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Deansgate Locks

Waterproofing and Cladding Works to curved arch / vault soffits and walls

Design and Access Statement

Date : 12 June 2023

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1.0 Introduction

1.1 Background

Deansgate Locks comprises 12 railway arches which originally sat below the rail route to Central Station. Following the closure of the station, and the creation of the Convention Complex, the original Metrolink scheme was constructed in 1991/92. The arches were redeveloped in the late 1990's and early 2000's. There had been reports of water ingress through the soffits as early as 1983, and when the redevelopment took place, specific and targeted measures were put in place to mitigate this ingress. This took the form of copper panels and gutters, and connected into new plastic downpipes in the location of the original cast iron. The water then drained through the existing underground system with the assistance of pumps where required. These new downpipes were connected to the upper-level cast iron pipes which formed part of the track drainage system above.

We are not aware of significant issues with water ingress through the walls at this time, and there are no apparent original works to combat this.

In 2013 the Metrolink Redevelopment / Remodelling scheme took place above the arches.

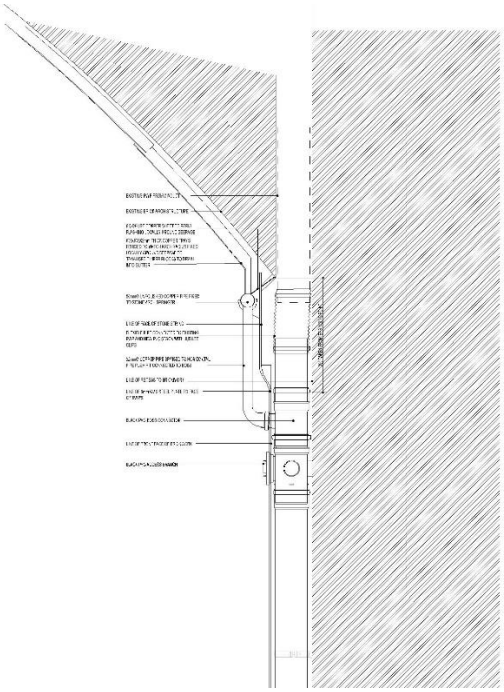
It is evident that from about this time water ingress significantly increased, and this also included water running down the walls. Various localized attempts have been made to combat this, including application of soffit linings, additional copper panels to the soffits etc. However, for a number of tenants the issues have proven to be of sufficient extent such that they have either ceased active trading or vacated the premises.

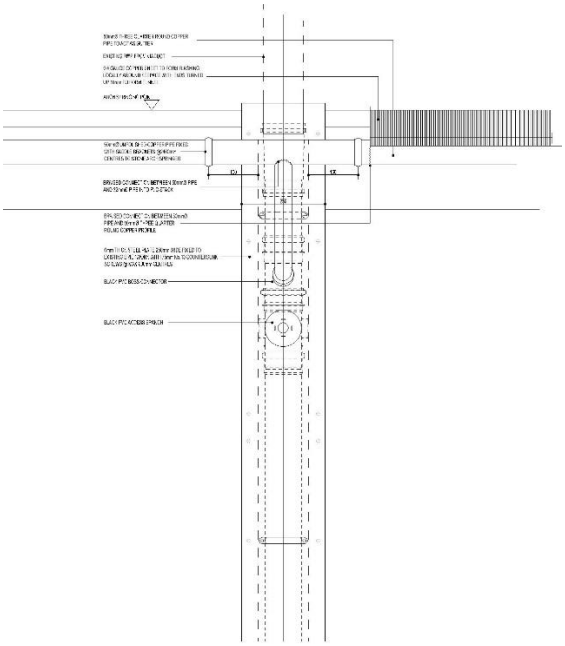
It is therefore apparent that if the arches, which were once a vibrant part of Manchester nightlife, are to again serve this purpose work will have to be carried out to significantly reduce the impact of water ingress.

1.2 Current Position

Water can be observed coming through the soffits and into the gutters, which have in many cases been extended or doubled up. There are also clear areas where water is coming through the walls. However, it should be noted that in many cases the walls and soffits are concealed by the tenants' fitouts and therefore the full extent of water ingress is not evident. However, there are areas where the fitout works show visible damage from water behind. The situation is therefore complex, and without removing extensive areas of the fitted out works and monitoring over an extended period, it is not possible to distinguish between areas that are effectively unaffected, and those which have significant ingress. This is further complicated by the use of Type A waterproofing systems in some locations which may have diverted water elsewhere.

From the information at our disposal, it is our understanding that the existing copper panels are interlocking trays without any additional liner, and drain directly into the gutters. There is clear evidence of water seepage through the joints between trays.





Extracts from 1999 Developer drawing

Typical water ingress to soffit

I WANT YOU
GRINGO
$1,000 ALIVE
$500 DEAD
FOAM

Water ingress to walls causing damage to tenant's fitout

Original copper panels, impacted by water.

2.0 Proposed Solution

2.1 Waterproofing Types

There are three recognized approaches to waterproofing protection, as defined by BS8102:2009 as follows:

- **Type A** is barrier protection (typically known as tanking) whereby a waterproofing material is applied to the internal or external structure forming a barrier between the structure and any water present.
- **Type B** protection is where the structure itself protects against water ingress. Clearly this is not the case at Deansgate Locks.
- **Type C** protection is where a water management system is installed to drain the water ingress to a safe point of disposal. Cavity drain membranes are studded on the external face to create drainage channels. The material needs to be carefully applied, fixed, and joints sealed, and connected to an effective system of disposal. A decorative lining can then be fixed using a batten system, with fixings integrated with those of the Type C membrane. It should be noted that Type C systems require regular inspection and maintenance to ensure that there has been no build-up of debris or blockage of the cavity. Such contaminants include lime and silt leached out from the brickwork. Therefore, a means of inspection and maintenance must be built into the system from the onset.

2.2 Design Approaches

With the above systems in mind, we have considered three design approaches to holistically dealing with water ingress as follows:

Option 1: Retaining visible brickwork:
Where water ingress is very minor or the surface only needs to be stabilised, the visibility of brickwork can be retained by using a specialist moisture blocker (eg Epicuro Permbloc used at London Bridge). This is a form of Type A waterproofing, but less intrusive compared to render solutions (as previously applied to Arch 2). These products have a limit on the hydrostatic pressure (Permbloc is rated at 70g/m^2/24hr). This type of solution may be appropriate for areas (eg walls) which are prone to minor water ingress. The main advantage of this approach is that it retains the brickwork as a visual feature, which is one of the main points of significance of the arches. This type of product is specifically designed for underground railways and stations, basements etc, but this will not be technically sufficient in all locations, and therefore cannot be considered at this stage for use throughout. Furthermore, it is not known what the consequences could be of trapping the water within the structure and diverting the problem rather than draining it. At some point all trapped water will find a point of release.

London Bridge

Option 2: Proprietary integrated systems (eg Rockwell Railway Arch Lining) – a PVC plastic / plastic batten approach which also acts as a waterproof liner. This system is a form of Type C waterproofing but avoids the need for additional linings with the use of water tolerant materials, and water resisting construction. The natural cavity drains to a perimeter channel, and water can fall onto the sheets and drain off. Visually, it is a poor solution, and does not provide much scope for tenant improvement. This approach is not considered aesthetically acceptable to client or leisure-based tenants and therefore is not a preferred approach.

Rockwell Railway Arch Lining

London

Option 3: Bespoke design solutions, using a Type C waterproof lining, and over-cladding with a decorative lining. The waterproofing system is designed to sit in the cavity created between the main structure, and a decorative lining.

Typical Type C waterproofing membrane prior to application of a lining

This is the preferred approach, and there are numerous lining options, which are considered later in this statement.

There is a further action which is to provide weep drains in areas of major ingress. These would not eliminate the requirement for other treatments but would be designed to relieve the water pressure to ensure that the other systems were working within their design tolerances.

These weep drains would be 50mm perforated drainage pipes wrapped in a geotextile 'sock' and placed in core drilled holes. The recommended locations would be through the brickwork close to the springing points on the sandstone imposts. The weep drain would extend through the brick to the infill behind. It is anticipated that this action could significantly reduce the water ingress through the brickwork by providing a path of less resistance, and especially to the walls below, and therefore potentially enable more brickwork to be left exposed.

3.0 Comparison of System Options

Option 1 : Retaining Visible Brickwork, although visually preferable, the technical advice obtained is that it would not provide an adequate holistic solution because of the varied extent of water ingress. Any solution which traps water in the soffits will divert it into the walls below, or into neighbouring arches thus potentially exacerbating the problem. This is offered as a solution for walls which are least prone to water ingress, and where the consequence of diverting the water can be satisfactorily managed. Where water ingress is shown to be insignificant, then areas of brickwork will be able to be left exposed.

Option 2 : Proprietary Integrated Systems is the cheapest way to both deal with water ingress and provide a visual lining. However, it is not considered to be an appropriate solution in this circumstance, principally because of its basic visual appearance.

Option 3 : Bespoke Design Solution is considered to be the best approach especially for the curved arch / vault soffits and walls. This statement considers possible materials and their application in order to provide a series of type options, which can be variously applied throughout the arches.

4.0 Type C Membranes

The bespoke design solution would be a combination of a Type C waterproof lining and a decorative attached lining. Type C membrane systems are available from a number of manufacturers, for example:

- Delta Membranes
- Newton Waterproofing UK
- Permagard
- Sika

These systems are all similar, but there could be specific considerations (eg fire resistance) which favour one manufacturer over another. However, irrespective of the chosen system, correct installation, and a full understanding of the whole system by approved installers, is vital if the system is to perform as designed.

A method of draining the water to a safe source of disposal will need to be provided. A system of gutters and downpipes will connect into the existing downpipes, and pumping systems (refurbished or renewed as required).

At the head of the arches, the membrane would be horizontal, or of inadequate fall to enable the water to discharge by gravity alone. Therefore, if water ingress is identified in these locations a section of Type A render is required to ‘throw’ the water further down the slope to a point where gravity will naturally discharge it.

On other areas of soffits and walls where water ingress is substantial and cannot be relieved by weep holes, additional Type A treatment may be required. It should be noted that Type A renders are not reversible as are Type C membranes, so every effort would be made to otherwise manage the water ingress in these locations.

The consequence of Type A renders is to divert the water path, therefore the knock-on consequence of applying this needs to be considered as it may require areas that are little impacted at present to require more extensive treatment.

5.0 Lining Materials – Soffits

The Type C membrane is not designed to be visible, but to be concealed behind a decorative lining. We have considered some possible decorative linings as follows.

5.1 Type

.1 Sheets:

These need either to be flexible (in one direction) or formed to the appropriate curve. Options are: profiled sheets (with ribs running across the curve); profiled sheets formed/crimped to a curve (with the ribs running along the curve); flat sheets (flexible) or flat sheets (rigid, and preformed to the curve).

.2 Strips:
Similar to sheets, these can either run across the curve (and therefore rigid) or along the curve (and either be flexible or rigid and preformed to the curve).

.3 Panels:
Depending on the size of the panel, these could be flat (in which case, the effect is less that of a curve, and more a series of facets) or preformed to the curve.

5.2 Materials:

There is no doubt that the existing brickwork provides the most impressive space, and the majority of images of fitted out vaults retain the brickwork at least to some extent where possible. Following detailed exposure and investigation, minor water ingress issues will be dealt with by injection systems, water blockers, or adequate ventilation to deal with any dampness. The brickwork and detailing in these areas can be left exposed.

These structures were designed for robustness, strength and function. They are inherently industrial in material, colour and texture. For many years they would have become discoloured from the industrial environment, and the sundry uses to which they were typically put. When cleaned and restored, they create impressive spaces, which respond well to a variety of uses.

In selecting a lining material there are several considerations.

Typical cladding materials are:

.1 Metals

Steel / aluminium / copper / zinc / metal alloys are typically used for both interior and exterior cladding. These products can be either coated or uncoated (some such as copper exhibiting natural patina which develops with age). Some metals have better resistance to moisture, but in an internal situation this can be overcome with the appropriate waterproofing and coatings. It should be noted that it is the concealed face which is likely to be exposed to some water ingress if there is a minor failure in the primary barrier.

Metals could be flat, textured, profiled, perforated – each having a different appearance and character.

.2 Timbers

There are many timbers extensively used for internal linings. Generally, timbers intended for internal use would not be damp tolerant but if there was a residual concern regarding the integrity of the waterproofing, then treated timbers could be used or a secondary barrier may be required. Timbers intended for external use (typically hardwoods), may be appropriate untreated. They could provide a dramatic statement, would be softer and more organic in nature than metal (and typically harmonize well with brickwork), and could also be used to manage acoustics if desired.

.3 Composite and other materials

Again, there are many composite cladding products available: high pressure laminates; cementitious boards; compressed fibre; ceramics; glass; brick slips etc. The use of a brick slip has been immediately discounted as being pastiche and an unacceptable conservation approach. With regards to the other options, they are largely decorative and may be appropriate for individual fitouts but would say little about the heritage of the spaces.

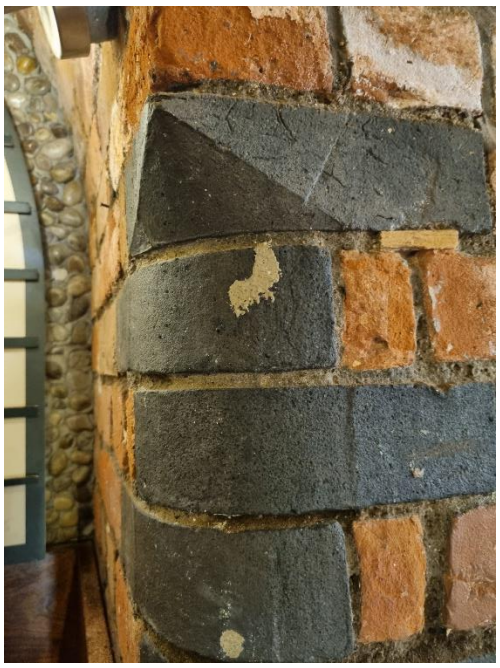
The preferred approach is to use metal panels of a size and weight that can be easily and safely removed for inspection. The appearance would not be dissimilar to the existing copper panels.

6.0 Lining Materials - Walls

6.1 Approach

Typically, the walls are significantly obscured by the tenants' fitouts, with bars, fixed seating, toilet accommodation, kitchens etc. The design approach is therefore to provide a simple independent lining to which these fitout elements and finishes can be subsequently fixed. This will comprise a moisture resistant plasterboard with a Type C membrane behind. It is expected that there will be areas of wall which can be left exposed, potentially without treatment, or using Epicuro Permbloc or similar where there is need to hold back water.

The preferred lining is therefore plasterboard, with preformed plasterboard curved corners (eg Curve' by Fulcrum) to soften the detail similar to the existing bullnose details.



Install like drywall

Tape & Mud like drywall

Finish like drywall

Prime & Paint like drywall

7.0 Other considerations

7.1 Acoustics

The shape and type of lining will have an effect on the acoustics of a space. The shape of the vault will create a focus point where sound will be amplified, and this is likely to be a characteristic of the existing brick vaults. Prior to any fitout they will be reverberant spaces, and it would be the expectation that the fitout design would respond to this appropriately for the use (eg the Comedy Store would have different requirements to a restaurant or bar). Most linings under consideration (without specific acoustic control) would probably be similar to the existing brickwork, or a typical unfitted space.

7.2 Fire

The existing brick soffits are non-combustible, and therefore would not contribute to fire load, or spread of flame. Changing the lining to another material will have a significant impact (not least the specification of the Type C waterproofing barrier, which may need to meet specific fire requirements). This may further apply to the linings. This would not necessarily limit the broad choice, but rather the particular fire-rating of the chosen product. Advice has been taken on this aspect, and provided it is covered by a Class 0 lining, need not be fire resisting. However, a risk assessment will be carried out when the full extent of the linings is established to assess whether a fire-resistant membrane should be employed.

7.3 Future maintenance and accessibility

Concealing a source of water ingress always comes with risks, even where the water has a designed path to discharge. It is assumed that the bricks were originally pointed with lime mortar (although repointing done in their restoration may be cement based). As a basic principle the mortar should not be harder than the brick, as this leads to greater degradation of the brickwork over time. Lime mortar is porous, and there is the potential for lime leaching to occur, a process by which water can

dissolve calcium hydroxide (free lime) which is then deposited on the brick face. This, along with any salts deposited, may also block the drainage path leading to water ingress. Additional deterioration may also occur over time to the structural integrity of the brickwork. Regular inspection of areas of brickwork (especially in areas of known high water leakage) is a strict requirement, both through the outer lining and the inner Type C waterproofing system. It would seem to be necessary to use a waterproofing and lining system which enables this to happen, either in predetermined locations, or more generally. For this reason, a panel system is favoured which would enable any panel to be removed to enable inspection behind, independent of the panels around it.

7.4 Concealed vs Exposed Surface Fixings

The use of concealed fixings can be problematic if they require a specific order of installation (and therefore removal) of the liner, especially if there is a requirement for a more general inspection regime. Exposed fixings may therefore be more appropriate, and also emphasise a more industrial aesthetic.

7.5 Mass / number of fixings

The mass of the total system will need to be considered in relation to the capacity of fixings (and therefore the number required). We have insufficient knowledge of this at present to be able to determine if this will discount some material options from consideration.

8.0 Design Conclusions

The extent of water ingress into the arches has impacted on the tenants' businesses in a number of ways and to varying extents, evidenced by the fact that some have been able to continue trading whereas others have not, despite installing additional treatments to seek to manage the ingress. It is evident where some linings have been removed that water ingress is causing a degree of unseen damage behind tenants' fitouts. The design approach has therefore been to develop a 'toolkit' of responses which will range from limited work to stabilise surfaces only (and therefore remain exposed), through drainage management Type C linings to areas where flows can be thus managed (such linings being removable if the ingress from above is reduced), to a combination of Type A barrier systems and Type C linings where flows are more substantial, but the Type A lining is not removable. Note that Arch 2 soffit has already been treated in this way. The inclusion of weep drains may enable reduced treatments to some affected areas, but the full effectiveness and consequences of their inclusion would need to be established for each instance.

The application of which treatment is appropriate in a particular instance will be determine by detailed (and in some cases) intrusive inspection of each arch. It is anticipated that brickwork will be able to be left exposed in a number of locations, but it is also to be expected that in the worst cases the treatments will need to be substantial, and the brickwork and stone detailing will not be exposed to view.

A decorative metal panel would be installed to the affected soffits, which would be similar in appearance to the copper panels installed in the original refurbishment works and subsequently added to. Plasterboard wall linings would be installed to affected walls, enabling tenants to apply their own decorative finishes without impacting on the brickwork behind. Inspection hatches would be installed within the plasterboard wall lining, and the soffit panels would be individually removable for inspection.

The overall conclusion is that soffits and walls need to be lined with a Type C system. Areas which are suffering major water ingress will require additional water blockers to reduce the flow rates within the tolerances of the Type C lining. Areas which are minimally affected can be left exposed and either remain untreated or sealed only, provided the potential consequence of diverted water can be discounted.

9.0 Impact of existing structures and tenants' fitouts.

Ideally waterproofing systems are installed prior to any tenants' fitouts, which need to respect the design requirements of the water management system. In this circumstance, there are existing tenants' fitout items to be managed (for example services, grilles, screens etc) which may closely abut the walls and soffits, leaving insufficient space for the water management system to be post-installed to standard details. Similarly, there are steel mezzanine structures which sit adjacent to the walls creating similar difficulties. The decorative lining can be more bespoke – designed around existing structures and fittings, if necessary, but this could create issues as and when tenants change, so a continuous lining would be preferred.

Each fitout item needs to be considered in the following sequence:

1. Removal and refix: items that hinder installation of the waterproofing system, but can be refixed back in their original locations (potentially a number of service items).

2. Removal, replacement and refix: items that if removed, cannot be simply refixed, but need to be replaced with a new but similar item.

3. Removal, redesign and refix: items which need to be removed, and a new redesigned item installed (there are some air grilles which may fall into this category).

4. Retained and a bespoke detail for the waterproofing developed and installed.

Ellis Williams Architects
26 October 2023