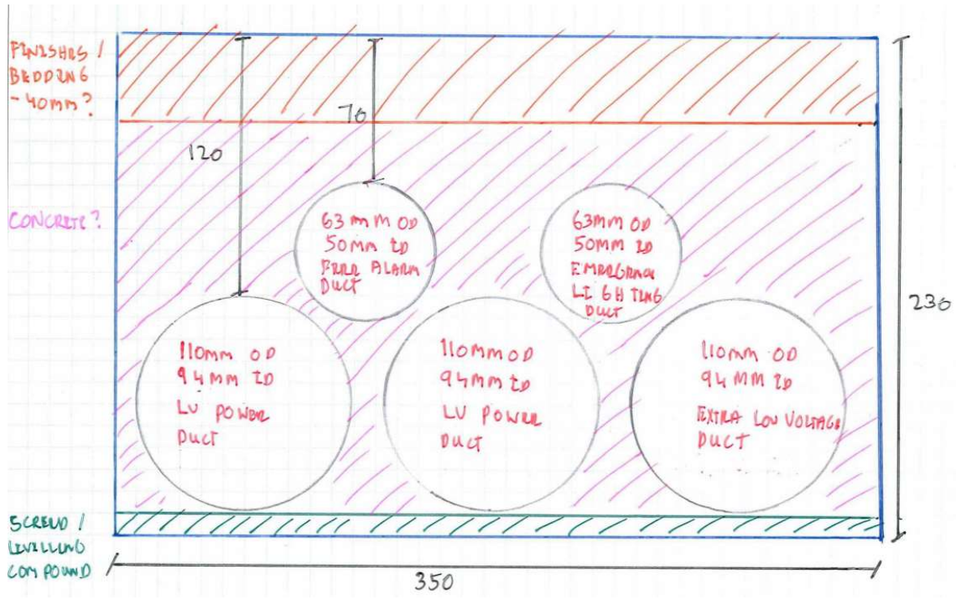


Figure 18 - Cross-section of typical mosaic floor crossing

6.5.5 Electrical Services distribution within spaces with suspended Timber Floors

Within the majority of perimeter spaces an existing raised timber floor is provided, with bearers supporting floor boards off the existing concrete floor. The bearers typically run from the corridors to the façade, providing an excellent service path.



Figure 19 - Typical existing raised timber floor with services in

Services will transition from the trench to the floor void via penetrations made in the walls between the trench and the perimeter space (within the floor void) - examples of these was carried out in the intrusive survey works. These penetrations will be as small as feasible, noting that it is important to provide future flexibility for services installations.

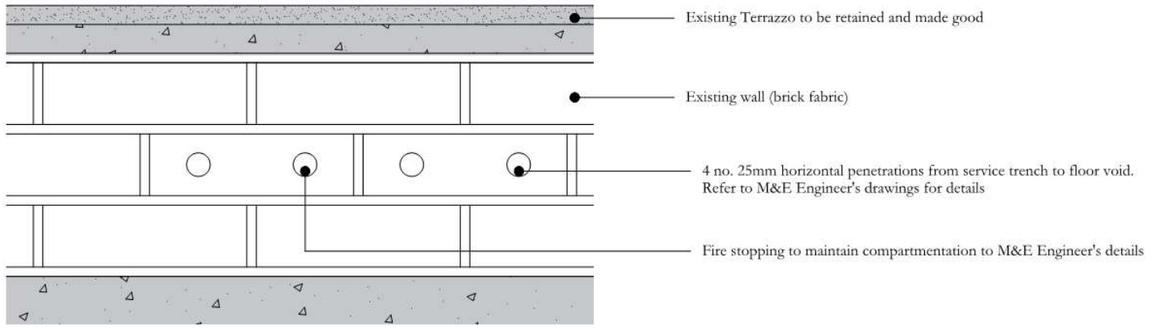


Figure 20 - Example of penetrations from trenches to perimeter spaces (below floor) - by Purcell

Within the majority of spaces, services will enter the floor void at one position, near the centre of the room. Services will then run within the floor void to the perimeter boxing-in, where services will transition in to other joists zones.

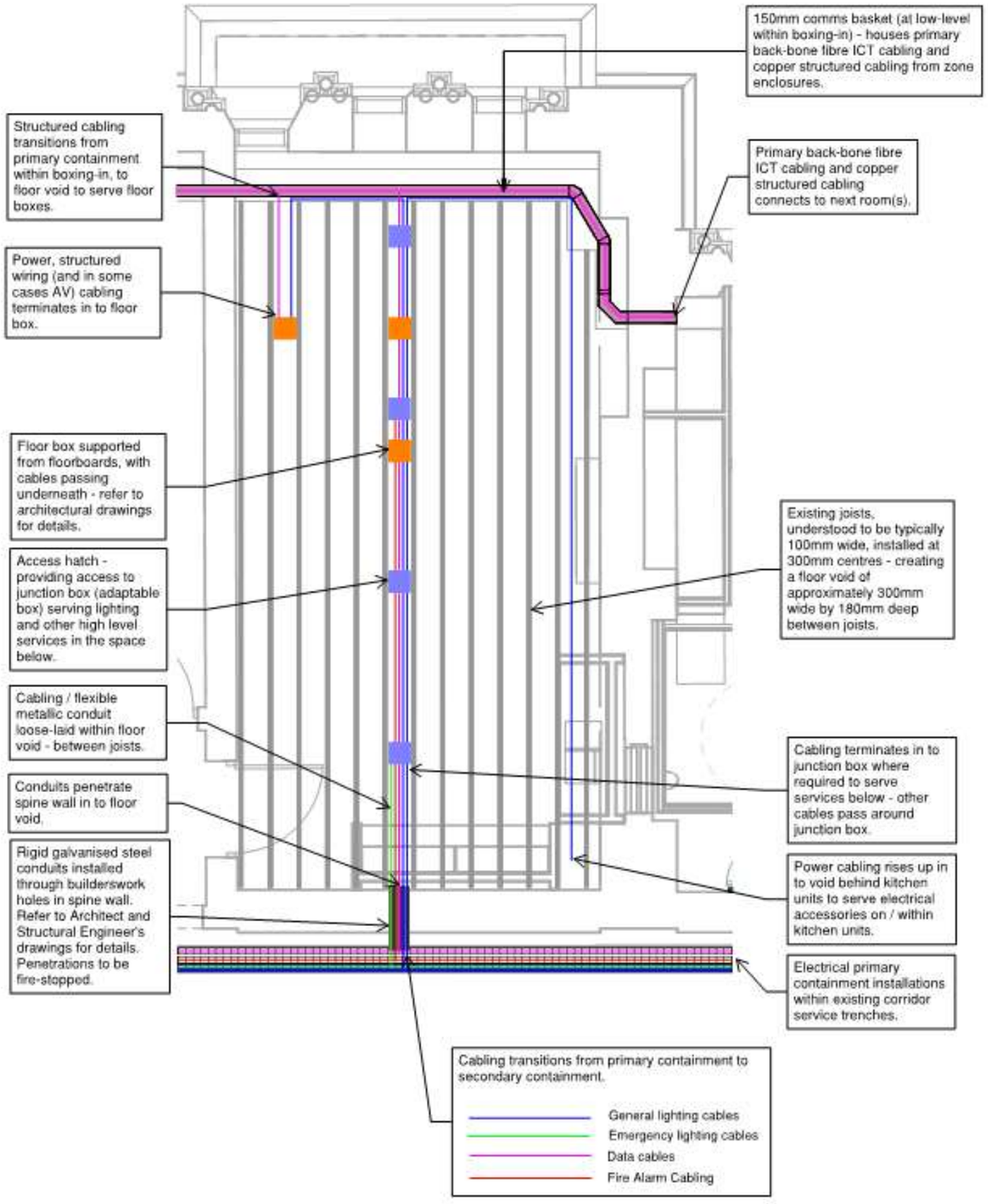


Figure 21 - Example of services distribution within the floor void of a perimeter space based on available space in trenches and perimeter boxing zones

In general, the strategy is for services within a floor void to serve low-level services at that level (for example floor boxes) and high-level services in the floor being served (for example lighting, fire detection, Wifi). BMS sensors have now been confirmed as being wireless sensors. Positioning of any cabling and visible equipment in very high significance spaces is shown on Purcell restoration drawings.

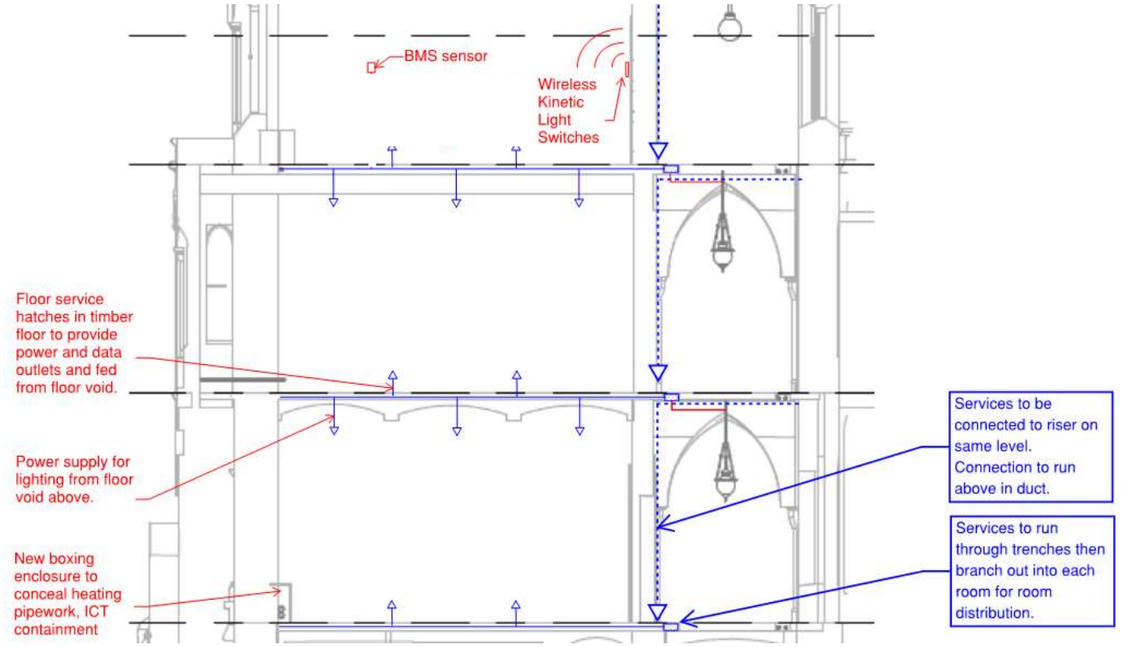


Figure 22 - Typical distribution strategy

Floor boxes will be high-quality metal-trimmed boxes, which are designed to sit between two joists. These have been carefully located so as to provide the maximum flexibility for the spaces, with minimal floor boxes.

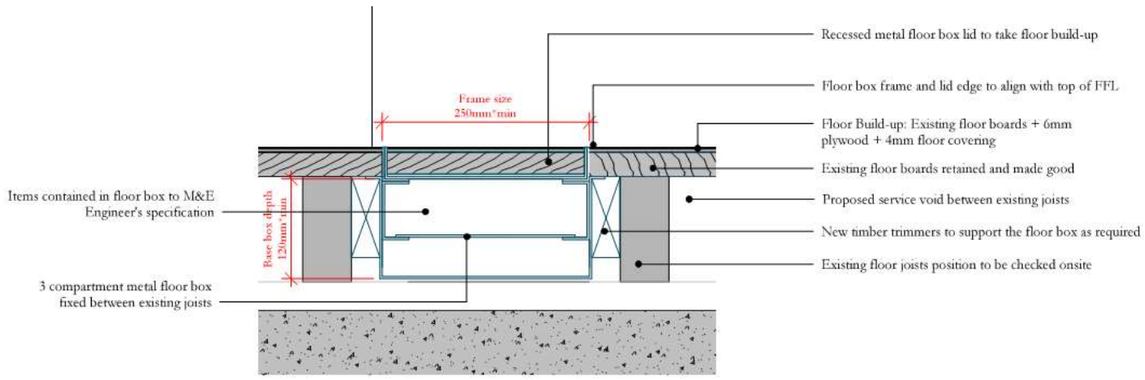


Figure 23 - Typical floor box installation within raised timber floors

Services at high-level will typically be distributed from the floor void above, with metallic conduits penetrating the existing jack-arch structure in the middle of the arches to serve lighting, fire detection and Wifi below. These penetrations have been located so that the minimum number of penetrations can be

provided, whilst avoiding cabling runs at high-level below. Purcell have developed setting-out principals for these penetrations.

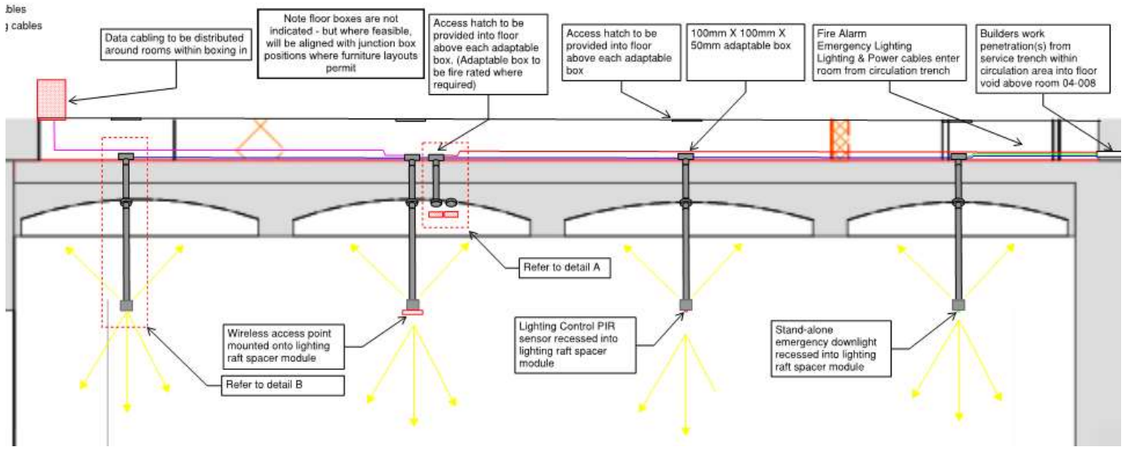


Figure 24 - Typical high-level servicing strategy

Above each penetration, an access hatch will be provided within the floor, so as to allow access to electrical junction boxes and cabling, so as to avoid the need for floors to be lifted in the future for services maintenance / installation.

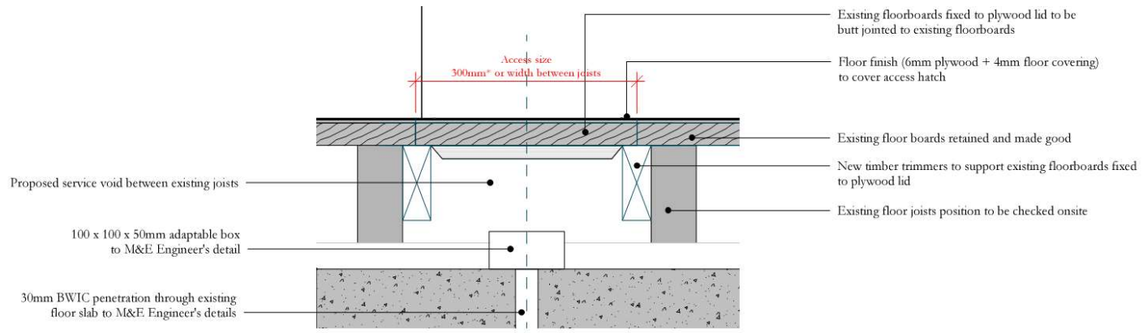


Figure 25 - Typical floor hatch detail - by Purcell

6.5.6 Electrical Services distribution within Corridors without Service Trenches

Service trenches are not provided on the Albert Square side of the building at Ground Floor or Level 1. Services within circulation areas are currently neatly installed surface mounted bare copper mineral insulated copper clad (MICC) cabling – this strategy is proposed to be replicated in the new installation.

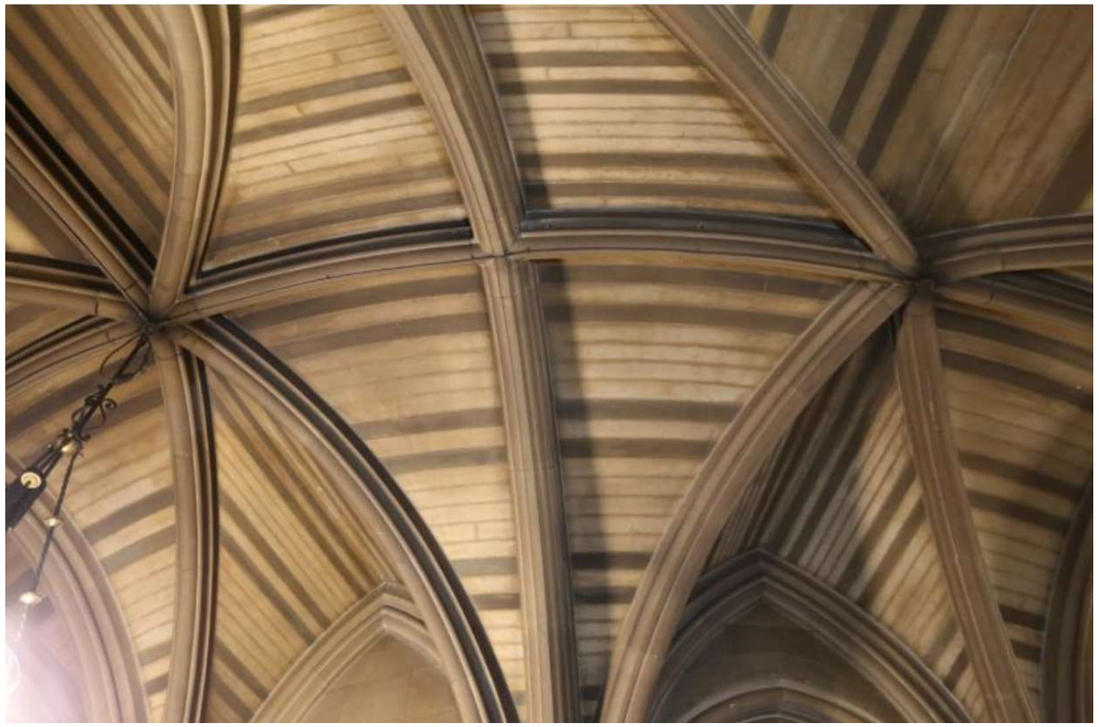


Figure 26 - Typical surface-mounted MICC cabling

On Level 1 on the Albert Square elevation, a new cast-in duct system is required to connect from the electrical riser in the central turret to the raised floor in the State Rooms. This will be a similar installation to Figure 18 except will not run between two trenches. The location has been picked due to existing damage to the mosaic floors.



Figure 27 - Existing damaged mosaic floor

6.5.7 Electrical Services distribution within spaces with Ceilings

For spaces such as toilets and kitchens, where ceilings will be provided for hygiene purposes, services will be concealed within the ceiling and services such as lighting recessed in to the ceiling. Where new partition walls are provided, services will be recessed in to walls.

Provision of suspended ceilings has been determined by Purcell.

6.5.8 Electrical Services distribution within Heritage Toilets

Within heritage toilets, services will not be provided within the floors, since this creates waterproofing / maintenance issues. Instead, services will be installed at high-level within suspended trunking installations.

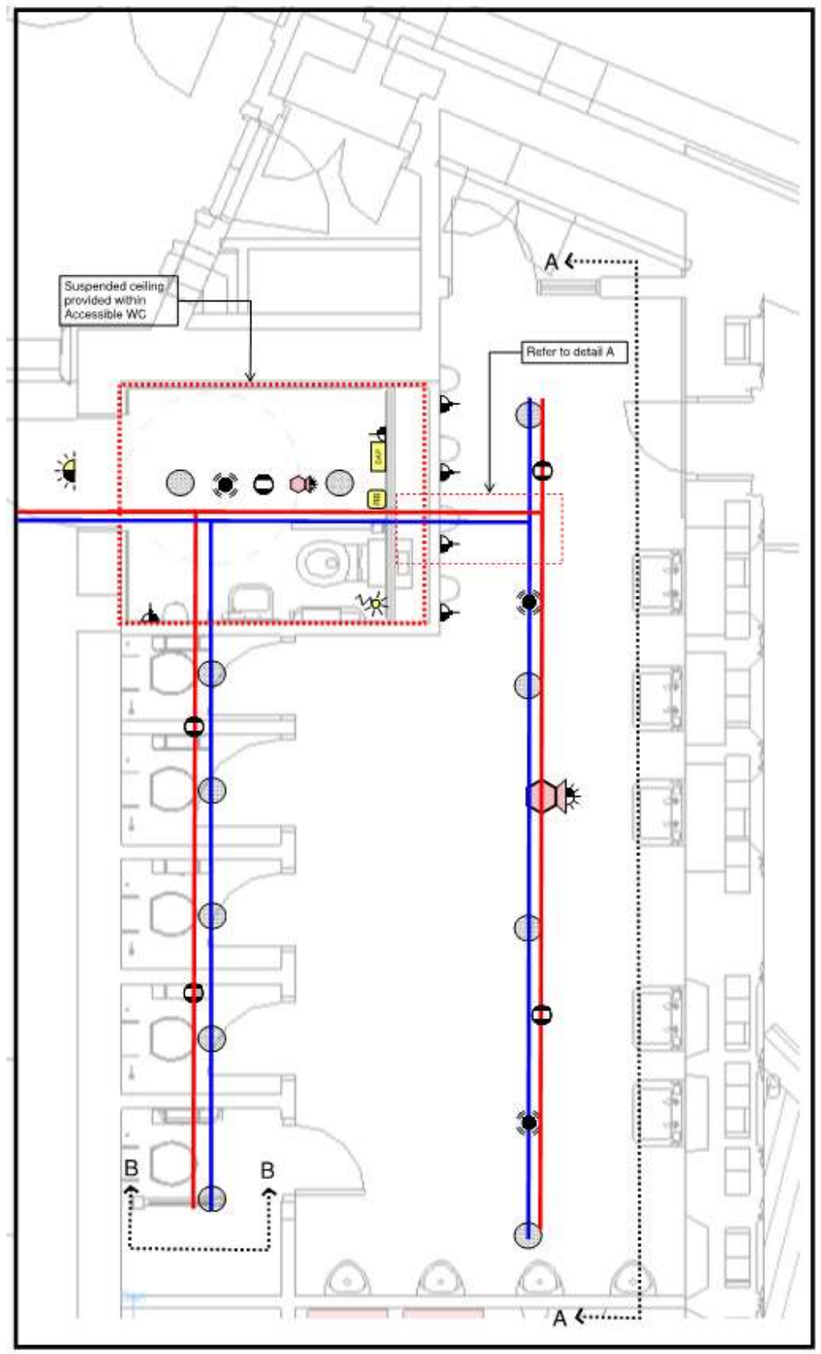


Figure 28 - Typical high-level electrical services installation within heritage toilets - with suspended two-compartment trunking (plan view)

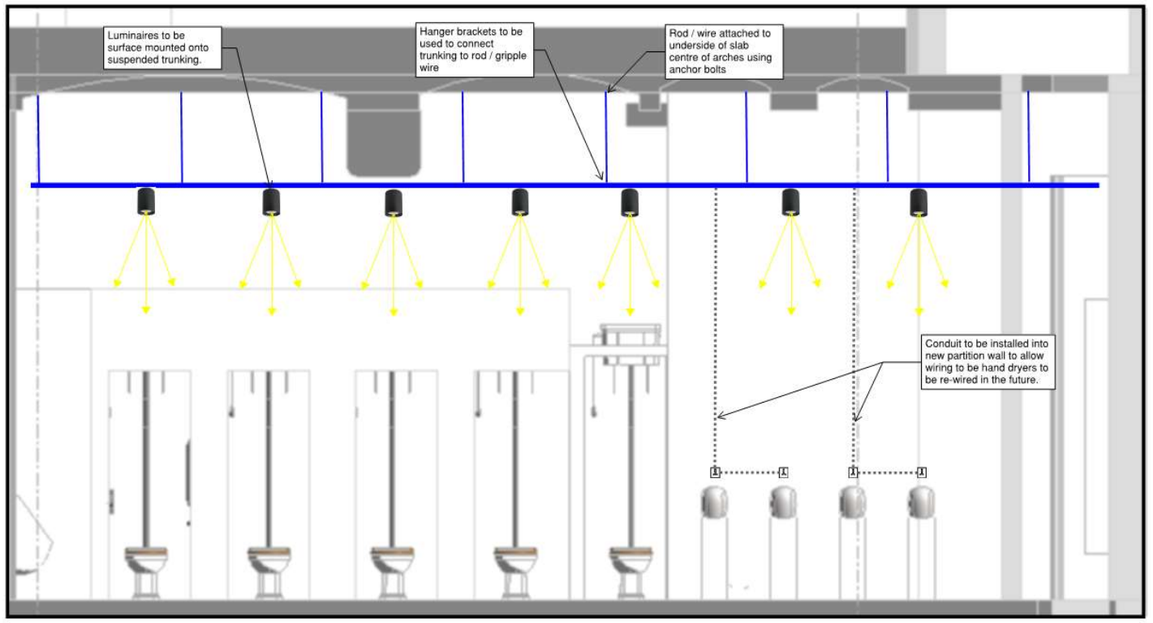


Figure 29 - Typical section of heritage toilet, showing suspended two-compartment trunking with lighting

6.5.9 Electrical Services distribution at Lower Ground Floor

It is not proposed that services penetrate from the floor void of Ground Floor to serve high-level services within the Lower Ground Floor, since we do not believe there are any existing precedents of this. Instead, services at Lower Ground Floor will be run at high-level and suspended from the soffit. Within the primary distribution raceway on the circulation corridors at Lower Ground Floor, services such as lighting will be fixed to the underside of the primary distribution, so as to avoid the need for additional fixings. Within perimeter spaces such as store rooms, secondary containment will be provided in to the spaces from the primary containment in the corridors. This will be used to connect services such as lighting, fire detection and Wifi. In both cases, conduit drops will be provided to perimeter walls for socket outlets etc – these will wherever feasible be provided on new infill walls, or on boxing-in where present.

Refer to Purcell Heritage Impact Assessment for assessment of heritage impact of Lower Ground Floor proposals.

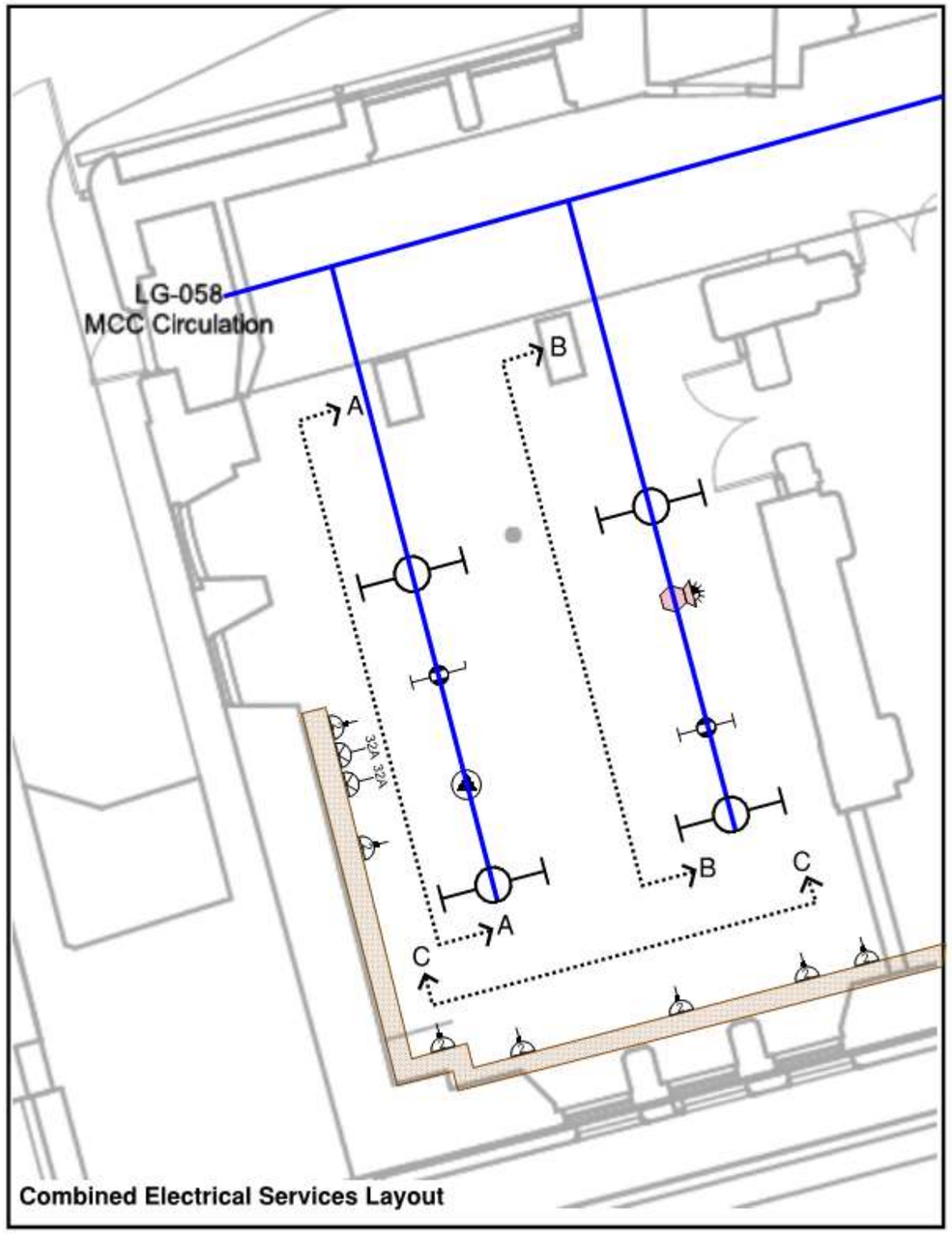


Figure 30 - Typical perimeter space at Lower Ground such as a store room (plan view)

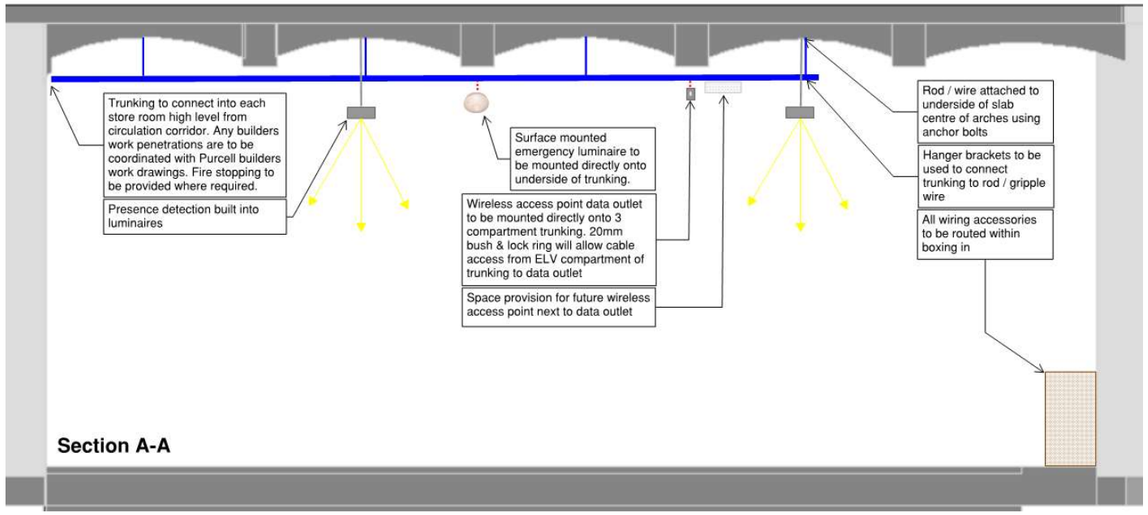


Figure 31 – Typical section of perimeter store room at Lower Ground Floor

Within plant spaces, primary distribution will be provided at high level – this will be utilised to serve (and where feasible) mount high level services. Perimeter drops will be provided on walls for items such as isolators to serve plant – these will wherever feasible be located on infill / partition walls, although this will not always be possible.

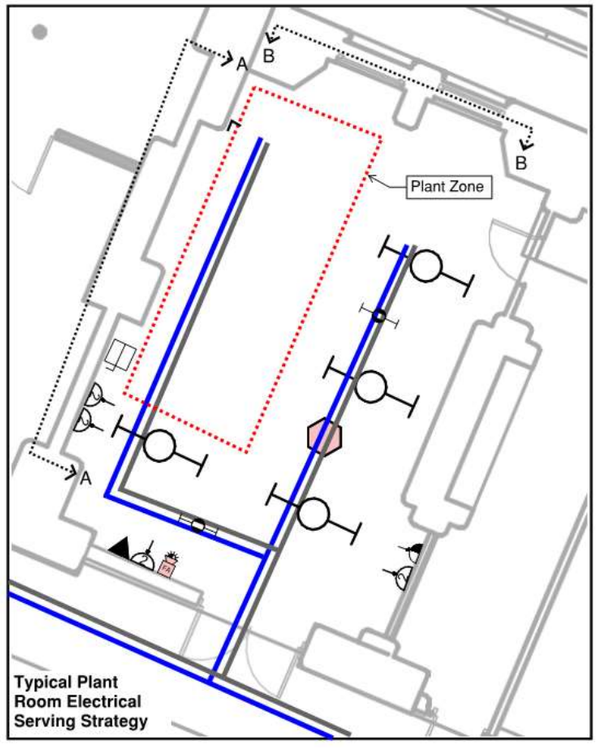


Figure 32 - Typical electrical services within plant space (plan view)

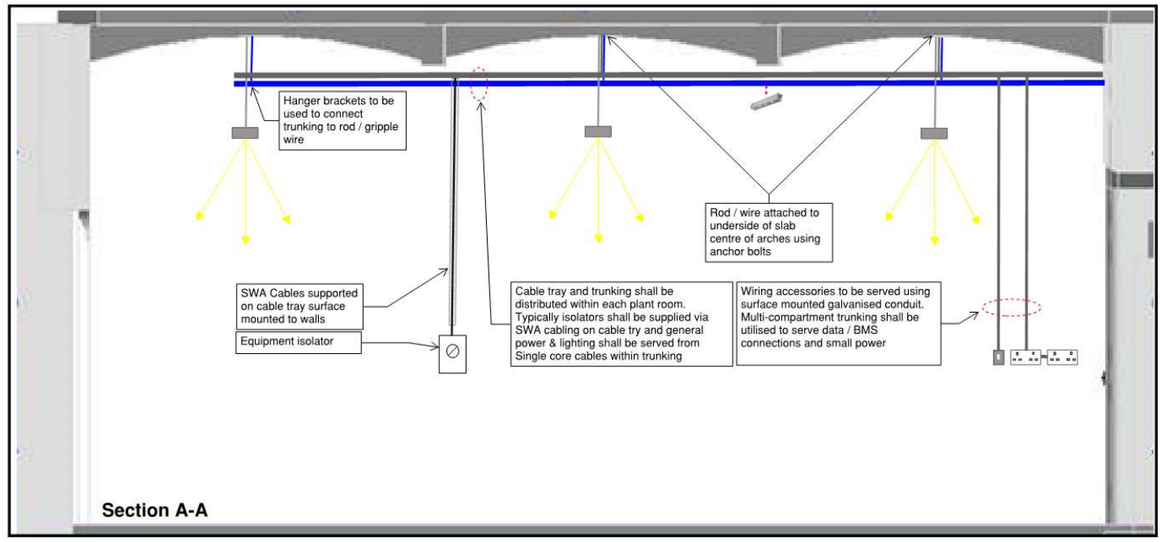


Figure 33 - Typical section of a plant room at Lower Ground Floor

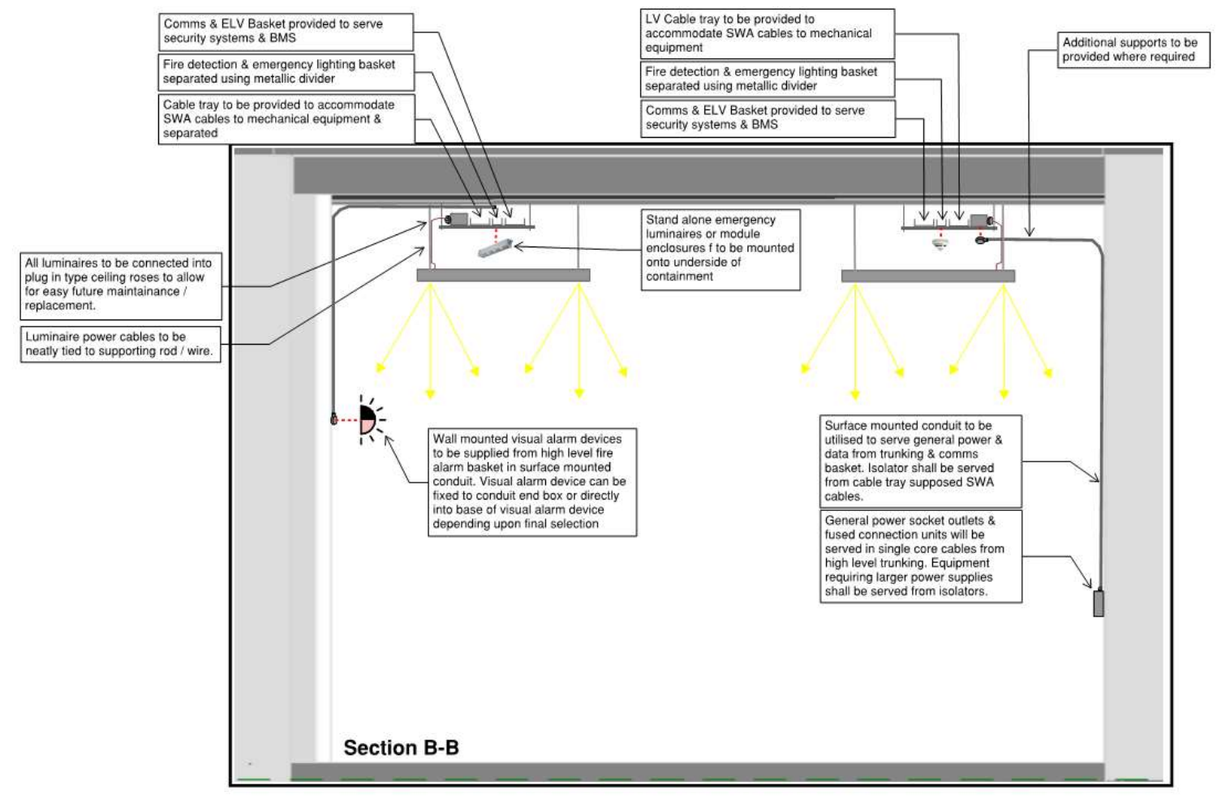


Figure 34 - Typical section of a plant room at Lower Ground Floor

6.5.10 Power and Data

A new general-purpose power installation is provided. This typically consists of:

- Floor boxes provided within the timber floor voids in offices and meeting rooms
- Recessed socket outlets on boxing-in within offices, meeting rooms etc.
- Recessed socket outlets within new partition walls, for example within kitchens, kitchenettes, toilets etc.
- Surface-mounted metal-clad socket outlets within plant rooms, store rooms etc.
- Industrial socket outlets within kitchens, comms rooms etc.
- Weatherproof socket outlets externally and on the roof.

In general, socket outlets will not be provided within corridors, as there is no sympathetic way of servicing these – however they will be provided within toilet lobbies, store rooms and risers off corridors.

All spaces to be provided with power to suit space use.

The finish of all socket outlets has required careful consideration so as to be sympathetic to the Grade 1 listed building, but to provide the necessary contrast ratio as required by Part M of the Building Regulations.

Socket outlets are provided with USB fast-charge sockets where accessible, so as to to facilitate easy charging of phones, tablets etc.

Switched fused connection units are provided to serve fixed items of equipment – their installation methodology will be similar to socket outlets.

Equipment sample process (as required by technical specifications) will be managed by Lendlease.

6.5.11 Furniture Power & Data Distribution

Power & structured wiring distribution systems is provided as part of furniture installations within offices and meeting rooms. This will ensure that there are minimal connections between the floor boxes and the furniture and will mean that all equipment itself is plugged in to the furniture, so as to avoid the need for regular access to the floor services hatches. Cabling will be contained within a cable spiral or cable sock, so as to reduce the likelihood of it being caught by user's feet.



Figure 35 - Typical cable spiral

Power & data will be distributed from the floor box to desk modules located on the underside of the furniture (within a cable basket) and be provided to serve fixed equipment (e.g. PCs and monitors).



Figure 36 - Typical desk module for locating on the under-side of furniture

Desk modules are also provided on the top-side of the furniture, to allow users to plug in portable equipment such as laptops – USB charging outlets are also be provided for charging phones and tablets.



Figure 37 - Typical desk module for locating on the top-side of furniture

6.6 Fire safety systems

A new BS 5839-1 Category L1 automatic fire detection and alarm system will be provided as part of the works to cover all areas of the building, including toilets. As outlined in the fire strategy, a double-knock system is proposed, with simultaneous evacuation

Point smoke detection is proposed, with heat detectors in kitchens. Adjustable tonal fire alarm sounders will be provided, integrated in to detector heads wherever possible. Visual alarm devices, compliant with EN 54-23 will be provided to all perimeter spaces to alert hard-of-hearing users of a fire condition, aside from large event spaces which will be managed by events staff.

Within offices and meeting rooms, fire detection and alarm devices will be located on the soffit – it is not proposed that they will be installed on the lighting service modules, since this would require dedicated conduit drops to the lighting service modules for the fire alarm cabling.

Detectors will be positioned as sympathetically as possible to suit existing building however positions, heights and spacing need to meet regulation requirements. Within corridors, the detectors will be located in existing locations where compliant, so that fixings and cabling routes can be re-used where feasible.

An active suppression system is not proposed due to appearance and impact on building fabric. Fire strategy and fire detection system have been developed to reflect not being provided. The exception to this is in the main kitchen, where an Ansul system will be provided adjacent to the main cooking range.

Aspirating smoke detection will be provided within spaces with ornate ceiling, heritage storage areas, ICT main equipment rooms and substations / HV switch rooms. Smoke detectors will not be located within lift shafts – instead duct detectors or aspirating smoke detections systems will be provided remote from the lift shaft.

In areas where aspirating smoke detection is provided, dedicated sounders will be provided. In areas with ornate ceilings, high output fire alarm sounders will be provided in discrete locations such as within radiator cases or within perimeter boxing-in.

Visual alarm devices will be located within detector heads themselves, however this is likely not achievable within spaces with high ceilings, where dedicated high-output visual alarm devices will be provided.

Refer to Purcell Restoration Drawings for locations of detection in very high significance spaces. Final locations will be agreed on site by Purcell with the LPA and MCC Conservation Officer (within regulatory constraint requirements).

6.7 ICT Design

The Town Hall will have two dedicated Main Equipment Rooms (MER) to accommodate core servers, storage and head-end networking equipment.

Dedicated ICT risers are provided to route cables between levels and support the planned resilient ICT backbone cabling infrastructure. Each MER will have diverse fibre backbone connectivity to ensure essential systems resiliency.

A common structured cabling infrastructure will be installed for the distribution of ICT and AV services within the building. This infrastructure will provide wired connectivity for the Town Hall systems. Backbone fibre cabling will be used to connect the main building spaces – ICT Main Equipment Rooms, Floor Distributers and Zone Enclosures, and to the Town Hall Extension where applicable. The fibre cabling is delivered in blown fibre conduit to ensure full futureproof design of the building.

To protect the building's aesthetic and historic appearance, smaller Zone Enclosures (ZE) are located within the new perimeter boxing-in details of the building. These ZEs will house edge switching equipment to deliver voice, data, Wi-Fi and AV services to rooms and specific spaces by reusing the existing horizontal and vertical pathways.

All offices and meeting rooms will receive connectivity from either a local floor distribution cabinet or a perimeter installed ZE cabinet - these cabinets can service multiple rooms. The ICT containment will run across all the boxing detail sections ensuring copper cabling can be routed to each room. Where Telecommunication Outlets are required, the containment will branch off the main run under the flooring and between floor joists to a fixed floor access point.

It is intended that the IT primary containment is following existing service routes (after the existing services have been removed). Advancements in technology now enable extensive use of wireless devices thereby reducing considerably the number of accessories required in the spaces. Floor voids allow cable distribution in most rooms.

Serving high significance heritage spaces with Telecommunication Outlets will follow the same design principle as the office spaces. In some instances, there is no perimeter boxing detail to populate a ZE cabinet locally; in these situations, data cabling will be fed from the closest ZE under the floor to integrated floor boxes.

The design philosophy for the Town Hall is to ensure that a viable Wi-Fi solution and design is implemented for this prestigious building. The following separate user groups will require Wi-Fi connectivity as a minimum:

- Internal office-based staff (council) - internal Office spaces and meetings rooms;
- Internal office-based staff (non-council) - Coroners courts, facilities management and catering, control room and security desks;
- Public Wi-Fi provision - Great Hall, café, visitor experience.

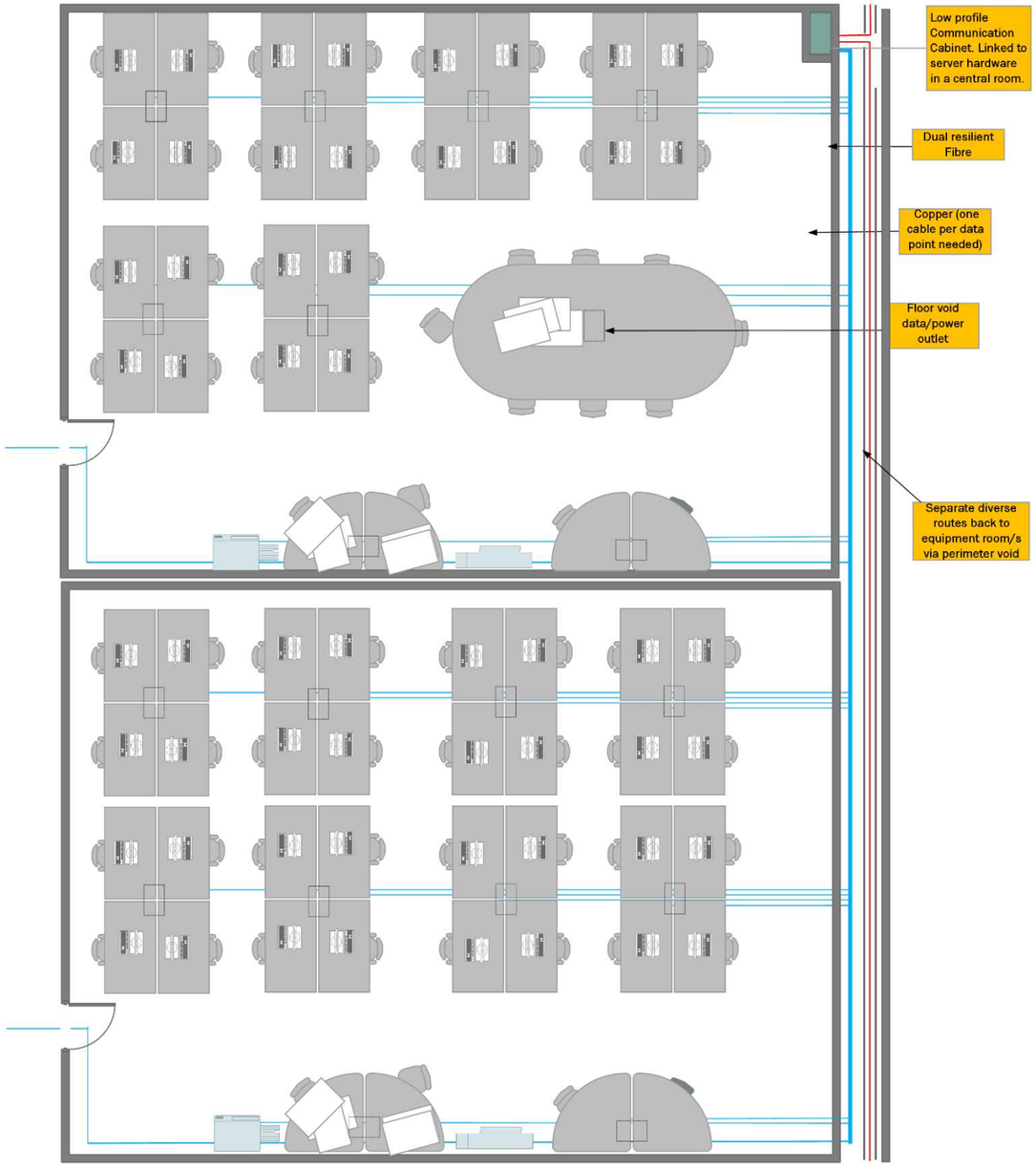


Figure 38 - Typical horizontal cabling deployment (no visible cables)

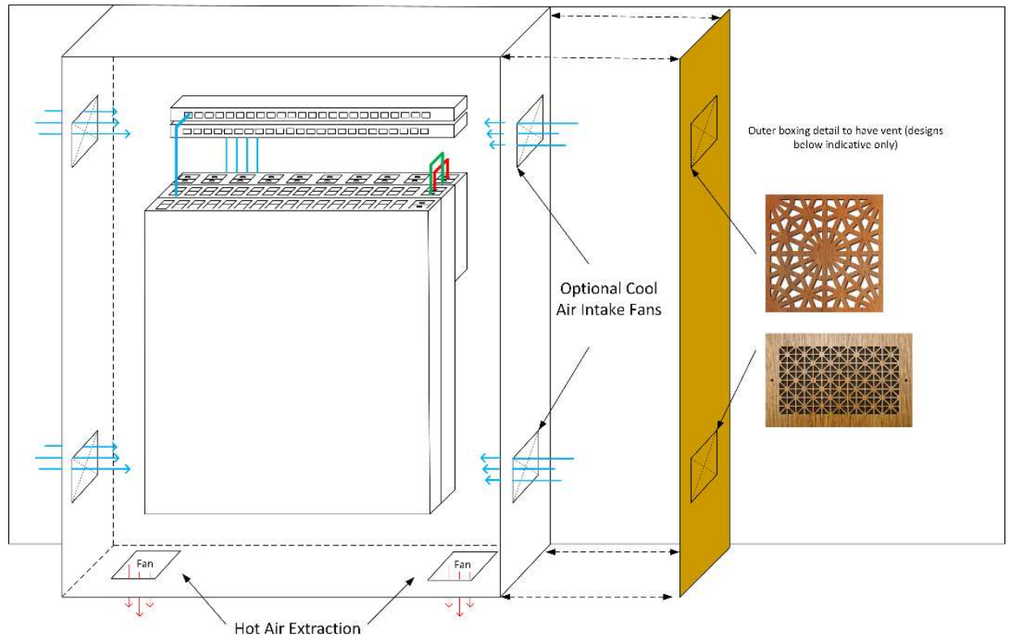


Figure 39 - Low-profile zone enclosure design

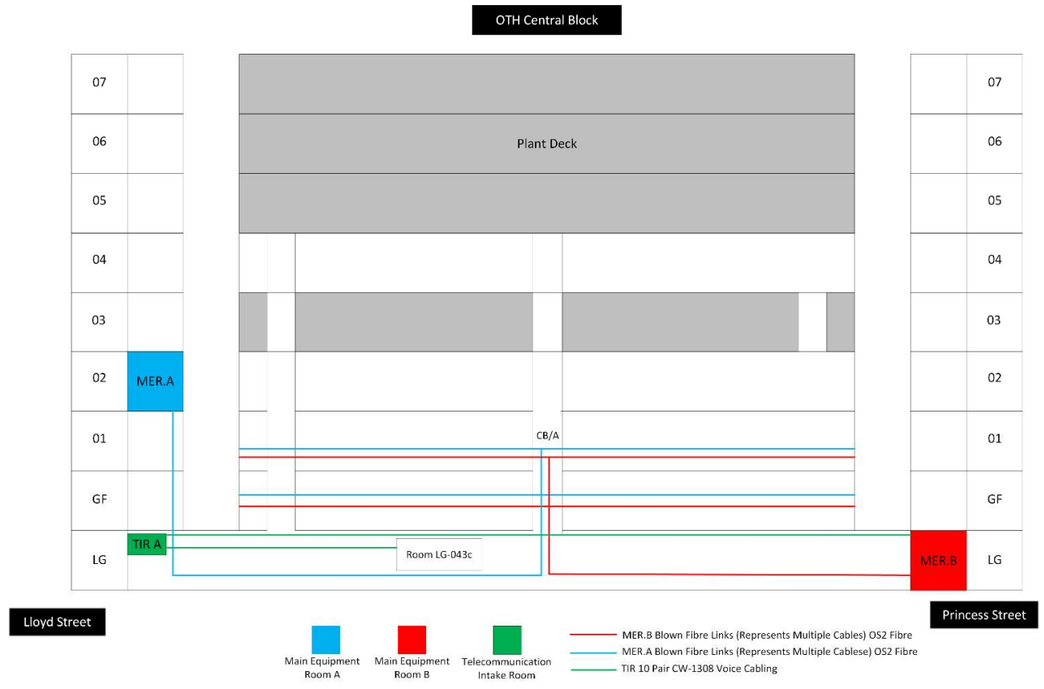


Figure 40 - Typical back-bone cabling schematic (Central Block)

6.7.1 Wireless in Offices and Meeting Rooms

The Wireless Access Point (WAP) for each office or meeting room will be mounted to the central connecting module on the light fittings, each light fitting will have a central joining bracket which will allow the WAP to be fixed on the underside of the light. It is recommended that the WAP should be colour matched where possible or be placed in a vanity box that can be painted to blend in with the furniture.

Two data cables will be fed from the level above, dropping down via the lighting power/fixing penetration points. This will ensure minimal cabling and allow Power over Ethernet (PoE) to be delivered to each WAP.

This arrangement is also part of the separate mock-up rooms submission and works.

Connecting module
Connecting module will house wireless access points, sensors, emergency lighting

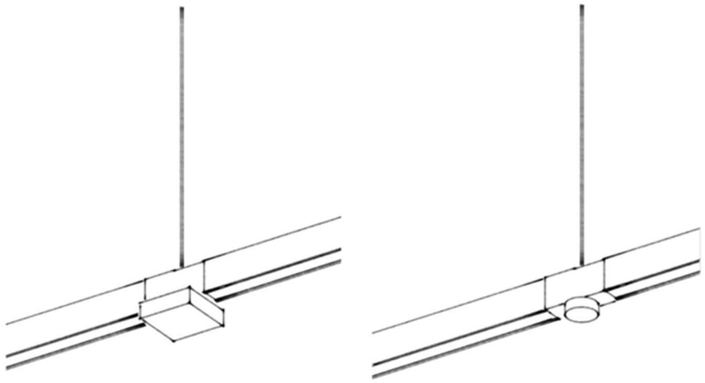


Figure 41 - Indicative lighting module sketch

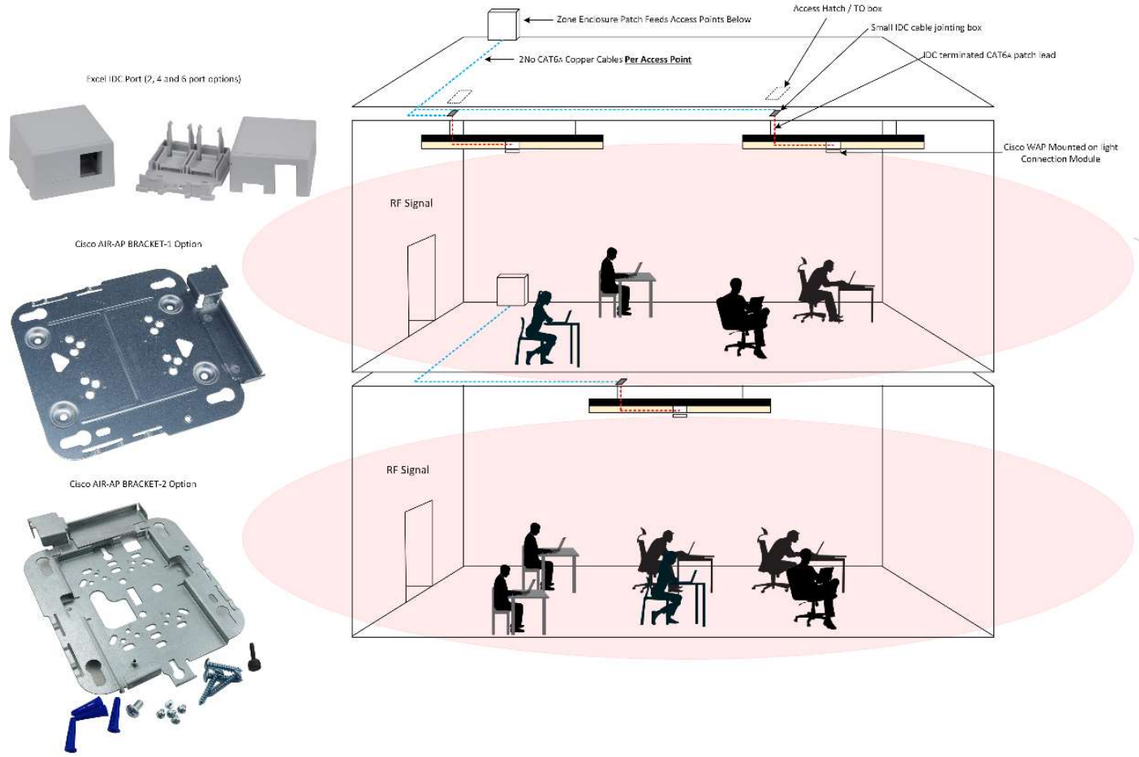


Figure 42 - Indicative low-impact Wi-Fi deployment

6.7.2 Wireless provision in Very High Significance spaces

Whilst an effective Wi-Fi design can be achieved for areas such as offices and meeting rooms, areas of very high significance require compromise of the positioning of Wireless Access Points (WAPs) and hence number of WAPs that can be deployed in these areas.

Due to the high heritage significance of some Town Hall spaces, wireless design is affected by the following factors:

- Heritage and decorative ceilings (cabling penetrations and surface mounting are not allowed)
- Heritage lighting furniture (mounting WAP, cabling and concealing antenna not allowed and difficult to maintain)
- Stone and mosaic flooring (no containment pathways)
- Visual implications in high density areas (more WAPs required to cater for large number of people including associated cabling and mounting locations)
- Maintenance of any active equipment allowed in these spaces would be problematic and could cause damage if maintenance is not managed and monitored
- Reliance on signal propagation from a single WAP can be affected by heritage features, thickness of walls and pillars.

Below is a list of potential impacts on the Wi-Fi deployment where optimal locations for WAPs are not possible.

- Limited coverage from the closest viable WAPs resulting in coverage blackspots
- Low throughput in high density areas (affecting visitor experience and potential Town Hall mobile app functions)
- Requirements for future ultra-high-speed line of sight WAPs will not be achievable.

In circulation spaces and areas such as the Bees it is proposed that wayfinding signage and/or stands will be utilised to conceal or house WAPs. In these cases, data outlets will be positioned in optimal locations for a mobile event connectivity.

The WAP locations have been agreed with Purcell to provide appropriate coverage and an on-site post installation survey will be carried out to verify provision.

In very high significance rooms, WAPs will be mounted at high-level on or above the door structure. The cabling will follow other service cabling for door actuators and fire exit signage. The WAP will have a colour-matched vanity skin/sleeve supplied to enable it to blend in with the surroundings.

The proposed solution will be coordinated with other services and any cabling will attempt to take the same route to create minimal visual disruption. Cabling will be routed from under the floor and traverse the door frame in a custom routed containment method. This option will be most effective and least intrusive to the building features.

WAPs can be disguised and blended into their surroundings to ensure less visual impact on the environment. Below is an image of an actual WAP with vanity covers applied. No vendor has been identified yet, however there are numerous manufacturers available in the market.



Figure 43 - Indicative diagram outlining proposals for mounting wireless access points above doors in areas of very high significance (door not representative)



Figure 44 - Indicative colour/pattern matched wireless access point

6.8 Electronic Security Design

A focused and rigorous approach has been applied to the design of security systems and their associated installations with primary consideration to the heritage nature of the building. Absolute minimal, but risk-led acceptable levels of intervention have been identified to meet the long-term durability and security needs of the building. Due to the UK Threat Context, minimal details on the security infrastructure of the Town Hall design are appropriate for open dissemination. This section provides a high-level description of the

methodology in use with further details being provided in accordance with the Manchester City Council's Security Aspects Letter.

All security enhancements have been designed to be discrete and compatible with the external and internal appearance of the building. Some security upgrades will be hidden or mounted away from original building fabric i.e. placed on new installations such as fire escape signs, secure lines and new lifts etc. Much of the design development for these devices has been conducted by referencing the Waterhouse scheme as a precedent. Where systems will be mounted on existing building fabric, specialist contractors are being employed to create bespoke mounting systems to minimise both the aesthetic and physical impact on the building.

The Electronic Security system for the Town Hall is designed to meet the following principles:

- Provide MCC with modern and functional electronic security systems to improve safety for staff, visitors, and occupants of Public Realm spaces
- Provide a system which considers Secure by Design (SBD) and Crime Prevention Through Environmental Design (CPTED) principles
- Use the most modern and innovative technologies, where available and appropriate, to reduce the heritage impact of deployed devices by:
    - Reducing the number of devices
    - Reducing the size of required devices
    - Reducing the visual impact of deployed devices.

6.8.1 Design Development

Continual reference to both the TVRA and evolving security strategy has focused the security design to ensure that it is proportionately aligned to MCC's risk appetite and absolutely necessary to meet the security needs of the Town Hall in response to the project brief. All security design proposals have undergone substantial review, scrutiny and refinement over the duration of the project, with multiple options explored and settled on collectively with MCC, the architectural team and other relevant stakeholders.

The outcome of design development to date is the use of state-of-the-art technology to significantly reduce the impact and magnitude of security system deployment at the OTH whilst providing the necessary security posture as required by MCC.

The number and locations of the proposed equipment are defined by agreed security strategy requirements. Final detailed setting out of cameras can be agreed (subject to not impacting operation of equipment). Refer to Purcell Heritage Impact Assessment for conclusion of assessment of the Electronic Security proposals.

6.8.2 Video Surveillance Systems (VSS) – Public Realm

As Albert Square is so highly utilised for public events, there is a requirement to protect the users of the space by providing appropriate CCTV coverage. To provide this coverage, we are planning to use high power pan-tilt-zoom (PTZ) cameras to reduce the total number of cameras to be deployed. These cameras are to be mounted on lighting structures within the square at high level with all cabling contained within the lighting structure. The camera casings are to be colour matched to the lighting columns to reduce their visual impact against the skyline.

In addition to the cameras observing Albert Square, the approaches to the site boundary are to be protected in order to give the earliest possible warning of a threat. These cameras are to be mounted on dedicated camera mounting columns.

As the Town Hall is part of a larger complex, utilised by Government offices (including GMP) we are proposing to mount one PTZ camera on the underside of each footbridge along Lloyd Street. MCC FM & Operations team have advised that the existing cameras do not provide required coverage. These cameras are small and are to be colour-matched to the bridge soffit. These cameras will also provide coverage of the vehicle gate into the Town Hall Courtyard and vehicle/pedestrian movements along Lloyd Street. The cameras are to be surface mounted to the soffit and wiring to be routed along with the lighting elements intended to affix to the soffit.

There is a requirement to provide surveillance onto the facades, entrances and moats of the Town Hall. In a similar fashion to the Albert Square provision, the most modern cameras are to be used to cover the widest possible area from a single position. In order to keep the cameras as unobtrusive as possible, PTZ cameras are not proposed (with the exception of one camera), instead, smaller fixed cameras are to be utilised, again with a casing colour matched to the surrounding soffit. Indicative external cameras are illustrated below.



Figure 45 - Indicative External Fixed Camera, indicative External Albert Sq PTZ and indicative External Bridge PTZ

6.8.3 Video Surveillance Systems – Internal

Based on the current UK security climate, there is a requirement to provide VSS monitoring within the Town Hall. Due to the design approach and existing structure of the building, there is no opportunity to mount cameras onto ceilings or containment within the main circulation corridors. The Design Team has therefore investigated multiple opportunities to mitigate or reduce impact to the building fabric yet still provide effective coverage for the security of all users of the building. The process of assessment for each camera position is illustrated below.



Figure 46 - Flow chart outlining the process for determining mounting arrangements for cameras

New structures are required within the building to bring it into compliance with code, especially Fire Regulations. Part of this compliance is to provide escape signage at key points within circulation spaces. As can be seen below, the preferred option for camera mounting is onto new structures that are unavoidable. Escape signage provides this opportunity in many areas.

The Design Team have developed a method to mount cameras onto escape signage whilst referencing the original Waterhouse design principles. Research into Waterhouse designed bracketry revealed a number of brackets included within *Examples of metalwork for Ecclesiastical & Domestic Use – Section 4* for lighting and a number of these brackets selected for design development into a combined-service mounting point. The original sketch of this bracket is below.

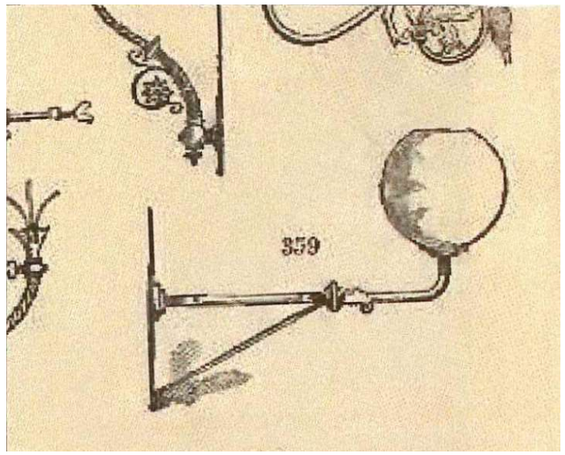


Figure 47 - Waterhouse bracket

As this bracket was originally designed to support gas lighting, the Design Team have developed bespoke attachments to incorporate the required cameras and signage into a removable item.

Totem mounted and single lens cameras were considered but a greater number required. This approach has been selected as the best technical solution & advised by Purcell as lowest heritage impact.

The modern element is sketched below with a complete unit in situ also identified. As with the public realm cameras, these mountings are removable with minimal remedial work to plug screw holes in the building fabric which are required by statutory requirements to mount escape signage.

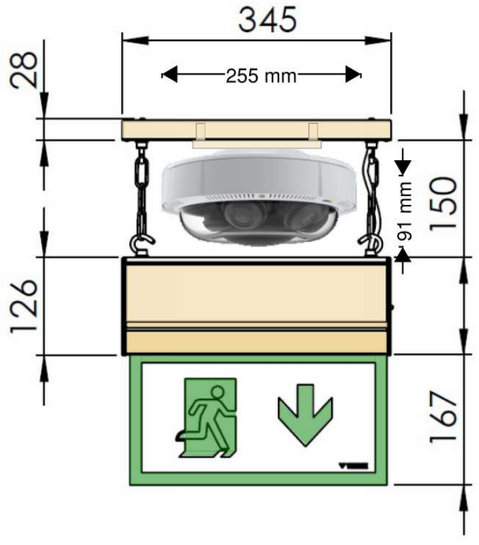


Figure 48 - Indicative escape signage mounting (finish not representative)



Figure 49 - Indicative corridor camera in situ

6.8.4 Electronic Access Control

To restrict access to non-public spaces within the Town Hall, an effective and discrete access control system has been designed. To reduce impact on the building fabric, low security spaces will be protected by wireless locking devices with electronics concealed within the door - an indicative device is illustrated below. Samples will be presented on site for review with the LPA and Conservation Officer. These devices not only reduce interventions for wiring but also remove any requirement for request to exit buttons, green break-glass devices and doors contacts around the protected door; these functions are provided within the lock itself.



Figure 50 - Indicative wireless lock (note the finishes are not representative)

Where wireless access control is not appropriate due to high security requirements, discrete card readers and high security locks will be deployed, with wiring hidden within architrave and floor voids. The details are part of the separate mock up room proposal and will reviewed on site.

6.9 Audio Visual Design

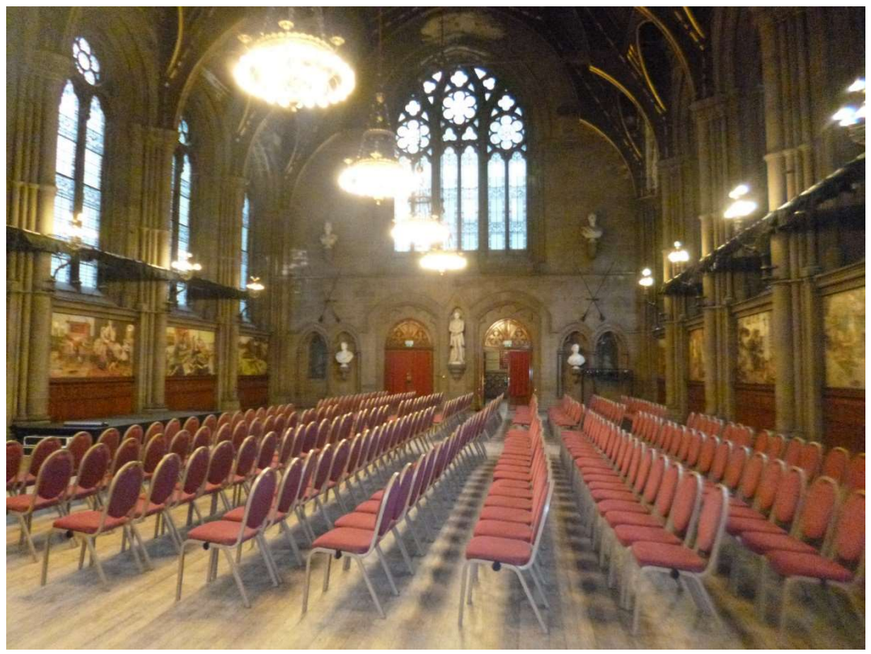


Figure 51 - Function in Great Hall

The Town Hall is used for a wide variety of functions, both by internal stakeholders and for external clients. These include conferences, weddings, local and international governmental events and dinners which all require modern Audio Visual facilities in the extremely heritage sensitive environment.

The new Audio Visual facilities offered by the building are in line with other regional event spaces to be attractive for a wide range of simultaneous events and efficient for operations.

The audio-visual systems are developed in line with the following principles:

- The audio-visual systems respect the **heritage nature of the building**. They will deliver the required functionality in ways that as far as possible avoid permanent intervention. Portable equipment and wireless solutions are used where appropriate, with support and access solutions which minimise damage to the fabric of the building which can occur with regular movement of events equipment.
- A **future-ready cabling infrastructure** is provided, recognising that cable routes are limited and much of the cabling will be inaccessible following refurbishment.
- The installed infrastructure will allow for **flexibility of room use** and recognise that room use will change over the lifetime of the installation.
- The installed infrastructure uses non-proprietary, industry standard cabling and equipment to allow for **technology upgrades** of equipment over the lifetime of the infrastructure.
- The systems are designed for flexible operations, allowing the MCC team to deliver the wide range of events required with **safety and efficiency**.

- MCC have signalled a desire to have induction loops where possible to minimise differentiation which can be associated with neck loop receivers. Induction loops are not possible in all spaces due to interference between vertically stacked rooms, and provision of installed loops will be prioritised for larger rooms where high background noise levels are expected and a greater number of unplanned public attendees are expected.
- In meeting rooms and other smaller spaces which will be susceptible to interference from adjacent spaces, infra-red systems will be provided with associated receivers. Infra-red systems will also be provided in areas where use is confidential or sensitive such as the court rooms.

Throughout the building there are several large multi-purpose spaces for flexible events use. Facility panels and 48mm receptors for loudspeaker poles will be provided in floor service hatches around the perimeter of each room for connection of portable events equipment. Rooms have similar provision to allow interchangeable use as far as possible. Some rooms will have discreet, installed loudspeakers to support speech and background music without the need for temporary equipment.

The Great Hall will also have motorised hoists. These will facilitate safe rigging of equipment at height, whilst protecting the highly significant murals.

The installed infrastructure will support the use of portable equipment to facilitate the anticipated range of events. This ensures flexibility for alterations and upgrades to the AV systems over time without the need for subsequent listed building consent. It is expected that equipment will be shared between spaces and allocated as required on a day to day basis

Refer to Arup report OTH-ARU-ZZ-XX-RPT-B-0002 '*Audio Visual Strategy*' for further details of the proposed audio-visual design.

6.10 New Lighting

This section describes the proposals for all new modern luminaires being installed, typically in areas of less high significance.

The following factors will be applied to all of the principle new lighting elements located within the building:

- Generally, use of warm white light sources synonymous with the original gas and tungsten light sources.
- Reliable lighting control systems are considered to reduce unnecessary lighting use and to maximise efficiency and flexibility.
- High quality LED light sources will be used within front-of-house spaces to ensure consistent colour, high efficiency and reduced maintenance.
- In 'wet or outdoor' spaces lighting will have a suitable ingress protection (IP) rating and corrosion resistance.
- All luminaires will have effective glare limiting measures.
- Existing luminaire mounting locations will be used where possible to minimise new penetrations to the building fabric.
- In jack-arch ceiling spaces, there will generally be one penetration per arch for the luminaires. This is the strategy for most of the offices and meeting rooms.

The following factors will be applied to the façade lighting scheme:

- Luminaires are in accessible locations for ease of maintenance.
- Where possible, luminaires are located on ledges that conceal the luminaire.
- Luminaires are linear and discreet in profile in comparison to the existing, redundant façade lighting fixtures.
- Albert Square façade luminaires will be capable of changing colour but will generally comprise of a static white colour of light.
- All other facades will comprise of a static white colour of light.
- Sky glow and light obtrusion will be within the guidelines listed in ILP Guidance Note for Obtrusive Light GN01.

Refer to the following documents for detailed information on the internal and façade lighting strategy:

- General Lighting Specification: OTH-ARU-ZZ-XX-SPE-E-0007
- Lighting layout drawings: OTH-ARU-TH-(__)-DWG-E-25401 to OTH-ARU-TH-(__)-DWG-E-25487
- Façade lighting layout drawings: OTH-ARU-TH-ZZ-DWG-E-3503 to OTH-ARU-TH-ZZ-DWG-E-3507.

6.10.1 Control Strategy

Two lighting control systems shall be provided and are described in this section:

- DMX based lighting control system for the façade lighting
- BLE (Bluetooth Low Energy) based lighting control system for the internal lighting

The feature lighting scenarios for the Town Hall façades will require a specialist lighting control system, in lieu of a more conventional building lighting control system. A standard protocol exists in the entertainment lighting world and this has been adopted by many facade lighting manufacturers for the control of white/colour-changing floodlights. Therefore, a Pharos LPC4 DMX controller using the industry standard DMX protocol will be adopted for this project. This type of control system shall enable dynamic and colour changing scenes to be created, as well as the predominant 'white' lighting scenario.

The DMX system shall be controlled in a variety of ways, including:

- real-time control via a touchscreen device (intended for the non-technical operator)
- external interface (to connect a guest DMX console for special events etc.)
- automated or pre-programmed sequences.

The BLE (Bluetooth Low Energy) based lighting control system for the internal lighting is a wireless control system that minimised the requirement for control cabling. This will be applied across the whole internal lighting scheme.

The BLE system will be controlled in a variety of ways, including:

- Facilities Manager: scene selection and control applied to the whole building, and across multiple mesh networks. Basic reconfiguration of scenes and groups via DPI (digital portable interface) and/or fixed touchscreen located in the Security Control Room.
- Local control: room switching and pre-set scene selection via local fixed switch and/or DPI.
- Expert Control: for commissioning engineer, direct connection to the central lighting control system via a DPI. This mode shall permit to control individual luminaires and also provide different functionalities such as scheduling, re-addressing of fixture groups and scene manipulation.

Local fixed switches will be provided in plant rooms, control room and meeting rooms.

Refer to the General Lighting Specification for more information on the controls (OTH-ARU-ZZ-XX-SPE-E-0007).

6.10.2 Emergency Lighting and Exit Signage

A new 3-hour emergency lighting and exit signage system will be provided, compliant with BS 5266. A hybrid system is proposed, to suit the different spaces within the building, with more discrete installations proposed in areas of higher historic significance. Existing heritage luminaires, and new replica luminaires will be backed off the emergency lighting central battery system so as to avoid the need for dedicated emergency luminaires in very high significance spaces.

The emergency lighting installation will be provided as an automated self-test system, with central reporting facilities. This will reduce the maintenance burden of emergency lighting testing and ensure regulatory compliance with a suitable audit trail.

A new illuminated exit signage installation will be provided as part of the works, designed in accordance with BS 5499-1.

6.11 Lifts

Vertical Transportation is a critical aspect of the Town Hall design, since it is the means for allowing universal access to all levels of the building and for highlighting the unique heritage of the building to the public.

The lifts proposals have been designed to work in tandem with the architecturally led new building entry points and the imposing staircases. Specifically, it is not the intent to replace or undermine the latter, on the contrary the proposed building entry points will promote the use of the staircases. Refer to Purcell reports for details of the building entrances, operational considerations and approach for positioning and travel of the lifts.

The new lift provision is summarised as follows:

- Lloyd Street lift (general, firefighting & evacuation lift) – Lower Ground to Level 6
- Lloyd Street split lift – shaft provision only from Level 5 to Level 7
- Goods lift (Lloyd St side of building) – Lower Ground to Level 1
- Albert Square lift – Lower Ground to Level 01
- Princess Street lift (general & evacuation lift) – Lower Ground to Level 5
- Princess Street lift (general & evacuation lift) – Level 5 to Level 7
- Cooper Street lift (general, firefighting & evacuation lift) – Lower Ground to Level 6
- Stage lift (platform lift) – Level 1 to Level 1 stage
- Albert Square platform lift – External level to Ground Floor
- Cooper Street platform lift – External level to Ground Floor.

Following statutory requirements three passenger lifts are necessary to comply with firefighting regulations. The proposal is that these will be located at the three corners of the building (in the immediate vicinity of Princess Street, Cooper Street, and Lloyd Street entries), taking also into account building fabric interventions. These will also act as evacuation lifts for mobility impaired people.

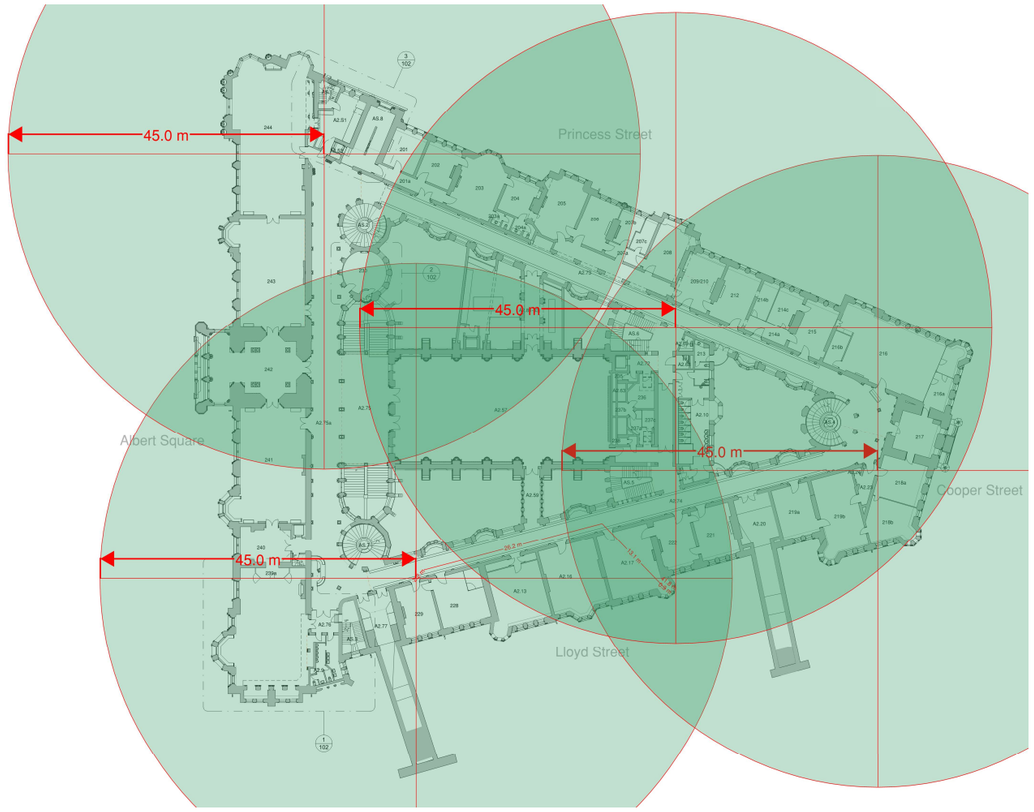


Figure 52 - coverage of fire-fighting and evacuation lifts (note Central Block has no lift – this is purely evacuation by evac chair

6.12 Water and Drainage

The public health services design includes domestic hot and cold water, above ground sanitary drainage and above ground internal rainwater drainage. The strategies aim to optimise energy efficiency while minimising the impact on the historic character of the building.

The existing external rainwater drainage system is intended to be refurbished and re-used: The proposals for this are addressed by Purcell's documentation.

The main challenge for the public health design is to provide adequate water and drainage services for the increased number of toilet and welfare facilities that are expected in a modern mixed-use office building with a court, ceremony rooms, and event/catering spaces. As an example, the Town Hall has 59 existing WCs and the new provision is over 125.

The public health servicing strategies aims are:

- Add in the additional services required whilst being sympathetic to the historic character of the building.
- Re-use existing routes and risers for water services and drainage where possible.
- Reduce the amount of plant required to provide domestic hot and cold water to the building.

- Provide centralised hot water plant that is compatible with the use of the heat generated from the new Civic Quarter Heat Network (CQHN).
- Installation of a building management system (BMS) to provide automatic control, plant monitoring and metering of energy and water consumption.

6.12.1 Domestic Cold Water Services

Water is provided to the building via the existing incoming mains water supply which enters the building at Lower Ground Floor level on the Princess Street side. Cold water storage will be provided to protect against interruptions to the mains supply and ensure that water supply pressures can be safely maintained.

The potable cold water storage tank at lower ground floor level supplies water to a packaged booster pump-set which in turn delivers a wholesome supply of water to all plumbing fixtures throughout the building.



Water services distribution pipework is distributed at high level within the Lower Ground level corridors and connects to a number of services risers that distribute water vertically up the building to all areas that require a domestic water supply.

Distribution pipework is sized to satisfy the system flow rates based on the number of plumbing fixtures connected to it. Diversified flow rates are applied to ensure economic pipework sizes are provided whilst giving due consideration for future flexibility.

6.12.2 Domestic Hot Water Services

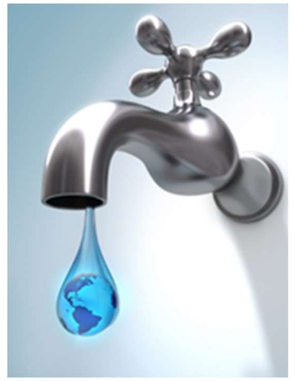
The existing strategy sees hot water being generated local to the fittings that require a hot water supply. This has led to multiple hot water systems being installed within in the building, which can prove to be difficult to maintain. Due to the numbers of sanitary appliances within the Town Hall, a central hot water system provides the most appropriate supply strategy.

The central hot water generation equipment is located at Lower Ground level in the central block plant area. Locating hot water plant in this location results in the hot water being generated in close proximity to the areas of the building that require the most hot water (the main production kitchen at Level 1 and the main toilet blocks on Ground Floor, Level 1 and 2). This avoids unnecessary heat loss from long lengths of large size hot water distribution pipework.

In order to prevent the potential growth of legionella or other waterborne bacteria, each hot water distribution system is designed to enable an automatic pasteurisation cycle to be carried out.

6.12.3 General Water Services

The following water conservation measures will be incorporated into the water services systems:



- To regulate water consumption, flow restrictors will be installed on all water terminal outlets.
- Where applicable (particularly in the new toilet areas), sanitary fittings will incorporate the use of infra-red proximity sensors or automatic closing taps.
- Use of PIR's to shut off water supply to toilet blocks when not in use for a period of time
- Low and dual flush WCs.
- Installation of pulsed output/M-Bus water meters linked to Building Management System to enable monitoring of water consumption in different parts of the water distribution system. This facility will be used to encourage future water efficiency and to provide an alarm facility in the event of possible irregular usage within the system, which could be attributed to leakage.
- Implementation of a leak detection system on the incoming mains water supply.
- The water services system will incorporate service valves on all items of plant and sources of supply to allow for isolation to facilitate maintenance.

A leak detection system will be provided adjacent to all distribution pipework which is installed in areas where a leak would otherwise go un-noticed and could cause adverse damage to highly significant building elements including, exhibits or primary electrical / ICT infrastructure.

6.12.4 Drainage

The Town Hall will be served by two completely separate drainage systems:

- Above ground sanitary drainage system (foul water)
- Above ground rainwater disposal system.

Below ground drainage is addressed separately by Ramboll reports.

Sanitary Drainage

All existing above ground sanitary drainage pipework that serves the Town Hall will be completely stripped out and replaced. A new primary ventilated sanitary drainage system is provided to all areas that require domestic sanitary drainage.

Layouts of toilets & welfare areas have been developed to re-use existing drainage pipe locations where possible. With the increase in toilet and welfare provision, the new provisions have been developed to enable new drainage pipe locations to be incorporated within the building to minimise impact where possible.

Sanitary drainage is routed throughout the building by gravity utilising a series of horizontal and vertical soil and vent pipes. Vertical soil and ventilation pipework is routed in service risers and will connect to the below slab drainage system.

The majority of the sanitary drainage system is installed within the building footprint with the exception of the foul drainage from the 1960s kitchen block which sits between the Central Block and the Princess Street

corridor on Level 1. For this area, two new sanitary drainage stacks are provided. These stacks will be installed on the external façade within the courtyard using cast iron pipework.

In general, due to the height of the building, foul flows from sanitary appliances on the lowest storey level discharge into separate stub stacks.

The sanitary drainage system will vent to atmosphere where possible. There are some toilet facilities on the lower levels that are unable to vent to atmosphere due to the existence of very high significance rooms above. In these instances, it will be necessary to include air admittance valves to introduce air into the drainage system.

The sanitation system is designed and routed throughout the building with due consideration of the acoustic requirements of the space that it passes through. In sensitive areas this may require some parts of the sanitation system to be acoustically insulated.

Suitable access points are provided in the sanitation system for cleaning and maintenance operations.

Kitchen Drainage

Kitchen drainage is technically part of the sanitary drainage network. However due to the likelihood of a build-up of fats, oils and grease in the kitchen drainage network, the layouts of the main kitchen area and the pot wash have been developed to allow the main grease producing appliances to drain via independent foul drainage stacks. These kitchen drainage stacks connect to two items of grease extraction plant. One is buried in the courtyard and one is to be installed below the slab in the Lloyd Street side of the building. The design of these is being undertaken by the Structural/Civil Engineer.

A grease extraction point will be routed from this plant to the catering entrance at the new Lloyd Street loading bay. This connection point will allow the grease extraction plant to be emptied without the need for a vacuum tanker to enter the courtyard.

Rainwater Drainage

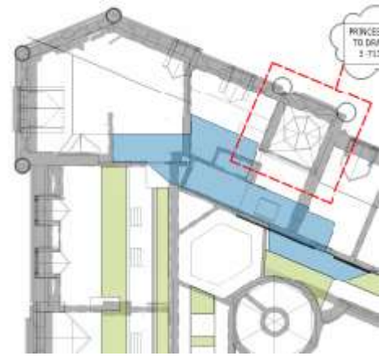
The Town Hall has an extensive rainwater disposal system which includes decorative rainwater pipework on the external façades around the perimeter of the building and within the courtyard.

This section describes the proposals for the new internal rainwater drainage. Refer to Purcell documentation for information regarding the external rainwater drainage.

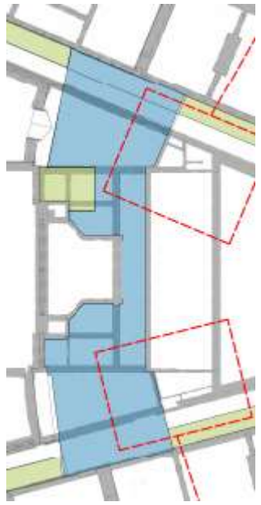
When the Town Hall was originally designed, the rainwater design standards recommended a peak rainfall intensity of 75mm/hr, which is a lot lower than modern day standards (202mm/hr). This modern rainfall intensity is based on a return period of 112 years.

Design checks have been undertaken to assess the performance of the existing disposal system against modern rainfall design standards. The aim of this was to ascertain if any areas of the building required additional rainwater drainage to prevent surcharge or flooding. It has been identified that three separate roof areas would benefit from the installation of additional rainwater outlets and downpipes. These are:

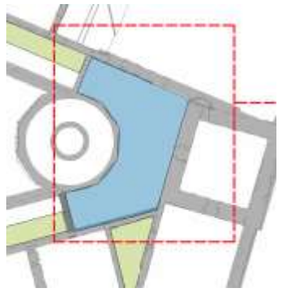
Above Princess Street Core



Above the Central Block



Adjacent to Cooper Street Core



The three affected roof areas are being amended to incorporate the introduction of lifts, changes to staircases and the introduction of plant, therefore these works provide an ideal opportunity to amend the rainwater design to alleviate drainage issues in these areas.

Five additional internal rainwater downpipes will be provided to drain these roof areas. Each of these downpipes will be cast iron and will connect to the below ground surface water drainage system. Refer to Ramboll information for details of the below ground drainage.

Current access for large areas of the rainwater drainage system is inadequate. Many of the rainwater outlet locations are inaccessible. This makes maintenance a complicated, time consuming and expensive task to carry out. As such, it is unlikely that the current rainwater system is maintained as often as it should be and resulting in blockages that go unnoticed until rainwater starts to enter the building.

Upgraded roof walkways and edge protection have been proposed by the architect to eliminate the need for abseiling to access outlets and gutters to provide suitable access to parts of the rainwater system that have previously been inaccessible.

6.13 Fire Suppression

Due to water companies reducing the pressure of water that they deliver to buildings, the existing wet rising main will be removed and replaced with a dry riser system.

Within each firefighting core dry rising mains will be provided within the main firefighting shafts serving each level, with a landing valve located at each floor level.

Inlet breeching pieces shall be provided at entry level on the building façade for each dry riser. Following discussions with Greater Manchester Fire & Rescue Service the redeveloped Town Hall will require four inlet breeching pieces. It is proposed to install three of these in close proximity to the existing inlet locations (with new inlets and pipework) with a fourth inlet being added halfway along the Princess Street elevation to serve the central block fire core.

In addition to dry risers, a hood suppression system will be utilised within the main kitchen.

6.14 Natural Gas

Natural gas is provided to the building via the existing incoming gas supply which enters the building at Lower Ground Floor level on the Princess Street side. Gas is only required for the main kitchen.

A gas solenoid valve will be required within the incoming gas room which will be interfaced with the fire alarm system and will shut off in the event of fire detection.

A gas solenoid valve will also be required for the main kitchen which will shut off the supply in the event of fire detection in the same zone. This will be interfaced to the fire alarm system. Emergency gas isolation switches will also be provided in the main kitchen for operation by users. These should be interlocked with the ventilation systems.

6.15 Lightning Protection

A lightning protection system is provided to reduce the likelihood of a building from being struck by lightning and to reduce the effects that a lightning strike has on the building itself, its users and any equipment within the building. The main principle of a lightning protection system is to provide an alternative, low resistance path for a lightning strike that is not through the building it protects.

The existing air termination network consists of a combination of copper conductors, copper tape and the use of metallic ridge features, metallic perimeter handrails and metallic roof leadwork. The existing air termination network will be replaced with a new network of conductors, reusing the existing locations and mounting holes where possible. Although metallic roof components are currently used as part of the air termination network, going forwards only dedicated conductors are used to form the air termination network.

The lightning protection installation has been carefully coordinated to ensure that it is as visually unobtrusive as possible, and existing fixings to stonework will be utilised wherever possible.

So as to reduce the visual impact of the lightning protection system, the design rationalises the air termination network on the roof through fortuitous protection from taller elements such as the towers and chimneys. Fortuitous protection from lightning can be gained to some elements of the roof from taller elements such as the Albert Square and Cooper Street towers, as well as the larger chimneys / flues. The building geometry is complex, and identifying such fortuitous protection is very challenging. However, Arup have developed a bespoke software tool to analysis this requirement, based upon the ‘rolling sphere method’ in BS EN 62305. The result is a substantial reduction in the provision of lightning protection, whilst still providing protection from lightning as identified by the risk assessment.

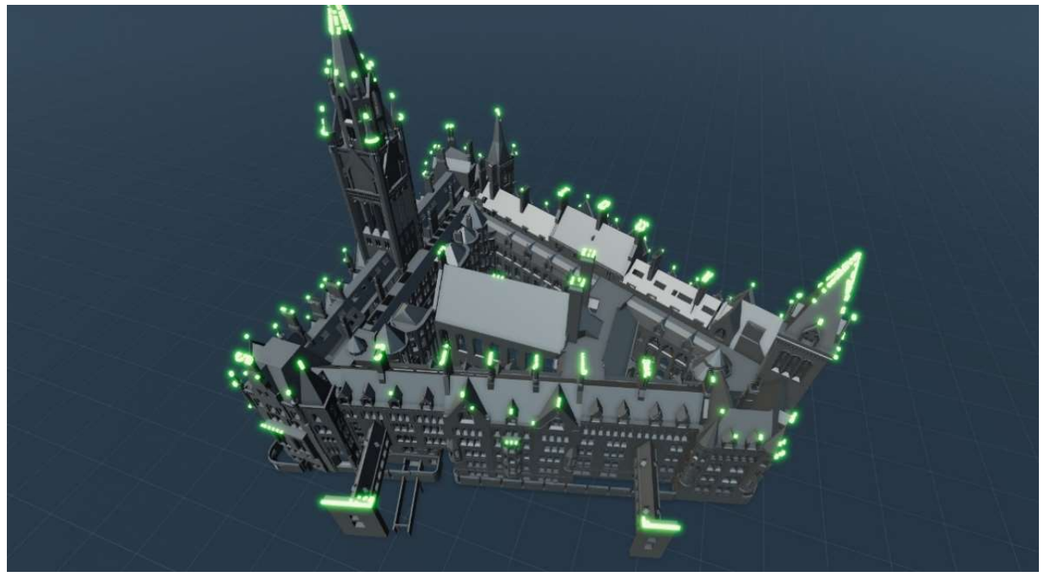


Figure 53 - Software model identifying green areas which are susceptible to a lightning strike

Existing air terminals will be replaced with new air terminals installed in the same positions as the existing ones, with additional ones being installed where required to achieve the required protection class following the risk assessment. The new terminals (both for existing and new locations) are finials or multi point rods, positioned and selected to be as sympathetic to the historic building as possible, in particular with respect to view from the streets outside the building.

The existing down conductors are façade mounted copper rope and cylindrical copper conductors. The existing down conductors will be replaced with new down conductors, utilising the same positions and mounting holes etc. where possible, in order to minimise the intrusion to the building fabric. The new down conductors will be installed to comply with BS EN 62305 and positioned in a way that is as sympathetic to the external façade of the building as possible. Additional down conductors will need to be installed to

comply with the updated BS EN 62305. According to this standard, all down conductors must be within 10 m of another conductor (for class I and II).

All roof mounted metallic equipment (both existing equipment and any new equipment provided as part of the project) will be bonded to the lightning protection system to protect both the equipment and anything it is connected to from the effects of a lightning strike.

All lightning protection installations will be copper throughout for longevity. The conductors will be PVC sheathed where necessary, in a colour which is similar to that of the elements they are mounted to. Samples are required to be submitted as part of the technical specification and this process will be managed by Lendlease. The sheath will be standard RAL colour to be agreed with Purcell, LPA & Heritage Conservation Office

Refer to Arup drawings OTH-ARU-TH-RF-DWG-E-24401 and OTH-ARU-TH-ZZ-DWG-E-34401 – 07 for details.

7 Building Services approach in Very High Significance spaces

7.1 Overview

Due to their very nature, great care and attention is needed with the design and installation of services in spaces classified as very high significance. Detailed design coordination workshops have taken place (generally within the spaces themselves), so as to agree the servicing strategies. Services in very high significance spaces are being designed, where feasible, to be as unobtrusive as possible – however it should be noted that the spaces classed as of very high significance are some of the most highly utilised places within the building, demanding great level of flexibility in some cases. As part of these design coordination sessions, MCC have provided feedback on the level of flexibility which should be provided for alternative future uses – this is important, so as to provide the right level of flexibility, without over-servicing spaces.

Within spaces identified for restoration and areas identified as very high significance, Purcell are providing Restoration Drawings detailing the proposals for each space – these principals have been collectively agreed with the design team and used as a basis for the Stage 4 design. Arup have provided feedback for compliance requirements for equipment as appropriate e.g. fire detection, emergency escape signage, VSS etc. The Purcell drawings include the proposals for locations of visible equipment and associated exposed cabling.

The appearance, visual and heritage impact of the overall solutions are addressed by Purcell as follows:

- For overall approach and/or visual impact of the proposals refer to Purcell report OTH-PUR-XX-XX-RPT-A-0100 '*Design & Access Statement'*
- For heritage impact relating to the building services refer to Section 4 of the Purcell report OTH-PUR-XX-XX-RPT-Z-0103 'Heritage Impact Assessment: Manchester Town Hall' and the Purcell Existing Heritage Significance plan drawings.
- For layout of new exposed services in very high significance spaces refer to Purcell drawings series OTH-PUR-TH-ZZ-DWG-A-57xx

These spaces are described in further detail below.

7.2 Circulation spaces

Within the main circulation corridors on Ground Floor and Level 1, the services installations have been designed to be as minimal as possible. Existing service trenches are being reutilised throughout for heating the spaces and distribution of electrical services. The electrical service trenches will be provided with a removable insert, so as to hide the cabling which will be multi-coloured and prevent build up of detritus. Heating trenches will be provided with an integrated mesh, so as to minimise the build up of dust and dirt.

Within the existing spiral stairs and Centre Block stairs, the servicing strategies will be very similar to the existing strategies, with heat emitters provided at the base of the stairs and cabling for lighting etc. provided using surface 'conduits' which will wherever possible follow the routes of the existing gas pipework – these will be supplemented with surface-mounted MICC cabling installations. The services provided within the staircases has been reduced to the absolute minimum, so as to minimise the visual impact.

Wherever feasible, existing surface-cable routes will be followed, with fixings re-utilised where workable and new MICC cabling installation provided. Care is needed on the selection of the finish of the MICC cabling and accessories, to ensure it quickly dulls, so as to be unobtrusive.

Fire detection within the circulation spaces will be provided through the provision of point smoke detectors with integrated sounders. Black-coloured devices are proposed, so as to be less conspicuous against the finishes, which are generally dark. Wherever possible, existing locations will be re-utilised, where compliant with current standards. The locations of manual call points have been carefully coordinated, with the majority of these located in areas with new interventions as part of escape stairs / lobbies. However, a small number of manual call points are required in the main circulation spaces to comply with current standards – these will be surface cabled in MICC.

There are no sympathetic locations for locating socket outlets within circulation spaces and staircases, and as such is not proposed that these are provided. MCC have confirmed that wireless tools are most commonly utilised in the Town hall for cleaning and maintenance, for this very reason.

Data outlets will be provided within the service trenches outside meeting rooms, so as to facilitate the integration of electronic room booking screens on free-standing mini totems.

New replica luminaires will be provided throughout – these are located at points where there are existing wiring routes. A proportion of these luminaires will be backed of the emergency lighting central battery system, so as to avoid the need for dedicated emergency lighting. Illuminated exist signage will however be required to comply with modern standards – where feasible these will be located on new interventions to escape lobbies – however intermediate signage is required. Exit signs and video surveillance cameras will be combined, so as to minimise the service routes.

7.3 Sculpture Hall

The Sculpture Hall will once again be utilised as a café, and a new café counter will be provided adjacent to the new finishing kitchen. This café counter is being designed to be removable and will connect in to stub services provided within a new trench backing on to what is currently a lift shaft.

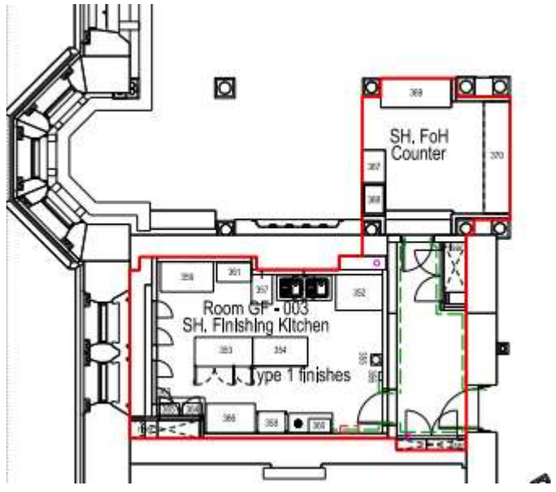


Figure 54 - Proposed cafe counter within Sculpture Hall

The existing service trench will be re-utilised for heating the space. The space is well known for historically being cold, so the heating in the space will be dramatically enhanced, whilst keeping within the confines of the existing service trench and existing under-window heat emitter locations.

Floor boxes will be integrated in to the service trench so as to provide power, data and AV facilities for temporary events.

New replica lighting will be provided – these are located at points where there are existing wiring routes. A proportion of these luminaires will be backed of the emergency lighting central battery system, so as to avoid the need for dedicated emergency lighting.

Following detailed CFD modelling as required by the Greater Manchester Fire and Rescue Service, aspirating smoke detection is required within the Sculpture Hall so as to provide the earliest possible indication of a potential fire.

There are existing high-level penetrations in to the floor void of the Lord Mayor's Parlour above – assumed to have been made as part of the 1985 re-wiring. These will be utilised for the wiring to the lighting, as well as for housing the sampling tubes for the aspirating smoke detection system (the main pipework will be run in the floor void above).

7.4 State Rooms

The rooms are commercially let for a variety of uses providing valuable income for Manchester City Council. They therefore need to be designed to be very flexible, whilst minimising visual services.

Flooring has been lifted as part of the intrusive surveys. It has been found that the floor void can accommodate trench heaters, but it is too shallow to accommodate the chilled water pipework for trench cooling. Trench heaters will be provided along the perimeter of the room and radiators concealed within casings are proposed for heating. These solutions require modifications to the joists and floor plate to accommodate the trench heaters. Refer to Purcell Heritage Impact Assessment.



Figure 55 - Typical floor void in state room

Through detailed examination of the existing floors, it has been identified that there are areas of the floor which are accessible and have been provided as service runs. These will be re-used and adapted for services installations going forwards. Through review of architectural drawings from the 1980s, it has been identified that alterations were completed to the floor in the Lord Mayor's Parlour, and the associated interconnecting rooms – thought to have been for alterations to lighting within the Sculpture Hall. These service routes will be invaluable not only for serving the state rooms, but also the Sculpture Hall below.

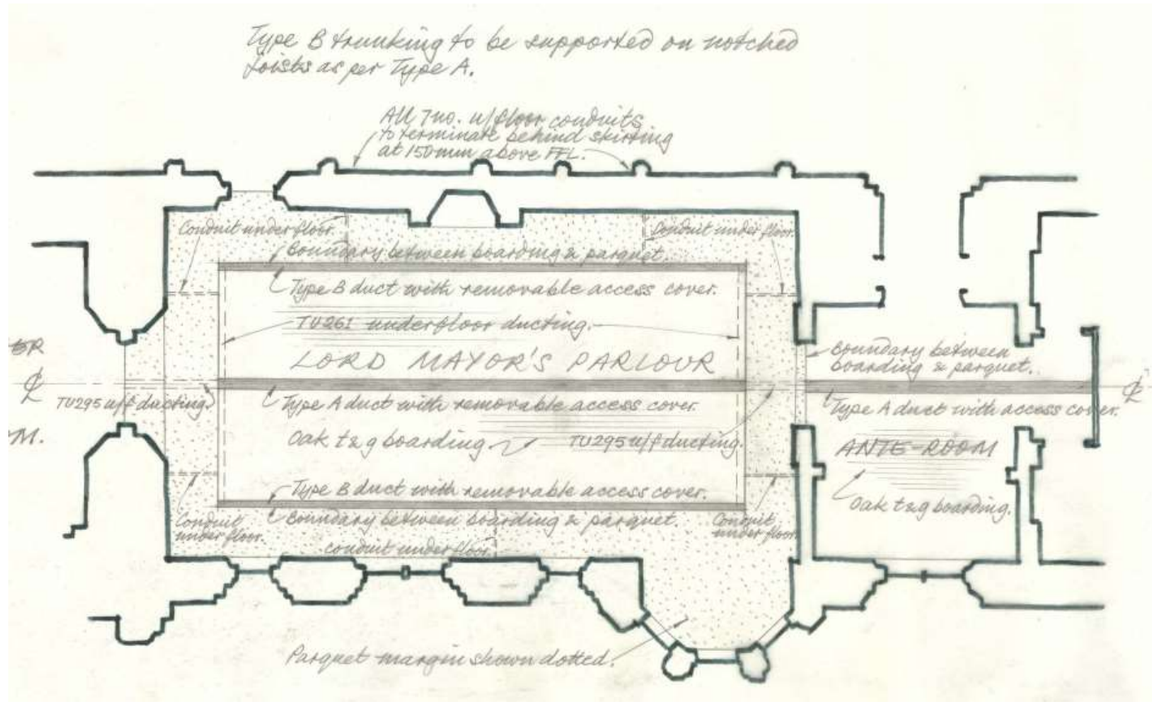


Figure 56 - City Architect's drawing of Lord Mayor's Parlour from 1985

Floor service hatches will be provided around the perimeter of each room to facilitate the connection of portable equipment such as audio-visual systems and temporary bars. Due to the extremely shallow depth of the floor, services will have to be side-mounted within the floor, with a bespoke hatch made from the existing timber flooring. Socket holes will be provided within the floor at positions around the perimeter of the spaces to facilitate integration of speaker poles during events – mitigating the need for tripods and the associated potential risk of them walling over.

The existing lighting within the state rooms will all be refurbished and provided with new light sources – the locations will in general be unchanged, except where they have been altered over the years, such as in the Conference Hall. A proportion of these luminaires will be backed of the emergency lighting central battery system, so as to avoid the need for dedicated emergency lighting.

The state rooms have never had automatic fire detection, which is of great concern considering the potential sources of ignition from temporary events equipment and the abundance of flammable finishes. Aspirating smoke detection will therefore be provided within the floor void above, with capillary tubes discretely penetrating existing bosses in the ceiling. The compliance requirements have been advised by Arup and Purcell are defining final locations.

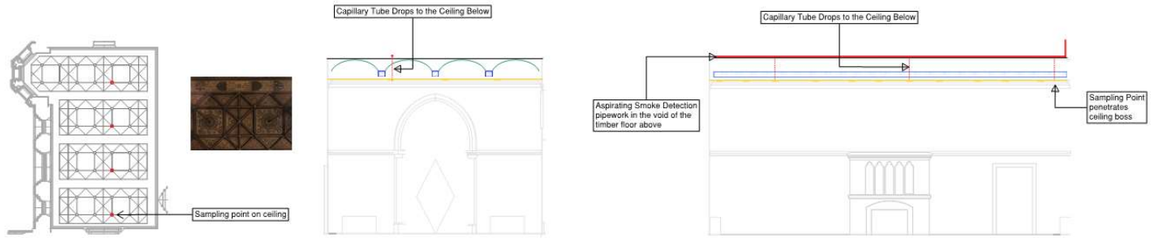


Figure 57 - Aspirating smoke detection proposals in State Rooms

Illuminated exit signage and wireless access points will be provided on panelling above doors, with cabling discretely routed to the floor void around the existing door frames.

7.5 Great Hall

The Great Hall is the largest space within the Town Hall. It is to be commercially let, providing valuable income to Manchester City Council (MCC). Consequently, the Great Hall poses a number of design challenges from a heating, ventilation and cooling point of view.

Underfloor heating/cooling with perimeter heating via radiators was found to provide comfortable thermal conditions throughout the occupied zone for both hot and cold weather conditions.

Underfloor cooling has been discounted based on the results from temperature monitoring equipment and the stakeholder engagement meetings where it is stated that there are only a few events (i.e. Irish Dance Festival) throughout the year which might need additional cooling.

In order to install the underfloor heating and distribution pipework, the wooden floor of the Great Hall is required to be lifted (it was completely replaced in the 1950s). The surface temperature of the flooring will be monitored not to exceed 27°C. Underfloor heating will be provided via four manifolds located behind the existing wooden panels under the frescos. Leak detection will be provided in the floor void of the Great Hall to give early warning of potential leaks from underfloor heating.

Radiators with high heat output are located behind the existing wooden panels under the frescos to prevent the cold draughts from the windows.

Ventilation to the space will be provided naturally via opening the windows at high level. The existing natural ventilation strategy has been proven to prevent condensation from forming within the Great Hall and has demonstrated that sufficient ventilation is supplied to the space.

The existing lighting will be refurbished and provided with new light sources – the locations will be as existing. A proportion of the wall lights will be backed of the emergency lighting central battery system, so as to avoid the need for dedicated emergency lighting. New illuminated exit signs will be provided over each door, with cabling discretely routed to the floor void around the existing door frames.

New floor service hatches will be provided at the perimeter or the space, one per bay. These will allow access to power, data and AV outlets below for events use.

Remote-controlled hoists will be provided within the roof void, servicing flying AV bars, one per bay, which will drop from above. These flying bars will be height adjustable and are located so that existing penetrations in the perimeter ceiling detail can be utilised for new suspension cables. These are proposed so as to mitigate the risk of damage to the existing frescos through work at height. Refer to AV Report for details.

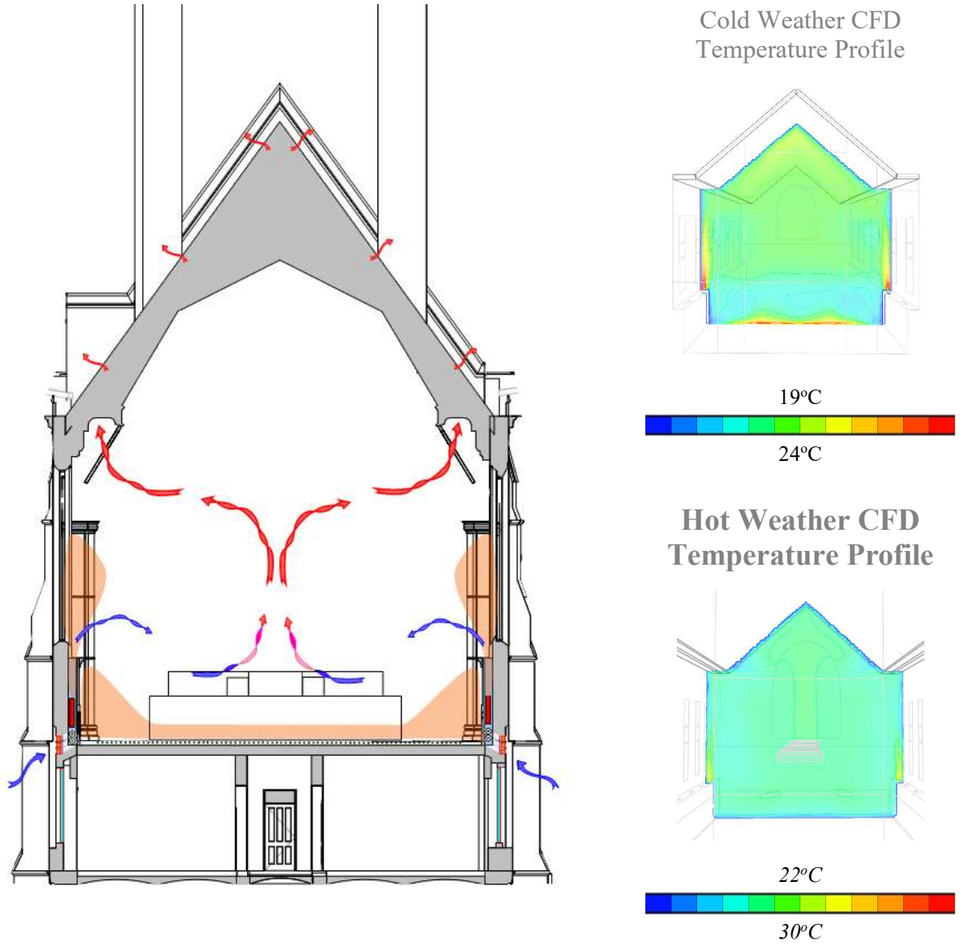


Figure 58 - Natural ventilation and underfloor heating proposals in Great Hall

Fixed speakers, surveillance cameras and wireless access points will be provided on top of the window ledges in a manner which is as unobtrusive as possible. The equipment selected is as small as feasible. The minimum possible fixings will be utilised to fix the equipment to the window ledges – it will be self-supported where possible.

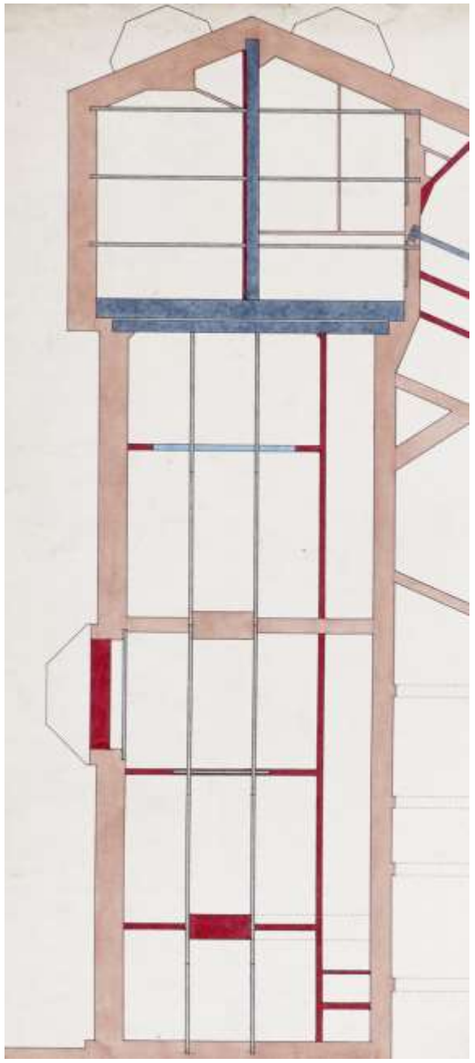
Aspirating smoke detection will be provided within the roof void, with capillary tubes passing in to the space through discrete openings in the ceiling.

Floor service hatches will be provided to facilitate the connection of a remote console for the refurbished organ.

7.6 Lord Mayors Apartment

Through review of the existing services installations within the Lord Mayor's Apartment, it can be seen that it is very standalone from the building. From a review of the existing structural drawings and through inspection of the floor void through existing openings, it is apparent that the majority of the spaces are very much

isolated from the rest of the building due to the substantial transfer structure within the floor buildup. The servicing arrangements for this space are therefore quite bespoke.



The Lord Mayor's apartment has had a number of quite detrimental alterations over the years – however the new servicing strategies will be in keeping with the rest of the building.

7.7 External Façade

Whilst not strictly a space, the external faced of the building is considered of very high significance, and as such services installations need to be designed and installed with great care and attention.

All existing services on the facades will be removed, including numerous existing façade lighting installations, cabling, lightning protection and video surveillance cameras.

New lightning protection installations will be provided, with new down-conductors where feasible following existing routes and re-using existing fixings. Where needed, they will be supplemented by new down-conductor routes, which have been located to as visually unobtrusive as possible, following natural routes.

New facade lighting installations will be provided. Façade lighting will be located so that it can be maintained from existing window openings. New cabling systems will be provided for façade lighting, these will run vertically up the façade from the moats, and where possible follow the rainwater pipes to make them as conscious as possible.

External mounting of VSS cameras will be achieved through non-invasive techniques. Cameras will be mounted to the existing drainpipes around the building façade by using straps that will not damage the finish of the structure. This technique is totally reversible and results in no remedial works in the event of device removal. The cabling to these will be routed through existing air bricks in to boxing-in behind.

8 Approach for exposed Services

Whilst services will be hidden where feasible, there will still be exposed services provisions within the building and on the façade. The design team have set out the following methodology to control and monitor the quality of exposed services installations.

