

Essential Repairs to the Roof, 1830 Warehouse

Science & Industry Museum

APPENDIX B - Methodology



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APPENDIX:

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APPENDIX B.1/

- **Methodology for Valley Gutters**

B.1: Methodology for Valley Gutters

Specification;

- The proposed solution is to create a deep sided tapered gutter detailed in accordance with traditional lead sheet detailing.
- This approach while adjusting the relatively unseen roof appearance provides major improvement to the weatherproofing of the building and therefore conserving the historic fabric of the structure below, protecting it from rainwater ingress and resultant damage.
- Replace and re-profile the 1990's valley gutters to accommodate current predicted rainwater calculations. Peter Deer & Associates have calculated rainwater parameters for 1 in 200 year return period plus 30% climate change allowance to inform the flood level design for the valley gutters.
- Raise the middle of the valley by adjustment to roof finishes above the existing structure.
- Raise the ends of the valley gutter above the valley purlins to maintain a wide valley gutter and to avoid dropping into the narrow space between the valley purlins and line the wide valley with leadwork to flash over where the slates have been removed.
- Line with lead sheet using traditional stepping drip detail following the Lead Sheet Association guidelines.
- Retain perimeter chute level and retain existing chute opening through the external wall for the lower chute to avoid enlarging the opening through the fabric of the external wall for the lower chute.

Specification of Lead;

- Lead to be graded at Code 8.
- The lead will be rolled in line with BS EN 12588.
- Installed fully in accordance with traditional detailing as set out in the Lead Sheet Association Manual.
- Specification for Valley Gutter Linings;
 - Underlay to be left as existing.
 - Patination oil to be used to underside of lead.
 - Lengths to be no more than 2000mm.
 - Cross joints, lapped not less than 300mm.
 - Welt edges and nail to top edges of each sheet.

Methodology to Valley Gutter Linings;

- The works to the valley gutters require both internal and external access. The valleys will be surveyed and worked upon each in turn and the contractor will work progressively along the building. Bay 4 will have a temporary roof due to the re-slatting works across all of the slate roof within that Bay.
- The contractor will establish localised temporary external weatherproofing and internal protection sheeting. Externally rainwater will be diverted and managed and to existing chutes through temporary rainwater deflectors.
- A simple scaffold can be established on the viaduct to minimize height and to reduce materials, and internally mobile elevated temporary working platforms.
- Internally, there are several existing live services distributed along the underside of key structural members and valley beams which will require identification and validation to enable the contractor to relocate temporarily without disrupting essential services.
- Contractor will first survey and mock-up the line and fall of the new valley gutter to check alignments on each valley in turn to ensure that only the minimum amount of slate is removed in each case (typically 2-3 courses of slate will be removed) to ensure the new leadwork is adequately dressed back and detailed under the slate above the flood line.
- The works will involve the removal of the 1990's valley gutter leadwork, plywood trays and carefully de-slatting 2-3 courses. The slates will be set aside for checking for re-use. Existing leadwork will be recycled off site for use elsewhere.

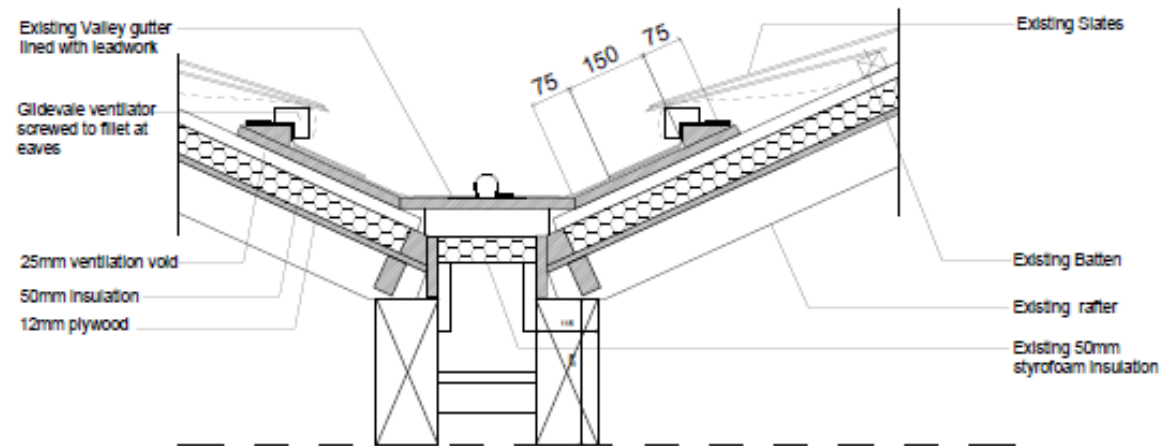
- Contractor will survey uncovered interfaces, such as the catch pit and the hidden voids into the cross brick walls to assess if any further remedial action is require. The catch pit will then be adapted to receive the new lead valley falls.
- The leadwork will be removed to the chute and replaced.
- Any brick repairs required when uncovered will be carefully undertaken and repointed with lime mortar. There will be new chutes formed to Bay 5 to match the details to Bays 1-4.
- The new deep sided tapered valley gutter will be installed in accordance with Lead Sheet Association details with Code 8 lead sheet and a build-up of new insulation, weatherproof breathable membranes, new 19mm thick plywood or penny-gap treated boards, and re-slatting with re-use of existing salvaged slates.
- The secret gutter at the parapet will be adapted to the chute.
- Localised leadwork detailing will be installed to the bottom edge of existing rooflights.
- Replacement lead will be measured, cut and formed in preparation for installation.
- A thin coating of patination oil will be applied to the underside of the lead and allowed to dry prior to installation and laying of lead.
- The lead will then be laid over and beyond the tilting fillets.
- The continuous eaves ventilation will be replaced like for like.
- The lead will have welted edges and a nail fixing the top edge of each sheet. The bottom will then be dressed neatly into the eaves gutter.
- Localised step and cover flashing to secret gutter will be visually surveyed and repaired where loose or replaced where failing. The fixing will be dressed into secret gutter and form a welted edge at side where existing slate interface. Nail top edge of each sheet to timber substrate and screw fixed to masonry. Dress bottom end neatly into eaves gutter.
- Dress leadwork to new bottom row of slate with new eaves ventilators and dress back existing membranes at the bottom edge of the slate.
- Adapt leadwork interface with secret gutter at parapet.
- Dress new leadwork flashing details to base of rooflights and to existing dormers on roof.
- Install new trace heating to base of valley gutter and carefully route through the roof above the floodline and via the ventilation zone under the slates and above the insulation. This to minimise the risk of water penetration. Internally, the cable will be carefully routed through the insulation and boarded soffit. the cable will be neatly aligned where visible to along existing joint lines and surfaces and a termination point will allow the interface with existing high level power cable distribution.
- All joints will be checked for quality and integrity of welt.
- All fixing centres will be checked to ensure they meet specification.
- The install will be fully checked and ensure it is fully supported and adequately fixed to resist uplift under windy conditions. However the install also needs to be able to accommodate thermal movement without putting the material under stress or causing it to distort.
- The internal linings will be locally replaced. In the case of Bay 4, the visible strip boarding will be newly installed like for like.

Quality Control;

- The specification and drawings will be adhered to fully. Any potential deviation or requirement to deviate will be fully discussed with design team taking on all comments regarding suitable solutions.
- Prior to the works being carried out in the particular location it will be photographed extensively to form part of the repair/remedial report and form part of the final records of the works.
- All stages of the methodology will be followed and adhered to.
- All joints will be checked for quality and integrity of welt.
- All fixing centres will be checked to ensure they meet specification.
- The install will be fully checked and ensure it is fully supported and adequately fixed to resist uplift under windy conditions. However the install also needs to be able to accommodate thermal movement without putting the material under stress or causing it to distort
- Upon completion of the repair work the area will then be photographed to form the final part of the repair/remedial report of the works.
- All evidence of the sample repair will be submitted to the design team electronically and also offered for physical inspection on site.

Rainwater Calculations by Peter Deer & Associates Inform the Setting out of the Leadwork Details

SIM, 1830's Warehouse RW Calculations and Valley Gutter Sizing. 27-01-23

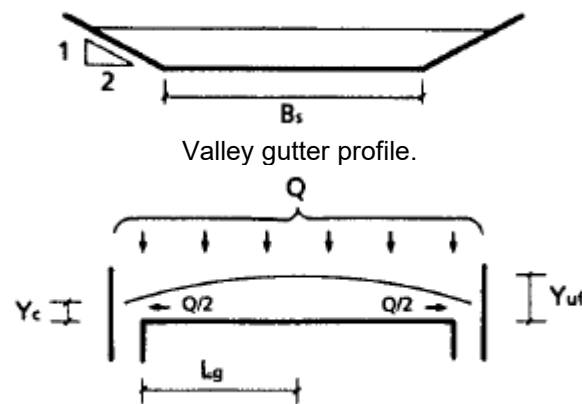


Section of bay 2 typical valley gutter.

Summary of calculations.

- The rainwater design flow rate for a return period of 200 years plus 30% climate change allowance is 0.082 litres/second/sqm.
- For roof area of 210sqm per bay this gives a rainwater run off rate (Q) of 17.22 litres/second per bay.
- Each valley gutter runs to discharge to 150mm diameter rainwater pipes on north and south elevations, so run off rate in each section of valley gutter is $17.22/2 = 8.61$ litres/second.

Valley gutter profile and section from IoP Guide for gutter sizing:-



Valley gutter section to RW downpipes on north & south elevations.

For a valley with trapezoidal profile as above, with total valley gutter length of 22 metres with length L_g 11 metres the required dimensions for the RW run off rate above are:-

For 150mm wide gutter:-

- For a valley gutter with width of base (as B above) of 150mm, overall depth of the gutter $Y_{uf} = 135$ mm. This includes an allowance for freeboard.
- The depth of the RW run off at the outlet end of the gutter is 54mm.

For 200mm wide gutter:-

- For a valley gutter with width of base (as B above) of 200mm, overall depth of the gutter $Y_{uf} = 120$ mm. This includes an allowance for freeboard.
- The depth of the RW run off at the outlet end of the gutter is 47mm.

Valley gutter outlets.

The detail between valley gutter discharge and the external 150mm diameter RW downpipes varies along each of the north and south elevations. The location of the RW downpipes in relation to the valley gutters, catchpits and connections to RW hoppers at the top of each RW downpipe varies as Studio Downie Stage 2 report dated 22-11-22.

The catchpits should be the full width of the gutter (150mm or 200mm) and at least 25mm deeper than the gutter, giving minimum depths of 160mm for 150mm gutter width or 145mm for 200mm gutter width.

The chute connecting each catchpit to each RW hopper should be 150mm wide x 100mm high or similar to suit the required connection detail.

Trace Heating and associated enabling to Valley Gutter works - the following has been prepared by Peter Deer & Associates

Electrical Services - Extent Of Works

- The works involve phase 3 of the repair works to the existing building and services to prevent further deterioration of the building fabric and risk of damage to the contents and internal finishes. The electrical works on this phase of the works involves the following:-
 - Survey existing electrical (and mechanical) services run in at high level in the vicinity of the roof valleys and adapt/temporarily lower/move the services if necessary to allow access for the new valley gutter works above the services.
 - Provide new electrically powered trace heating to the 9 number valley gutters, and associated rainwater catchpits and outlet chutes to external hoppers as indicated to prevent build up of ice and snow and reduce the risk of water ingress into the building caused by melting ice/snow or blockages in the rainwater disposal system.
 - Operating manuals, record documentation and as installed drawings for the new electrical services.
- The works are to be carried out and phased to allow continued operation of the museum including the events programme in the 1830's warehouse during the contract. Full details as noted in the appropriate Architect's drawings/phasing proposals.
- All builders' work associated with the electrical and mechanical services will be carried out by the Main Contractor, to be based on drawings showing the extent of the works to be provided by the electrical services contractor. Advise the main contractor of the builder's work requirements.
- Building constructional details are shown on the Architect's and Structural Engineer's drawings. The contractor will have deemed to have reviewed the drawings during the tender process.
- The mechanical and electrical installation shall be read in conjunction with and coordinated with all other building services and the architectural, interior and structural layouts.
- All equipment, accessories, etc., shall be complete with all necessary fittings and fixtures to complete the works in every respect.
- The Contractor shall ensure that they are fully familiar with the extent of the other services to be installed and shall arrange their services accordingly. Agreement shall be reached concerning the physical location of equipment before any work is put in hand
- Comply with the CDM regulations and carry out the duties required under the regulations for the roles of mechanical services and systems coordinator and installer.

Adaptation of Electrical Services Below Valley Gutters;

- The work to be carried out includes the survey existing mechanical and electrical services run in at high level in the vicinity of the 9 number roof valleys and adapt/temporarily lower/move the services as necessary to allow access for the new valley gutter works to be carried out above the existing services and timber structure.
- The existing electrical services run at high level below the 9 number valley gutters vary between each roof valley and are generally cabling run in cable basket and busbar systems suspended from the timber structure via unit strut and drop rods as image to the right. There is also mechanical services pipework which may require temporary adaptation to enable the valley gutter works to be carried out.
- Adapt the existing services as necessary to provide adequate space for the valley gutter works being carried out above; this may involve temporarily lowering the existing cable basket/cabling by a short distance as advised by the valley gutter specialist. It is not envisaged that the existing high level services require permanent relocation, just temporary lowering at a short distance say 50mm then reinstatement following completion of the valley gutter works above; extent required to be confirmed by site survey.



Example of existing services run below roof valley gutters.

Valley Gutter Trace Heating System

- The work to be carried out under this section is the provision of electric trace heating tape to the valley gutters and, associated rainwater catchpits and outlet chutes to external hoppers as indicated and detailed below.
- Provide new electrically powered trace heating to the 9 number valley gutters, and associated rainwater catchpits and outlet chutes to external hoppers as indicated to prevent build up of ice and snow and reduce the risk of water ingress into the building caused by melting ice/snow or blockages in the rainwater disposal system.
- The small power and controls cabling installation for the trace heating shall be shall be wired using 6491B LSZH singles in galvanised steel conduit/trunking. The exposed conduits/trunking shall run surface run parallel or perpendicular to the walls and vertically down the walls and using existing cable trays/basket for horizontal/vertical cable routing where available. Suitable mechanical protection shall be provided to comply with BS7671.
- The electrical contractor shall supply, fix and connect 2 number 13A switched fuse connection units supplied from an existing local distribution board in assumed location indicated on the drawings, to be confirmed by on site survey to serve the 2 number power supplies required to the valley gutter trace heating system. All electrical installation shall comply with the current BS7671 IEE Wiring Regulations.
- The final positions of all the outlets, conduit and containment routes to/from the existing local distribution boards to shall be agreed with the Architect before the work commences.
- Provide switched fused connection outlets comprising a double pole switch controlling a single outlet and fitted with a 13A fuse-link to BS1362 to provide 2 number power supplies to the 2 number valley gutter trace heating systems, manufactured to comply with BS 1363, DP switches to comply with BS EN 60669-1.
- Double pole switches and switched fused connection units shall have neon indicator lamps and when mounted adjacent to equipment they supply, the plates shall have flex outlets unless the equipment is switched via an unswitched socket outlet. All fused connection units will be engraved stating the item of equipment they supply, e.g. supply to leak detection system will be labelled “VALLEY GUTTER TRACE HEATING SYSTEM”. Switched fused connectors to match the socket outlets.
- Provide an electric trace heating system as indicated/scheduled comprising 2 number systems, each with an external thermostat and 13A power supply run from existing local distribution board as indicated.
- One system, designated system A is to serve 4 number valley gutters on the west side of the warehouse and system B is to serve 5 number valley gutters on the east side as indicated.
- Each system is to be controlled via an external thermostat located on the parapet wall on the south side of the warehouse (so not exposed to direct sunlight) set to initiate the trace heating when the external temperature falls below 3oC (adjustable). The trace heating system A and B shall also be disabled when the external temperature is less than minus 10oC (adjustable) as there is less risk of melting/water ingress at extreme low temperatures.
- System to be designed and supplied by First Trace Direct, or similar approved, to provide an electric trace heating system as described and scheduled for the 9 number valley gutters and associated catchpits and chutes to external RW hoppers.
- Trace heating cable to be self-regulating heat output of 24 watts per metre @ 5oC, product code ‘Trace20J’ with following cable composition:-
 - Modified polyolefin outer jacket.
 - Tinned copper braid.
 - Modified polyolefin insulation.
 - Moisture barrier.
 - Self regulating conductive cable.
 - Copper bus wire.
- Provide volt free output from each thermostat and link to site BMS to indicate status of each trace heating system operation, if ‘on’ or ‘off’.

- The system components include systems each with 20A power supply; 2 thermostats with mounting brackets, self regulating trace heating cable for each valley gutter, gutter clips, interlinking cables between each valley gutter for each system, See details of cable and typical arrangement of trace heating cable as below. Note thermostats to be located externally (not in roof void as image).

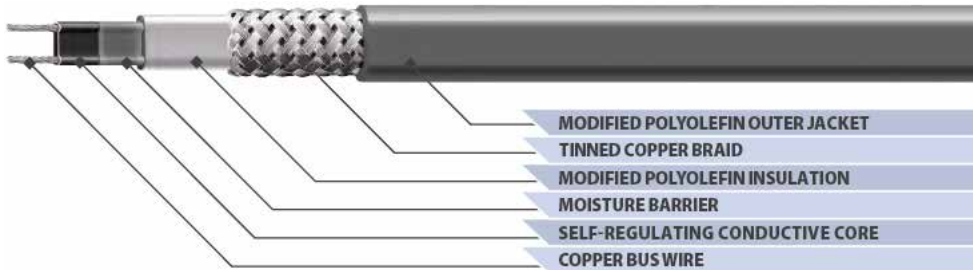


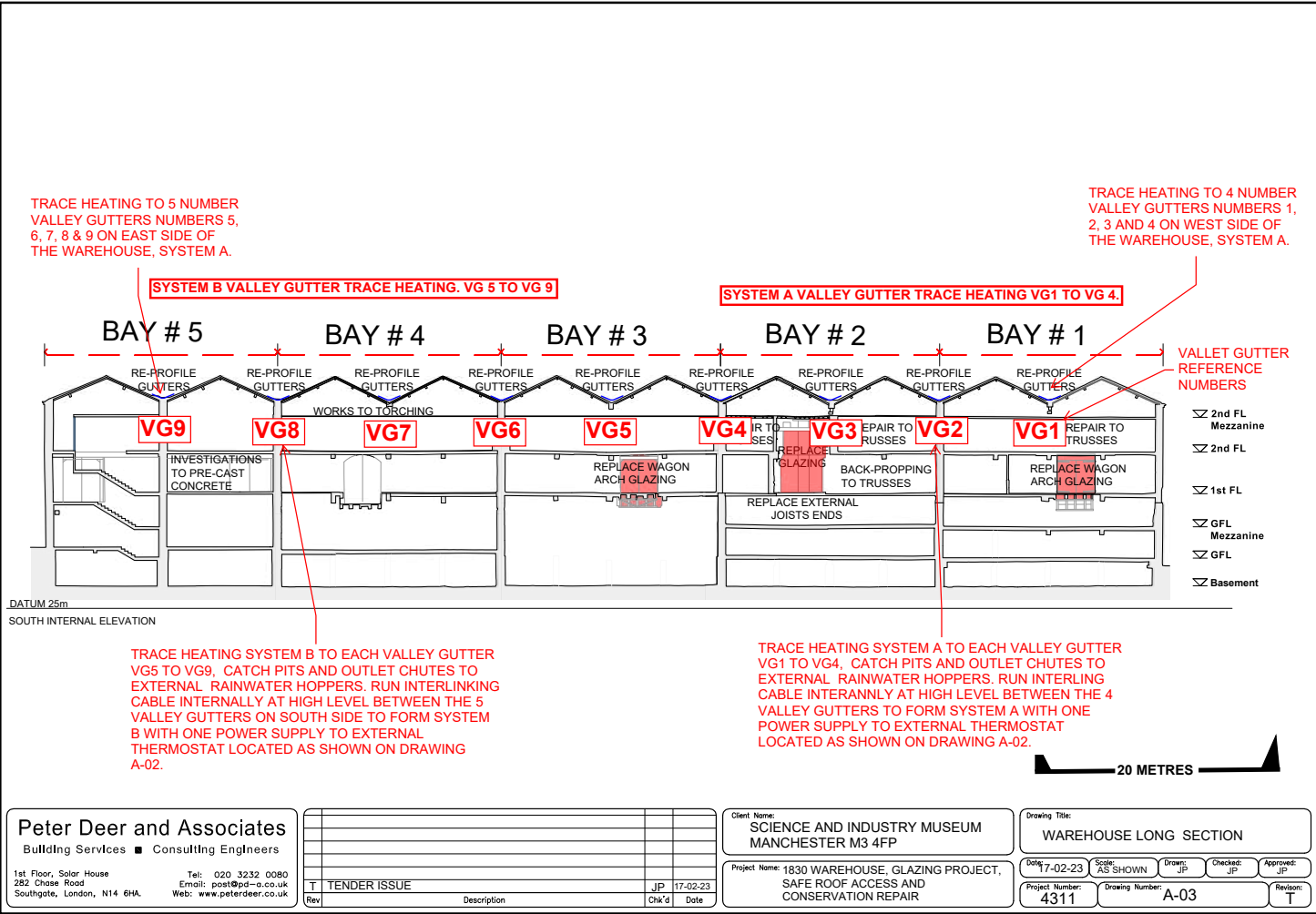
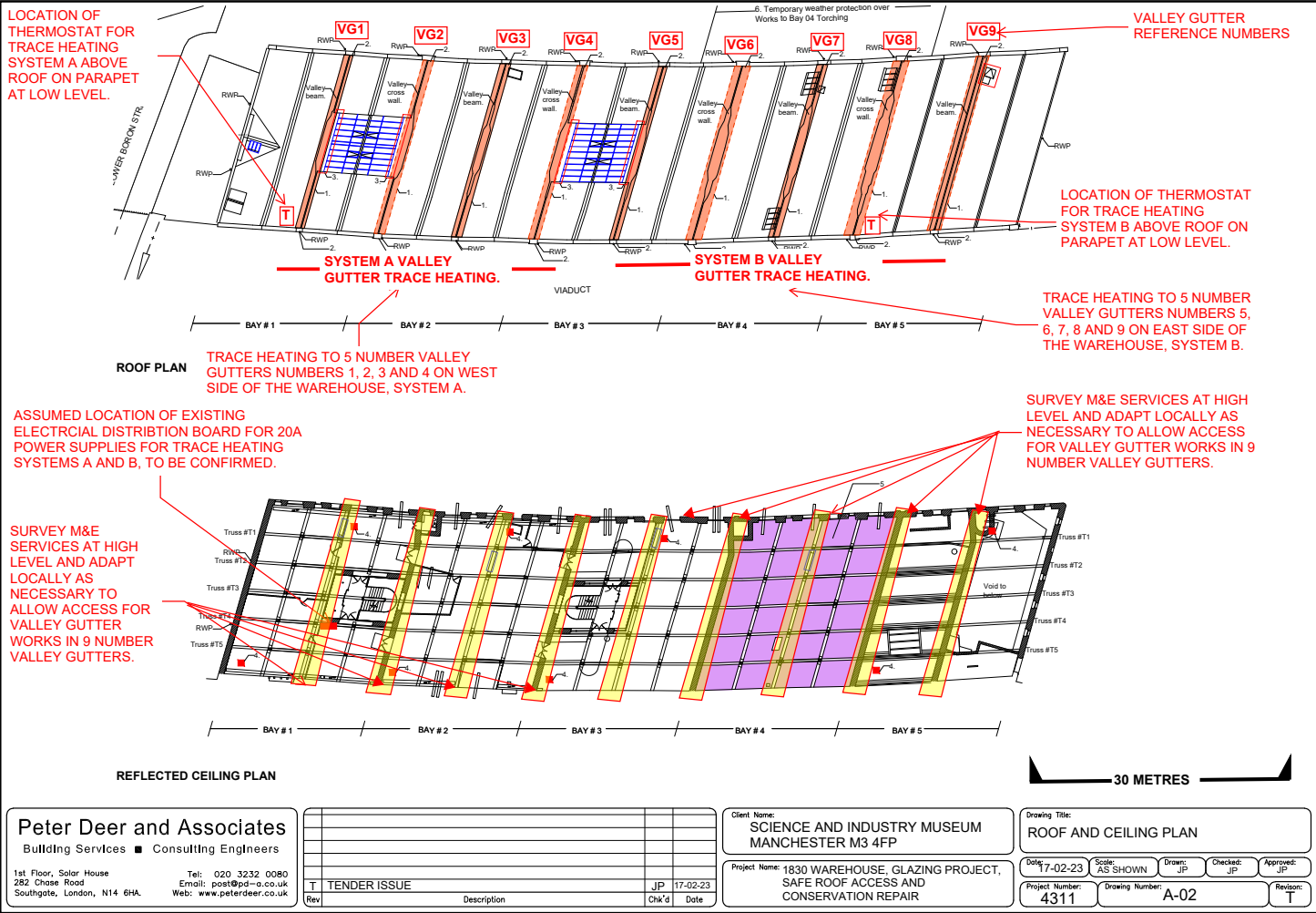
Image of trace heating cable.



Image of typical valley gutter trace heating layout, note thermostat to be located externally NOT in roof void as image. Note double run of cable only required on valley gutter widths greater than 500mm, to be confirmed by supplier.

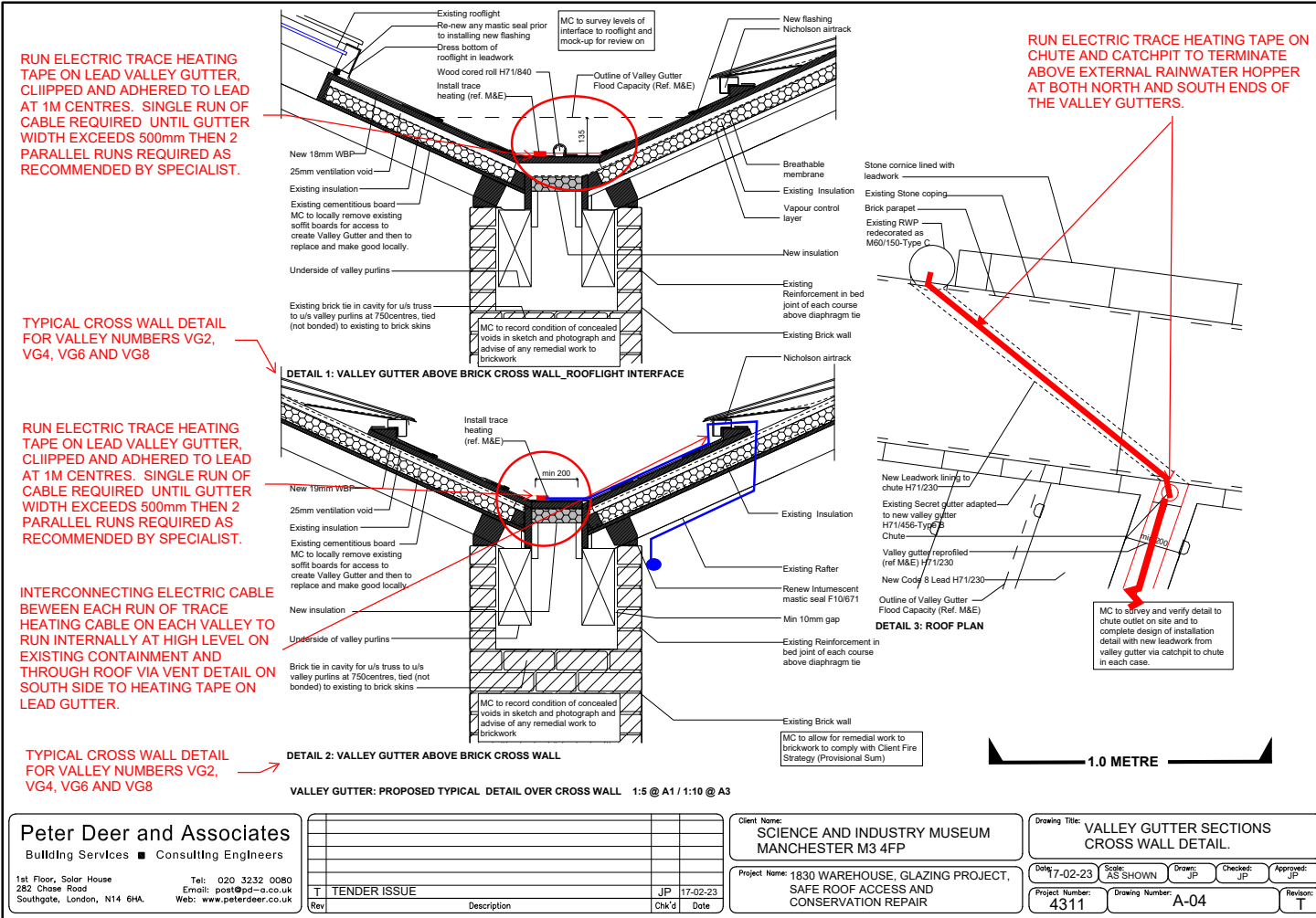
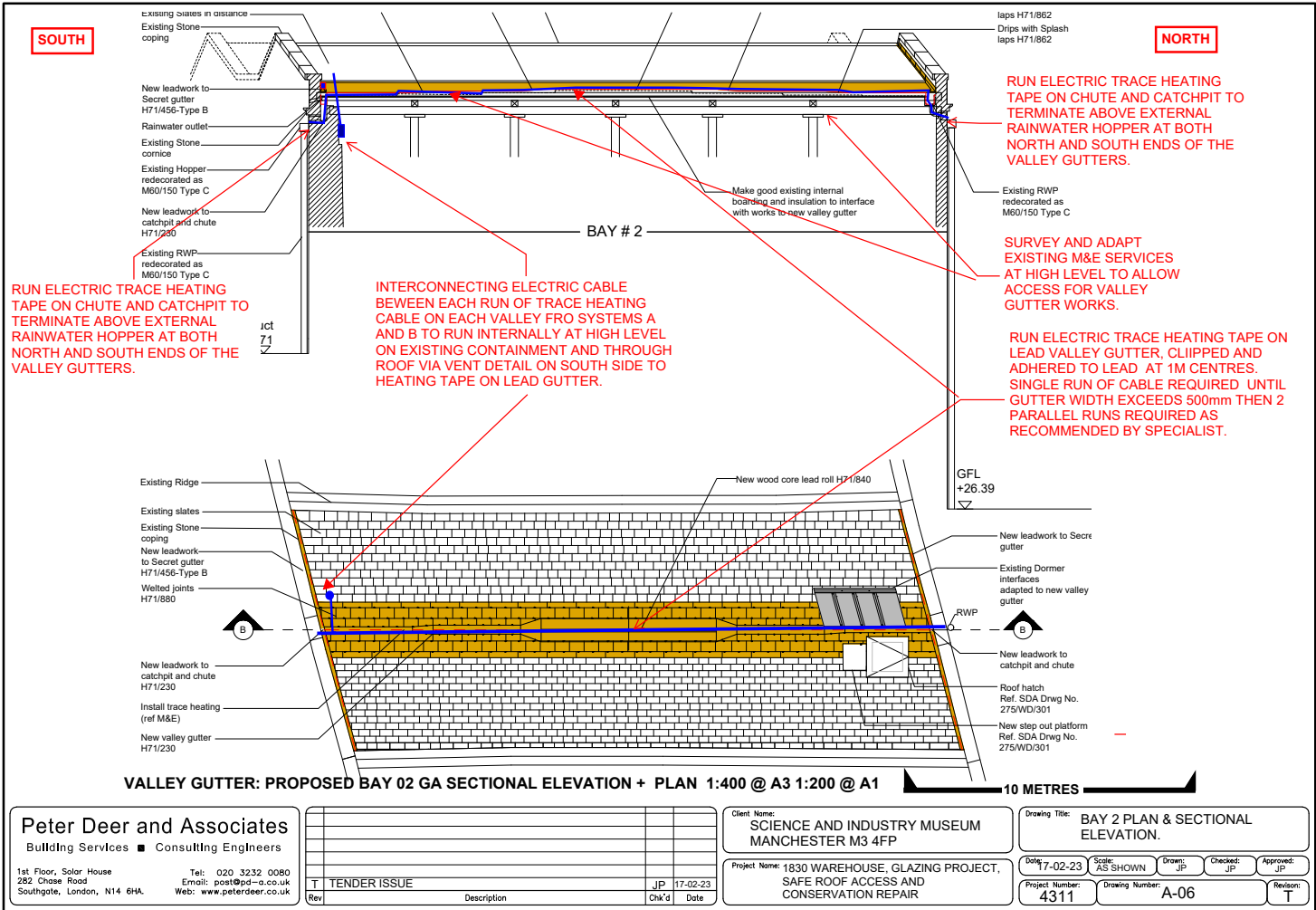
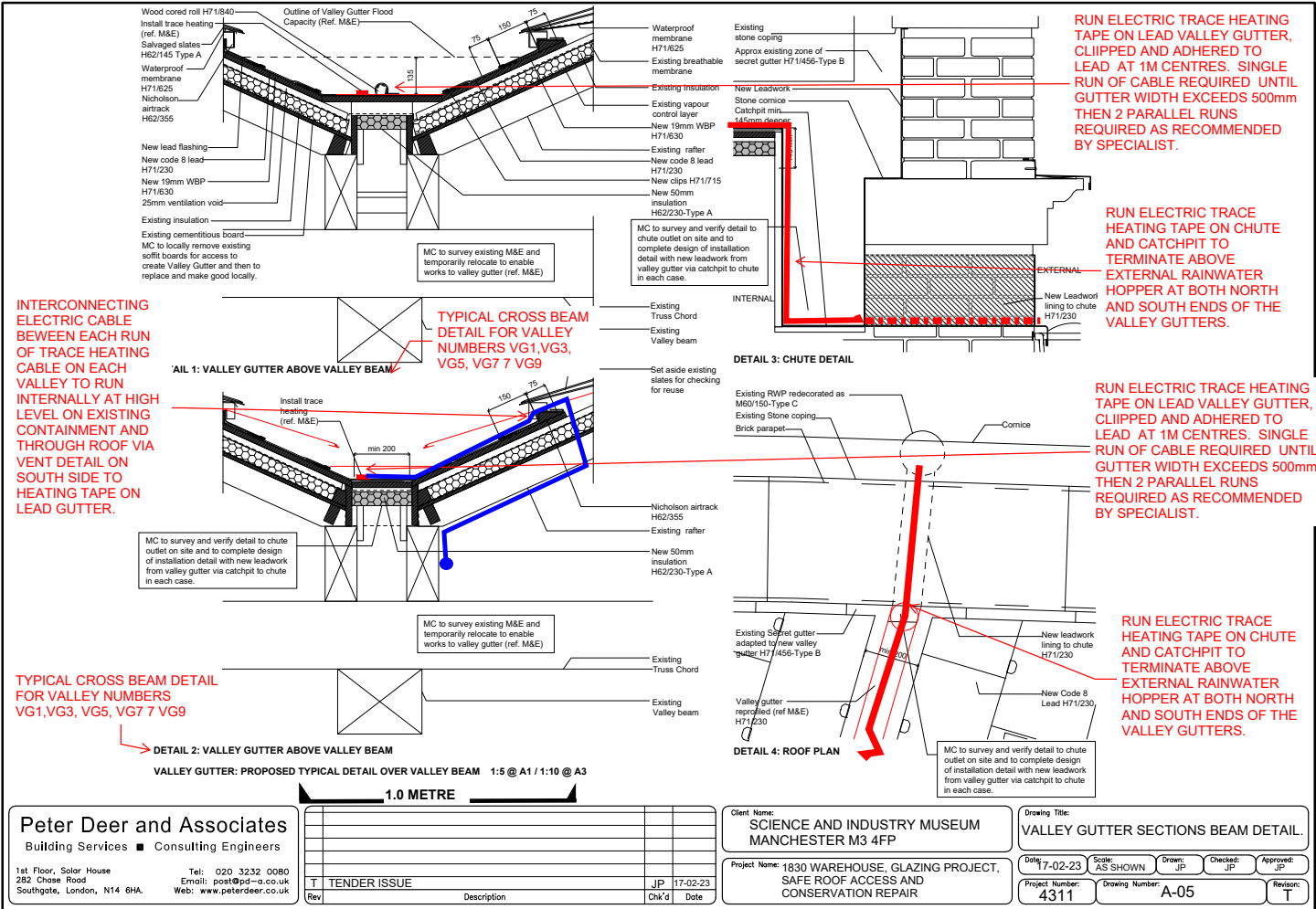
Trace Heating - genera; arrangement;

- The mark-up prepared by Peter deer & Associates illustrate the scope of the trace heating installation.



Trace Heating - detail;

- The mark-up prepared by Peter Deer & Associates illustrates the detailed methodology of the cabling for a the typical valley gutter.



APPENDIX B.2/

- Methodology for Bay 4 Roof

B.2: Methodology for Bay 4 Roof

Analysis;

- A specialist survey of the torching was completed by Hutton & Rostron (H&R) and is included with this application; the client had reported falling debris in public access areas. H&R were called in as an emergency with areas of loose torching removed as a precaution and protective sheeting installed directly beneath.
- The survey identified that there was no fibre in the fallen pieces. With closer inspection it was noted there were several loose areas where it had slipped and wedged into the rafters exposing the underside of the slate and overall its preparation and application were wholly inadequate.
- The survey also noted that further areas of torching that are currently 'sound' are likely to fail and fall into the gallery space below and the proposal for public safety is for all the torching to be carefully removed from beneath the roof slates.
- A sample of the existing torching was sent for laboratory analysis and the results issued to the manufacturer who prepared a specification for a like for like replacement with due regard to appropriate preparation.
- Following evaluation of client requirements and a risk assessment, it has been decided not to re-instate the torching like for like with a better mixed lime plaster but to use the opportunity to upgrade the roof with wood fibre insulation over the rafters to create a warm roof and to mitigate against cold bridges to reduce energy use in coordination with new valley gutter detailing which should support the long-term sustainable use of the building for important revenue earning events with lower energy costs sympathetically adapting the historic building. The concept was discussed with MCC 17/01/23 and 08/03/23 in parallel to requirements for improved valley gutter details. Options for soffit finishes were discussed and the proposed solution (Option 6) was agreed as achieving a good balance.

Specification;

- De-slate and salvage the slates for re-use.
- New battens fixed to the top side edges of the rafters to provide a fixing point to screw the woodwool boards back into.
- New breathable insulation (tongue and groove high density water resistant wood fibre insulation fixed to treated battens over the rafters, taped and sealed across butted edges, e.g. to ridge). New breathable membranes above the rafters and above the insulation.
- Treated counter battens and slate battens fixed above the new insulation to create a void for ventilation under the slate tiles.
- Re-slate with the existing salvaged slate roof tiles over the new insulation with a void for ventilation.
- Leadwork detailing to valley gutters as per methodology B.1. The existing internal visual detail to the underside of the valley will be installed with traditional timber finish to match the existing.
- Breathable woodwool carrier board to the soffit, and fix soffit battens to match the existing pattern of visible slate battens.
- Natural lime plaster finish to the internal soffit carefully hand trowelled between the soffit battens. The lime plaster to consist of an 8mm thick basecoat of pure lime plaster, a reinforcing mesh will be embedded 2mm into surface of base coat, 3mm thick lime plaster finish coat (e.g. wood float finish).

Methodology for works to existing slates;

- The works would require the temporary closure to the upper level of Bay 4.
- The temporary works will include elevated working platforms to provide safe access for removal of existing torching and protection to the existing fabric; a temporary roof during the de-slating and installation of insulated roof finishes; elevated working platforms for application of new lime plastering.
- Remove finishes around the valley gutter first to enable the works to the valley gutter.
- The existing torching layers will be carefully removed by a specialist contractor using hand tools. Progressively working to one pitched slope at a time.
- During de-slating each slate will be inspected for re-use and numbered with its position, the salvaged slates will be set aside for re-use.
- The existing slates will be reinstated once the insulation has been installed.
- Any broken slates will be replaced with like for like with salvaged slates primarily sourced from slates to other bays arising from the works to the valley gutters. Where salvaged slates are used from other roofs, careful mixing of varied colour may need to be undertaken when reinstating the slates to avoid visible new patches of slate.
- The valley gutters will be detailed in lead consistently as per methodology B.1.

Methodology for insulation;

- New treated battens will be fixed across the top of the rafters to provide fixing for the insulation boards and plaster carrier boards.
- The wood fibre insulation boards are weather resistant. They will be applied from the first row above the valley and set out left to right with a string line. The insulation boards will be secured by firstly fastening the boards with zinc coated clout nails or cleats onto the battens.
- The next row is begun with the cut-off of the row before. The rest of the installation is staggered, the displacement of the joints from row to row is at least one rafter space and at least 25 cm. On the roof surface, every board must cover at least two rafters.
- The boards are accurately fitted and grooves must be avoided. Even the smallest of installation grooves will be sealed with underlay adhesive sealant before installing the counter-batten.
- After sealing the connections on the roof ridge with suitable system adhesion tapes, the counter-battens are secured by counter sunk screws, cleats, self-piercing screws or threaded nails through the board into the battens to prevent it being pushed or pulled.
- Internal flexible insulation will be laid between the battens over the rafters over the woodwool plaster carrier board.
- Internal battens to be added in between the rafters to match the existing visible arrangement and to keep lime working areas smaller for better control of adhesion and finish.

Methodology for lime plaster finish;

- Generally, the internal finish would be a lime putty, or ‘fat lime’, carefully applied by a specialist plasterer experienced in the use of lime plasters to the wood wool plaster carrier board in between the existing rafters. This will retain the natural colour and subtle textural variations similar to the torching.
- The woodwool plaster carrier boards do not need to be dampened down prior to applying the pure lime basecoat.
- The plaster needs to be ‘knocked-up’ - a process of chopping, beating and turning which will release some water - with a bell mixer or whisk and bucket. Water will be added cautiously to make a workable mix.
- The lime plaster will be applied in accordance with traditional techniques with the application of coatings firmly and in one continuous operation between angles and joints to achieve good adhesion and a firm bond, allowing each coat to set sufficiently before the next is applied. Rule to an even surface then comb and cross scratch surface as necessary without penetrating the coat to control shrinkage and to provide a key for the next coat.
- A 10cm wide jute scrim should be trowelled into the basecoat at corners or at wall junctions. This will help counteract shrinkage in these areas.
- Dampen undercoat to control suction. First layer applied using a steel trowel, then wet the surface of the plaster before working it over with trowels or floats, by splashing with water (careful to avoid overwetting).
- A reinforcing mesh will be embedded 2mm into surface of base coat, prior to applying the finish coat.
- Feather edge and soft brush the base coat to give a key then apply the second layer applied using a wood float in the opposite direction to the first layer. Consolidation using a wood cross grain float.
- Finish by dampening with a stock brush. Prevent excessively rapid or localized drying out by keeping damp by light spraying with water until coating is sufficiently firm to control shrinkage.
- The appearance of finished surfaces will be even and consistent, free from rippling, hollows, ridges, cracks and crazing. Finished to a true plane, to correct line and level, plumb and square.

Quality Control;

- The specification and drawings will be adhered to fully. Any potential deviation or requirement to deviate will be fully discussed with design team taking on all comments regarding suitable solutions.
- Prior to the works being carried out in the particular location it will be photographed extensively to form part of the repair/remedial report and form part of the final records of the works.
- All stages of the methodology will be followed and adhered to.
- Trial areas of the lime finish will be cast applied these small square zones above the mezzanine loft to test the method and to agree the quality of finish.
- Upon completion of the repair work the area will then be photographed to form the final part of the repair/remedial report of the works.
- All evidence of the sample repair will be submitted to the design team electronically and also offered for physical inspection on site.



Example images of carefully tapping away to remove torching from a previous damaged area of torching.

**ILLUSTRATIVE EXAMPLE OF TONGUE AND GROOVE
WOOD FIBRE INSULATION**



The underlay must be dust-free to establish a permanent connection. Remove dust and sawdust from the underlay using a brush or compressed air.



The ridge joint is sealed and counter-battens are secured to the wood fibre boards.



Apply primer to the width of adhesive tape with a brush.

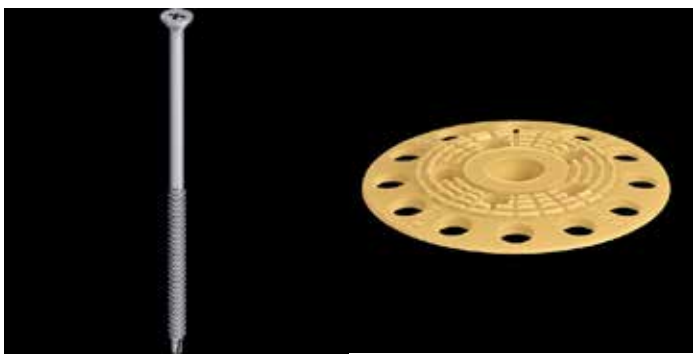


The underlay is secured onto the eaves on the surface on the wood fibre boards with primer and adhesive tape.
Subsequently the slate battens and slate roof is installed over to finish.

**ILLUSTRATIVE EXAMPLE OF CONCEALED ACCESSORIES
FOR THE INTERNAL LIME PLASTER FINISH**



Woodwool plaster carrier board.



Example of screw and washer fixings for the woodwool plaster carrier board.



Example of reinforcing mesh embedded into the base coat of the lime plaster.

Subsequently the lime plaster finish coat is applied.

APPENDIX B.3/

- **Methodology for Truss Chord Repairs**

B.3: Methodology for Truss Chord Repairs

Timberwork Repair Specification;

- This element relates a range of structural and architectural repair and treatment.
- Structural Softwood – Species to be generally Pinus Sylvestris/Pseudotsuga menziesii, graded to C24.
- Structural Hardwood – Species to be generally European Oak. The timber will be graded to THB/TH1 – equivalent of D30 graded structural timber.
- The Contract Administrator or Structural Engineer will be notified if there is the need to deviate due to the requirement to match an existing species.
- The surface finish of the timber will be regularised. There are no preservative treatments required.
- Planned moisture content of timber at point of installation to be 20%.
- Timber to be sourced from well-managed plantations or forests in accordance with
 - o Local laws in forest management in country of production.
 - o International agreements such as Convention on International Trade in Endangered Species of wild fauna and flora (CITES)
- Evidence will be provided to support compliance with sourcing of material with regards to provenance of timber supplied or evidence that the supplier of the material has adopted and implemented a formal environmental purchasing policy for timber and other wood based products.
- Friable material will be removed. Where localised repairs are required the decayed wood will be carefully cut-out and replaced with hardwood scarfed in. Where decayed throughout, the existing profile will be recorded, the existing decayed element removed and replaced with hardwood to match the existing profile.

Methodology for splice repairs;

- All operatives will be suitably skilled and experienced in carrying out the works.
- Retention where cracking/splitting has occurred but the majority of the section of wood is free from decay.
- Remove and replace those elements of wood where major rotting and crumbling of the material has occurred. Cut out full cross section of member where wood is defective or decayed,
- The area of works will be carefully assessed for temporary propping requirements before any works commence. The temporary propping solution will be suitable for the task at hand and will be assessed at each stage of the repair to prevent damage to the structure.
- All dimensions will be taken on site for the affected units etc. to ensure accuracy prior to fabrication.
- Any fixtures or fittings that need temporary removal for installation of replacement unit will be carefully marked up and set aside. Once new plates are in place they will be refixed and reinstated in line with traditional methods.
- Once area for timber repair is propped and stripped the new steel plates will be offered up and bolt locations marked for drilling. Any other necessary works will be carried out to the area to prepare for the installation of the new plates.
- The plates will be lifted and fixed into place in line with the relevant structural timber detail. All surrounding interfaces will be finished in line with the Structural Engineer detail.
- The newly installed steel plates will be permanently marked with the date of repair. The location of this is to be agreed with the design team

Quality Control;

- The specification and drawings will be adhered to fully. Any potential deviation or requirement to deviate will be fully discussed with design team taking on all comments regarding suitable solutions.
- Particular care and attention will be paid to timber source and eventual timber selection for each individual timber replacement/repair. The timber will be responsibly sourced in line with the specification.
- Prior to the works being carried out in the particular location it will be photographed extensively to form part of the repair/remedial report and form part of the final records of the works
- All stages of the methodology will be followed and adhered to. Particular care will be paid to the existing timber and surrounding interfaces that are to remain untouched, undamaged and in-situ whilst the repair is being carried out
- Upon completion of the repair work the area will then be photographed to form the final part of the repair/remedial report of the works.
- All evidence of the sample repair will be submitted to the design team electronically and also offered for physical inspection on site.

APPENDIX B.4/

- **Methodology for Temporary Works**

B.4: Methodology for Temporary Works

Design Approach

- Several options for a scaffold solution were considered during the course of the project design. This enabled the relative merits of each scheme to be considered alongside the operational requirements of the Museum and the structural and heritage constraints of the building.
The options considered had to factor in:
 - The high designated grade of the listed building and thus high sensitivity of its materials.
 - The inherent structural qualities and relative heritage values of the exterior brick fabric and mortar joints and the largely cobbled nature of the surrounding yard areas.
 - The need to keep the 1830 Warehouse in use during works
 - The need to maintain clear and safe access through and around the building during works for staff and members of the public.
- The facing brickwork of the 1830s warehouse is a significant aspect of its aesthetic and material evidential interest. This is embodied particularly in the brick materials themselves, the quality of their faces and the bond of the brickwork with details at openings, corners and parapet. The pointing of the brickwork is considered of some merit but is, across the building, in poor condition with multiple areas of patched mortar. The mortar joints were considered less sensitive to temporary interventions than the facing historic brickwork. Where a tie into a brick is unavoidable due to strength requirements and efficiency of design, the contractor will (as previous phases) follow the careful refilling of the hole with a mix of brick dust and mortar.
- The temporary works design to the south elevation will be a buttressed design with a system of tie bolts set into the mortar joints to secure a scaffold structure. This option:
 - Removes the need for substantial cross bracing that would be required of a free-standing scaffold.
 - Minimises the stability issues arising from the inherently uneven surface to the adjacent railway tracks.
 - Leaves no remnant structural fixings or materials within the wall fabric following dismantling of the scaffold.
 - Impacts mortar joints and pointing rather than the primary building material - bricks except where unavoidable and in all cases a sensitive 'repair' will be made.
 - Enables the continued and ongoing use of the building through works, and free movement through the surrounding areas.
- Following completion of the works the scaffold and related fixing tie bolts will be removed and the facades of the building made good. Mortar repairs and re-pointing form part of the schedule of works, suitable mortar finish and colour will be established during the course of the works.
- The scaffold is essential to facilitate the essential repair of this listed building. There is high heritage benefit in securing these repairs. The impacts to the facing brickwork and mortar joints will be small in scale (considered over the building as a whole) and temporary with no long term change to the aesthetic of the building – this factors in careful mortar matching and the other brickwork façade repairs that are also part of the project schedule.

Specification

- The approach is a largely buttressed with the specification and quantity of ties developed by the scaffold designer to be minimal in number and detailed into mortar joints to minimise invasive work which can be sympathetically repaired without harm to the fabric.
 - Scaffold standards and ties
 - Scaffold screw installation PIS method statement
 - Scaffold screws, zinc, weld, bending check
 - Apollo Bolts , SC05, SC06, SC07
 - Nylon scaff plug
 - Scaffold Hooks
- Large elements of buttressing designed within the scaffold installation.
- Minimal ties into the external walls through mortar joints or through bricks,

- Does not disturb existing facing brickwork, There will be no alterations to the physical façade other than the tie hole mortar repairs and these will be sympathetically remediated to match the current mortar types and make-up.
- On completion, the ties will be removed and repaired with mortar to match the existing.
- Where there are fixings to the façade these locations will be carefully chosen and will also coincide with mortar joints in the brick façade.
- On dismantling, mortar bed repairs will be mixed to a colour and a constituent material matched mortar repair to the tie location once removed.

Methodology

- Materials will be stockpiled on the viaduct and loaded to scaffolder's loading sequence which will be:
 - Using HIAB sequence of loading of materials & HIAB Risk Assessment.
 - HIAB Risk Assessment as attached to be followed in respect of task specific hazard.
 - Daily Safe start to capture site specific or environment hazard, routes and interfaces before commencement.
- Materials within the capabilities of the machine to be relocated to work areas and off loaded
- The scaffolding will be erected in a logical and measured fashion to ensure continuity and care is taken during the critical erection phase of the scaffolding.
- The façade will be carefully inspected by the Temporary Works Designer to set out suitable locations for the nylon scaffold tie fixing and also for any window reveal friction ties.
- Due to the overall cautious approach to the works that need both care and attention given the Grade 1 listed nature of the project in order to minimise harm to the existing façade of the building there are large elements of buttressing designed within the scaffold installation to allow for minimal ties fixing to the building. Where there are fixings to the façade these locations will be carefully chosen and will also coincide with mortar joints in the brick façade.
- The scaffolding as it is sequentially stripped in the same manner as it was erected the contractor will have specialist heritage masons in attendance to make up a colour and a constituent material matched mortar repair to the tie location. This will be carefully installed to the tie location as per the other mortar repairs in previous phases.
- There will be no alterations to the physical façade other than the tie hole mortar repairs and these will be dealt with, with care and attention and sympathetically to the current mortar types and make-up.
- Detailed methodology follows on the following pages.

Quality Control;

- The specification and drawings will be adhered to fully. Any potential deviation or requirement to deviate will be fully discussed with design team taking on all comments regarding suitable solutions.
- Prior to the works being carried out in the particular location it will be photographed extensively to form part of the repair/remedial report and form part of the final records of the works.
- All stages of the methodology will be followed and adhered to.
- Upon completion of the repair work the area will then be photographed to form the final part of the repair/remedial report of the works.
- All evidence of the repair will be submitted to the design team electronically and also offered for physical inspection on site.

PRECEDENT ILLUSTRATIVE EXAMPLE: TIE BEING UTILISED



Image of system in use on listed building, (above) the narrow walkway close to the building, and (below) self tapping anchor eye-bolt fixed through mortar as a reversible fixing



(above) right hand side the horizontal scaffold pole abuts the building and is hooked on (below) into the bolt to minimise contact with the fabric



Erection of access scaffolding

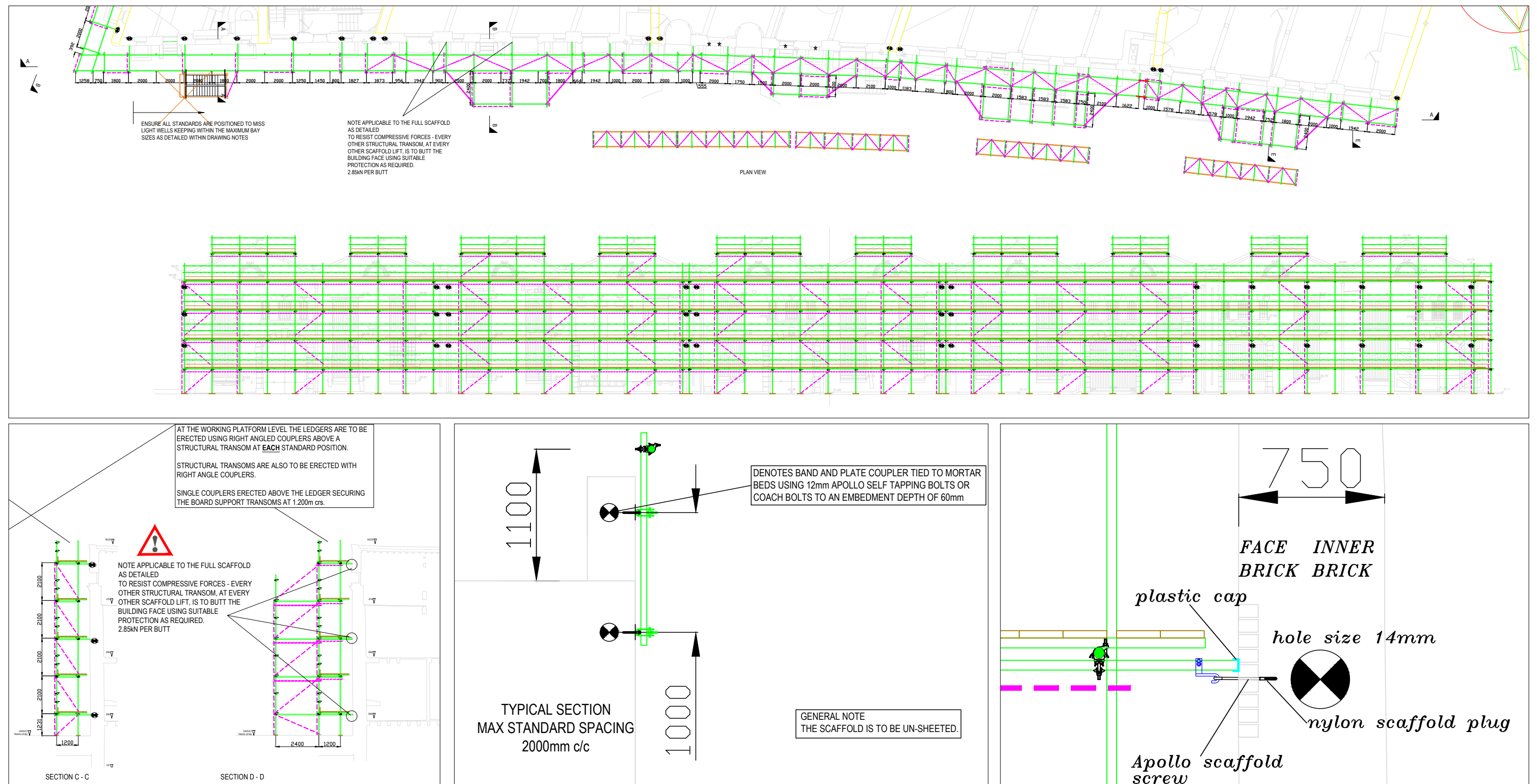
- Scaffolders will operate in 2-man teams. When erecting and dismantling any scaffolds. Only one Scaffolders at any one time working on the scaffold erecting or dismantling scaffold. The 2nd scaffolder will lay materials out in front of the scaffolder when erecting and remove materials from behind the scaffolder.
- MC to segregate all working areas to eliminate other trades working in the same areas
- Scaffold standards to be positioned to be set on base plates and sole pads/sleepers.
- Standards to be connected with ledgers and transoms at kicker lift level.
- Transoms to be positioned on ledgers to suit the boarding maximum 1200 metre centres.
- Once kicker lift is constructed including the double guardrail and toe-board this to be erected standing on ground level at all times. Boards are then to be placed to kicker level.
- 1st lift level to be constructed from the fully boarded, hand railed and toe boarded kicker lift.
- Ledgers and transoms are to be placed as per kicker lift level once complete safety step is to be used to fix the next level top handrail and mid-rail.
- Safety step to be placed on kicker lift top guard-rail with then scaffolder to clip their harness on to the back ledger before accessing the step.
- Double couplers are to be placed on the uprights so as both rails can be fitted once couplers are in place. The rails are to be fixed in the uprights with all fittings tied off and sleeves positioned where required to join the guardrails these also to be tied off from the safety step.
- Once all the next level guardrail is positioned the boarding can be placed to this level from the kicker lift level below.
- Once all boarding complete the ledger bracing is to be installed before any access to the level above.
- Once all bracing is complete, access can be gained to next level by safe means i.e. stair-tower or ladder access working from the access lift to be completed with toe board's ladder hatch/gate before any materials are passed onto the scaffold.
- All further levels to be constructed as per the detail above
- All ties will be pulled tested with certification passed onto MC site manager.
- No netting to be attached to the scaffolding until the scaffolding has been inspected and all ties are in place.
- Complete scaffold will be checked handed over and scaff-tagged as complete with certification issued to MC.

Dismantle of access scaffolding

- Scaffolders will operate in 2-man teams. When erecting and dismantling any scaffolds. Only one Scaffolder at any one time working on the scaffold erecting or dismantling scaffold. The 2nd scaffolder will lay materials out in front of the scaffolder when erecting and remove materials from behind the scaffolder.
- MC to segregate all working areas to eliminate other trades working in the same areas.
- All scaffolds to be cleaned off before any works commence.
- Complete scaffold will be checked handed over and scaff-tagged "Do Not Use" with certification issued to MC.
- The top lifts can now be dismantled off the fully boarded lift following proceeding repetitively in adherence to risk controls for SG4:10 and work at height compliance as stated within the risk assessment section to the height required.
- Equipment from upper levels will be transported using 2 potential methods either by hand to operative below at ground level or locating the materials or stillages to a safe position. The controls specified in the risk assessment for manual handling, telehandler movements, demarcation and communication to be followed.
- All scaffold to be checked before the dismantling of each lift, i.e. all ties and bracing are in place.
- Once this has been carried out the lift can now be dismantled in accordance with SG4:15.
- On the scaffold dismantle the first operation will be to remove the boards from the level below.
- Once all boards are removed the scaffolder is to use the scaffold step to remove the higher level guardrail. Whilst on the scaffold step the scaffolder is to be clipped on at all times.
- Once the higher handrail tube is removed from the higher level the fittings that supported the handrail are to be removed.
- The scaffold level can now be dismantled and removed from the platform. All handrails and toe boards are to be left in place and secure whilst dismantling platform.
- Once the scaffold level and ties have been fully dismantled this also to include all sway braces.
- The toe-board is to be removed as the first operation of the edge protection removal.
- Once the toe-board has been dismantled and removed from the platform. The mid-rail is to be dismantled and removed. Once the mid-rail is removed the fittings supporting these are to be removed.
- If any operation on the boarded level requires kneeling or bending down below the top rail once the mid-rail has been removed then harnesses will need clipping to the top rail at all times.
- The top guardrails will be left in place with all fittings secured at all times.
- Repeat to 1st lift.
- The ledgers and standards and transom together with doubles to make a rectangle, which formed the first lift can then be removed
- The base plates on sole pads at ground level can be removed.

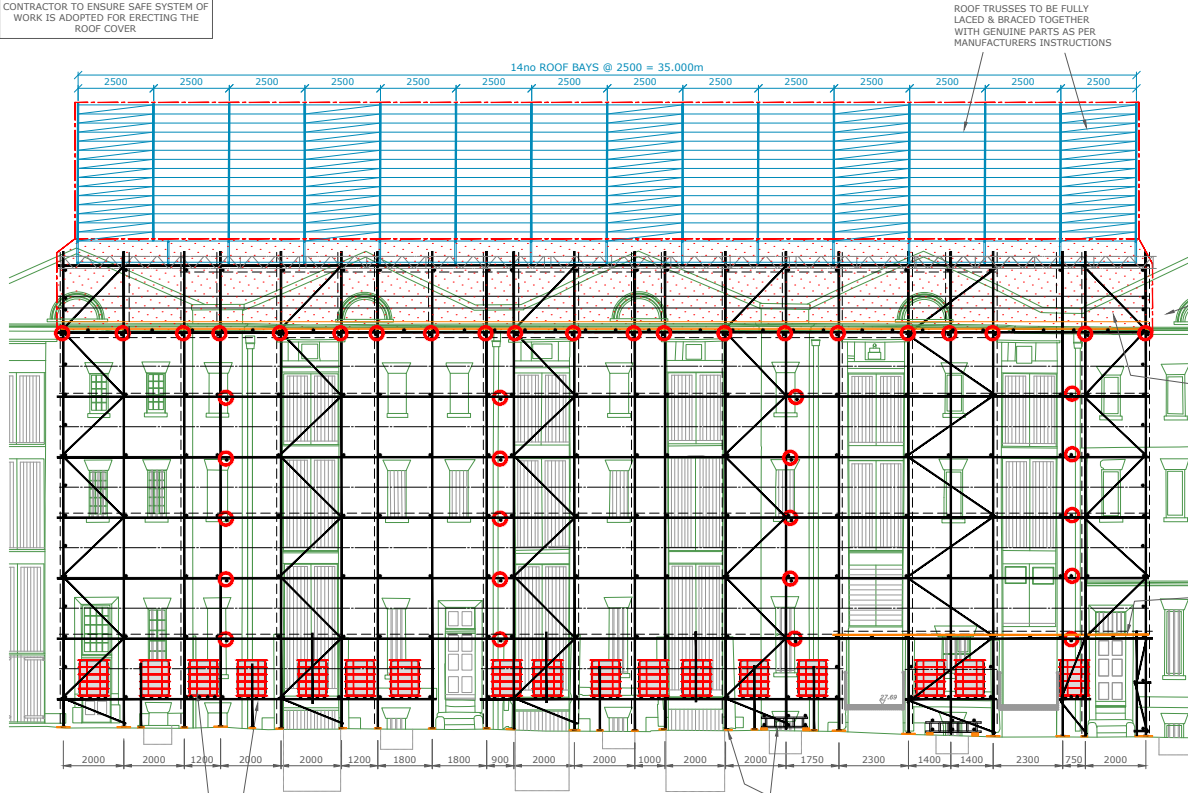
Erecting & dismantling of haki staircases to independent access scaffold.

- Scaffolders will operate in 2-man teams. When erecting and dismantling any scaffolds. Only one Scaffolder at any one time working on the scaffold erecting or dismantling scaffold. The 2nd scaffolder will lay materials out in front of the scaffolder when erecting and remove materials from behind the scaffolder.
- MC to segregate all working areas to eliminate other trades working in the same areas
- The haki staircase access scaffold will be erected off sole boards standards placed on base jacks.
- The ledger beam can be connected to higher level pockets and connect transom to same standard then next standard connected to transom and erect ledger until complete kicker lift is erected and levelled.
- Entrance step and landing placed over ledgers to square tower up then fit guard frames to standards
- Erect lifts to suit stair flights handrails to be erected from lift below
- Stair landing to next level placed over ledgers and pushed away now stair flight can be positioned vertically and located into slots of bottom landing then lower stair flight until top flight is fully located into top landing platform.
- The scaffolder will clip their lanyard to the inside ledger, then erect the top handrail post to landing then erect stair handrail into posts and engage locking catches
- Erection platform to opposite end to landing now next lift can be erected to suit next flight of stairs.
- Once scaffold reaches full height a small platform will be erected onto the scaffold.
- Haki staircase to be tied to the main steelwork using girder clamps in pairs.
- Haki staircase to be erected and tied as per manufacturer's guidelines
- All control measures referenced both internal & external will be followed.
- Once complete scaffold will be inspected tagged complete with certification passed onto MBC site manager.
- The process in reverse on dismantling.



INDICATIVE ILLUSTRATION OF SCAFFOLD TO SOUTH ELEVATION

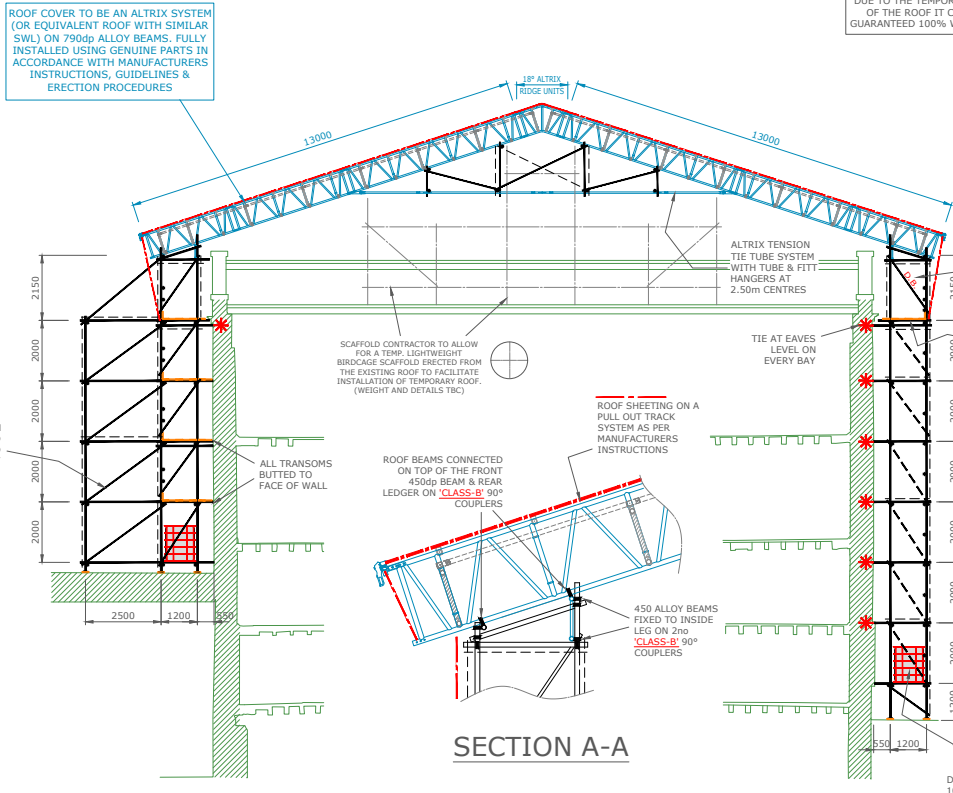
METHOD STATEMENT & RISK ASSESSMENT
TO BE CARRIED OUT BY SCAFFOLD
CONTRACTOR TO ENSURE SAFE SYSTEM OF
WORK IS ADOPTED FOR ERECTING THE
ROOF COVER



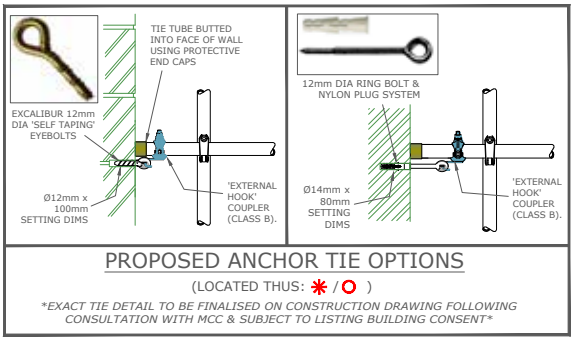
NORTH ELEVATION

SECTION B-B

ROOF COVER TO BE AN ALTRIX SYSTEM
(OR EQUIVALENT ROOF WITH SIMILAR
SWL) ON 790dp ALLOY BEAMS, FULLY
INSTALLED USING GENUINE PARTS IN
ACCORDANCE WITH MANUFACTURERS
INSTRUCTIONS, GUIDELINES &
ERECTION PROCEDURES



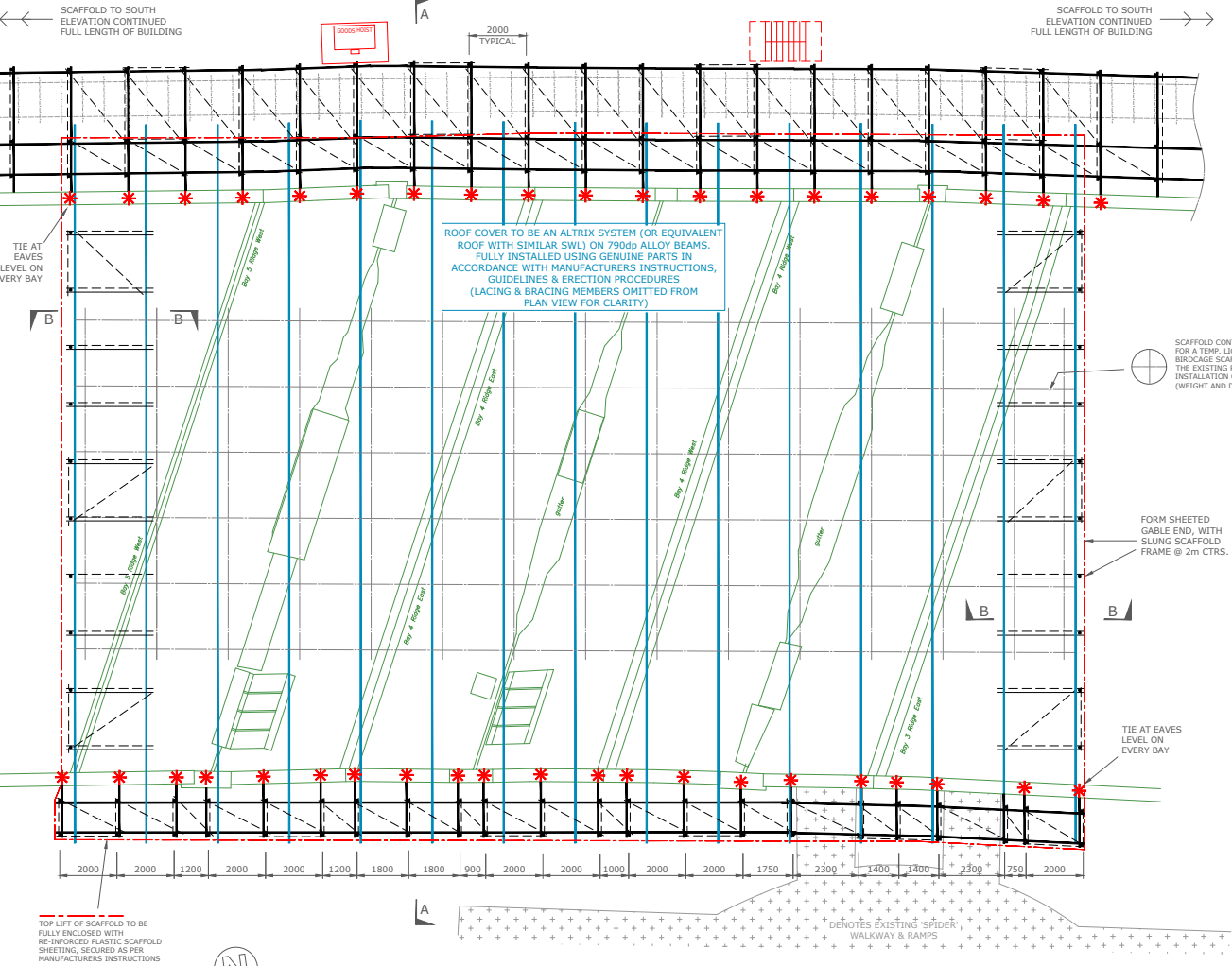
SECTION A-A



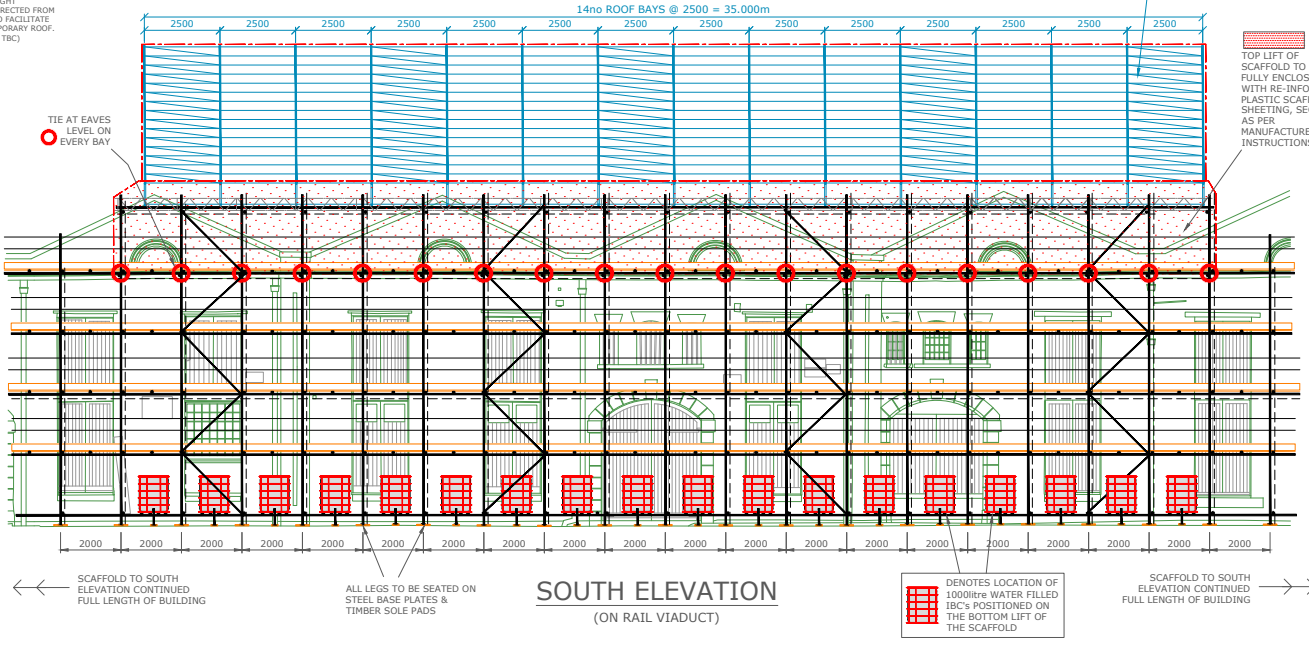
PROPOSED ANCHOR TIE OPTIONS

(LOCATED THUS: * / O)

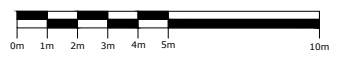
*EXACT TIE DETAIL TO BE FINALISED ON CONSTRUCTION DRAWING FOLLOWING
CONSULTATION WITH MCC & SUBJECT TO LISTING BUILDING CONSENT*



PLAN



SOUTH ELEVATION
(ON RAIL VIADUCT)

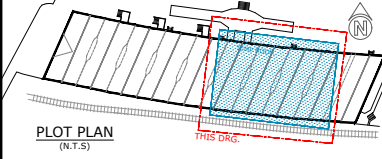


GENERAL NOTES

- This drawing and any associated documents are the property of P.B.S.D. Ltd. The drawing is confidential and it and the copyright therein are the property of P.B.S.D. Ltd.
- Scaffold to be constructed in full compliance with NASC documents TG20-21, SG4-15 and all relevant statutory regulations, by suitably qualified & competent operatives.
- Scaffold built from steel tubes and steel fittings conforming to BS EN39 and BS EN74, unless noted otherwise.
- All timber scaffold boards used are to be 25mm x 38mm in accordance with BS2482 unless noted otherwise.
- Scaffold to be constructed using load bearing fittings throughout, except when fixing intermediate bearers directly below platform levels and securing to existing structure.
- This drawing has been prepared from details supplied to us by the enquirer/client who should check that we have correctly interpreted their requirements and that all loadings, dimensions, details, and erection sequences are correct and practicable. Any changes to the design required due to the absence of detailed information or a suitably completed 'Design-plan' will be at their cost.
- The client is to prepare and ensure that any foundations/supports are suitable for supporting the loads imposed upon it by the scaffold in its work load.
- No sheeting, wind protection or fans, (unless already shown) are to be added to the scaffold structure detailed on this drawing without prior reference to P.B.S.D. Ltd.
- The enquirer/client is to ensure that adequate facilities for tying or anchoring the scaffold are made available and that the structure, building, ground or concrete to which the scaffold is tied or anchored is capable of withstanding the additional imposed loads.
- No ties or braces are to be removed or any modifications to be made to the scaffold without prior reference to P.B.S.D. Ltd.
- The enquirer/client is to design, supply and fix all necessary auxiliary equipment and is to ensure that such auxiliary equipment is capable of safely transmitting the loads to the scaffold tubes.
- The enquirer/client will be responsible for setting out and critical working levels of scaffolding or similar equipment used as a system of support.
- All dimensions are as stated or as calculated. Drawings must not be scaled.
- All working platforms must at all times be in compliance with relevant statutory regulations.
- The Construction (Design & Management) Regulations 2015, require that work cannot begin until the client is aware of and understand their duties outlined in the above mentioned regulations. These duties are detailed in the approved code of practice 'Managing Construction for Health + Safety' or contact P.B.S.D. Ltd. for specific advice.

SPECIAL NOTES

- CLIENT AND/OR CONTRACTOR IS TO CHECK & ENSURE THAT ALL EXISTING FOUNDATIONS, STRUCTURES AND TIE POINTS ARE CAPABLE OF WITHSTANDING THE APPLIED LOADS (AS SHOWN) FROM THE SCAFFOLD PRIOR TO ERECTION.
- ALL COUPLERS ARE TO BE LOAD BEARING EXCEPT BOARD BEARERS.
- ALL BOARDED LIFTS TO BE FITTED WITH TOEBOARDS AND GUARDRAILS TO STATUTORY REGULATIONS.
- EXACT POSITION & TYPE OF SCAFFOLD ACCESS/EGRESS IS TO BE AGREED ON SITE & ERECTED IN ACCORDANCE WITH STATUTORY REGULATIONS & NASC GUIDELINES.
- CHECK FITTINGS ARE TO BE LOCATED IN POSITIONS SHOWN THUS: X
- BOARDS TO BE SECURED IN POSITION AS PER TG20-21, SECTION 6.15.
- ALL DIMENSIONS TO BE CHECKED ON SITE, ANY VARIATIONS TO BE WITHIN TOLERANCES STATED IN TG20-21, TABLE 2.2.
- ALL LEGS TO BE SEATED ON STEEL BASE PLATES & TIMBER SOLE PADS, ON FIRM LEVEL GROUND.
- ALL PREFABRICATED SCAFFOLD BEAMS ARE TO BE FULLY LACED & BRACED ON LOAD BEARING COUPLERS AS PER SUPPLIERS' MANUFACTURERS' RECOMMENDATIONS (IF IN DOUBT CONTACT P.B.S.D. Ltd.).
- CONSTRUCTION RISK ASSESSMENT, MANUAL HANDLING ASSESSMENT AND METHOD STATEMENT TO BE CARRIED OUT BY SCAFFOLD CONTRACTOR, PRIOR TO ERECTION COMMENCING.
- SCAFFOLD TO BE ERECTED IN ACCORDANCE NASC : SG4-15, OR SPECIFIC RISK ASSESSMENT & METHOD STATEMENT.
- DURING THE DESIGN PROCESS HAZARDS HAVE BEEN ELIMINATED OR ASSOCIATED RISKS REDUCED (AS FAR AS REASONABLY PRACTICABLE), WHERE THIS HAS NOT BEEN POSSIBLE AND HAZARDS STILL EXIST THE RISK IS HIGHLIGHTED AND INDICATED BY THIS SYMBOL AND ACTION IS REQUIRED BY CLIENT (and/or) CONTRACTORS TO SUITABLY ELIMINATE OR MANAGE THESE HAZARDS DURING CONSTRUCTION.



DRAWING KEY:	
	SCAFFOLDING
	SCAFFOLD BOARDS
	SCAFFOLD ROOF SYSTEM
	SCAFFOLD SHEETING
	SCAFFOLD ANCHORS
	EXISTING BUILDINGS / STRUCTURES

PROVISIONAL ONLY
NOT TO BE USED FOR CONSTRUCTION

REV.	DESCRIPTION	DRAWN	DATE
1	SCIENCE MUSEUM GROUP		
CLIENT		SCIENCE & INDUSTRY MUSEUM, M/CR	
SITE		SCIENCE MUSEUM GROUP	
TITLE		PROPOSED ACCESS SCAFFOLD & TEMP. ROOF TO ROOF BAYS 3 + 4: 1830 WAREHOUSE	
DATE:		DRAWN BY:	APPROVED BY:
01/03/23		R.Park	P.J.B
SCALE		DRAWING No.	REV.
(A1) 1:125		SMG6391-1	



Product Information Sheet and Pictorial Installation guide for the Apollo Scaffold Screw System

Nylon Scaffold Screw System, Installation Procedure

Installation when the structure to be fixed into is visible

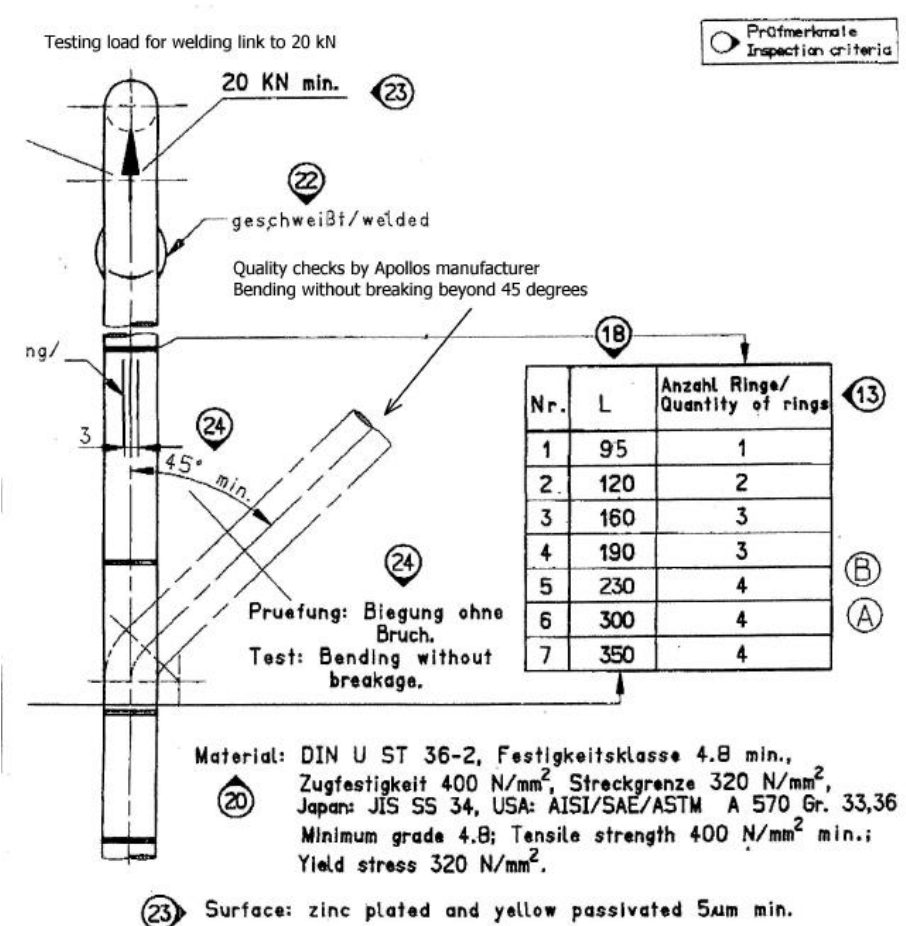
1. Choose the correct plug length and style.
The 70 mm length is considered suitable when fixing directly into brick, stone, granite, concrete most mortar joints and blockwork.
Plug lengths of 75 mm or 80 mm are not suitable alternatives and will have an adverse effective on performance and disrupt the setting procedure.
Plugs that do not have a collar are also not suitable as the collar not only controls where the expansion takes place but also assists in the correct setting of the system. Plugs without a collar can be pushed down the hole without intention when the screw is offered too the plug immediately prior to expanding it.
When a structure has been rendered or has rough cast use a plug length that provides a minimum but optimum embedment into the structural material of 70 mm.
2. Select the position that the hole is to be drilled by offering the tube to the structure whilst in contact with preferably 2 no. standards or ledgers.
(The position is determined by the type of scaffold hook being used).
Drill a 14mm diameter hole clearing as much dust as possible. Drill the hole to a depth of 15 mm longer than the plug length. This means that you do not have to blow the dust out of the hole.
3. Install plug into the hole until the plug collar is flush with the surface. When installing into mortar joints ensure that the expansion is in the direction of the brickwork / blockwork*.
4. Select the scaffold screw. Before screwing it into the plug identify the correct depth marking on the shank of the screw.
The correct depth marking is established by holding the plug alongside the scaffold screw with the both ends level. The top of the plug will line up with the appropriate depth markings.
Where allowed there are three depth markings but a fourth one will be introduced during 2012.
Screw the screw into the plug. After a few turns it will be difficult to screw it in by hand and a scaffold spanner handle can be placed through the screw eye.
Continue screwing until the correct depth mark is level with the plug collar. Stop screwing in the screw.
Over screwing does not improve the strength of the fixing.
Over screwing may take the screw to the bottom of the hole were if screwing continues on screw lengths of 230 mm or more it increases the risk of the screw shearing.
5. Installation complete. Whenever the tube butts up to the front of the screw ensure that the fixing and tube are perpendicular or close too perpendicular to the wall so compressive forces can be accommodated*.

*For further information contact Apollo.

Fax: 01527 64999 Apollo Construction Products Tel: 01527 63999



Product Information Sheet for Apollo Scaffold Screws



Fax: 01527 64999 Apollo Construction Products Tel: 01527 63999



Anchor systems

Apollobolt self tapping anchor for concrete and most masonry substrates

Diameters from 6 mm to 20 mm
Lengths from 35 mm to 200 mm



No plugs or inserts.

The Apollobolt self taps and cuts its own thread into concrete, granite and brickwork. They are also suitable for blockwork, mortar joints and sandstone.

This concept is an established principle within the fixing and fastening industry. Using threads in metals is standard practise for fastening within the engineering industry, as is using woodscrews to cut their thread into wood within the construction industry.

The Apollobolt offers the engineer a stress-free fixing that can be installed nearer to edges and closer together and at varying embedment depths. The Apollobolt performs well in a variety of solid and hollow substrates, is simple to install and is totally removable. An extremely versatile anchor, the Apollobolt offers good load carrying capacity for more arduous applications and is very cost effective.

The Apollobolt in scaffolding applications

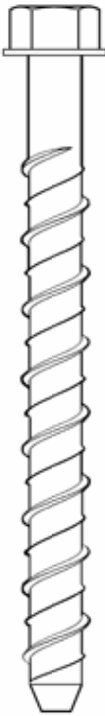
To connect a scaffold tube to an Apollobolt use either of the options displayed on the next page.

Purchaser and installer benefits

- You have a product that is suitable for most substrates.
- Its removable so you should not have too consider stainless steel when long term staining and rusting could become an issue.
- Easier to install than the traditional insert: no special setting tools, just clamp your fixture and the anchor is installed. Torque settings are only important when either 6 or 8 mm diameters are being used, as they may be over tightened or when a high load will be exerted onto the anchor (about 50% off the average failure load of the anchor).
- You can drill three 12 mm holes in the time it takes to drill a 20 mm hole
- Battery drills will become more efficient with a significant reduction in drilling time and more holes per battery.

Benefits over the traditional 16 mm internally threaded systems

- Stronger in place anchor than the traditional M16 system, re: most masonry substrates
- No critical setting procedures
- Provides low in place costs
- Quicker to install than the traditional insert
- Can be positioned substantially closer to a concrete edge
- Can be used in brickwork, sandstone and blockwork



Fax: 01527 64999 Apollo Construction Products Tel: 01527 63999

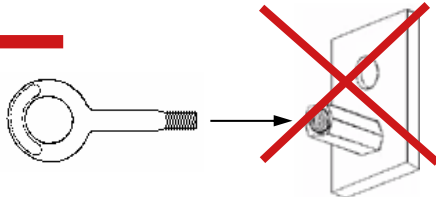


Anchor systems

Brackets and scaffolding applications for the Apollobolt self tapping anchor

Masonry brackets

See catalogue pages 8 and 9 for further information.



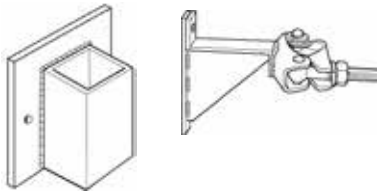
Masonry tie clips

See catalogue page 16 for further information.



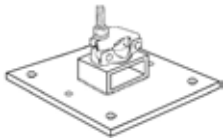
Edge Protection Brackets

See catalogue pages 14 and 15 for further information.



AST Shear tie brackets

See catalogue page 19 for further information.



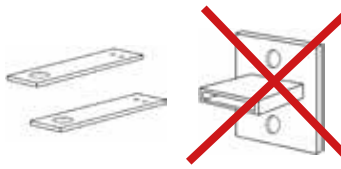
Panel brackets for thin concrete panels

See catalogue page 17 for further information.



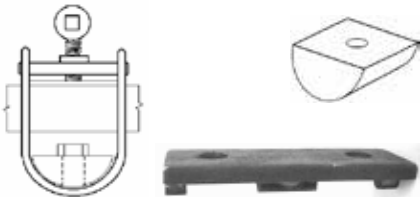
M16 system for fastening concrete stonework, cladding boards and other thin joints

See catalogue page 18 for further information.



One and two hole band washers

The Apollo band washer programme can be viewed on catalogue page 49.



Fax: 01527 64999 Apollo Construction Products Tel: 01527 63999



Anchor systems

Apollobolt self tapping anchor for concrete and most masonry substrates

Diameters from 6 mm to 20 mm: Lengths from 35 mm to 200 mm

Performance data in C20/25 concrete

Anchor and hole diameter		6 mm		8 mm		10 mm		12 mm		16 mm		
Embedment Depth mm		30	45	40	60	50	75	60	90	80	120	
Average Ultimate Load kN	Tension	8	16	12	24	18	35	25	52	40	72	
Safe Working Load kN		2	4	3	6	4.5	9	6.5	13	8	18	
Average Ultimate Load kN	Shear	10	14	24	30	40	50	54	60	79.34*		
Safe Working Load kN		2.5	3.5	6	7.5	10	12.5	13.5	15	19.84		
Normal Edge		Tension		60		60		80		90		100
Distance (mm)		Shear		80		9		120		140		190
Normal Spacing (mm)		Tension		100		120		170		200		220

*Characteristic load. Performance values refer to the Hex head bolt style only. For performance data for other head styles and the hex head 20 mm diameters please call our technical services team.



Edge distance reduction factors for concrete, C20/25

Size mm	Edge mm	20	30	40	50	60	70	80	90	100	110	120	130	140	200	220	240
6	Tension	0.56	0.59	0.73	0.86	1.00											
8		1.58	0.72	0.86	0.93	1.00											
10			0.39	0.52	0.64	0.77	0.90	1.00									
12			0.52	0.60	0.69	0.77	0.85	0.92	1.00								
6	Shear	0.35	0.52	0.70	0.78	0.85	0.92	1.00									
8				0.32	0.40	0.48	0.65	0.83	1.00								
10						0.33	0.39	0.51	0.63	0.76	0.88	1.00					
12								0.32	0.36	0.48	0.61	0.74	0.87	1.00			
16								0.19							0.51	0.76	0.87

Spacing reduction factors for concrete, C20/25

Size mm	Distance mm	20	30	40	50	60	70	80	90	100	110	120	140	170	200	220	240
6	Tension		0.52	0.59	0.66	0.73	0.80	0.86	0.93	1.00							
8				0.78	0.81	0.84	0.87	0.89	0.92	0.95	1.00						
10						0.69	0.70	0.70	0.71	0.72	0.72	0.73	0.84	1.00			
12						0.76	0.77	0.77	0.78	0.78	0.78	0.79	0.85	0.92	1.00		
6	Shear					0.35	0.52	0.70	0.78	0.85	0.92	1.00					
8							0.32	0.40	0.40	0.48	0.65	0.83	1.00				
10								0.33	0.33	0.39	0.51	0.63	0.76	0.83	1.00		
12									0.32	0.36	0.48	0.48	0.61	0.74	0.87	1.00	

For performance details into brickwork, blockwork, sandstone and mortar joints please contact our technical services who have knowledge of anchoring into these substrates.

Fax: 01527 64999 Apollo Construction Products Tel: 01527 63999

Apollo Nylon Scaffold plugs
Manufactured from polyamide PA6 (nylon)



Apollo only supply scaffold plugs manufactured from high quality polyamide PA6. A scaffold plug differs in design and length to a standard nylon plug. A scaffold plug has a collar and when the plug is positioned in the hole the collar is flush with the surface. It provides control where the expansion of the plug takes place. It also provides a permanent visual guide to a correctly set scaffolding tie that should produce consistency in performance.

Genuine and dimensionally suitable scaffold plugs are only available in lengths of 70, 100, 135 and 185mm. Plugs without a collar are not suitable. They are not recognised as part of the system and a non collared plug will effect the consistency of setting.

Plug lengths of 75 and 80 mm are not suitable for any scaffold screw system as they do not allow a visual guide to the correct setting of the system during or after installation and are therefore likely to offer lower and inconsistent in place tensile loads.

Nylon, the optimal material for the Fastening world

Apollo nylon scaffold plugs are made from high grade Polyamide PA6. Due to its excellent characteristics PA6 can be described as the most valuable material in the fastening world.

- Large temperature range of – 40 C up to + 100 C
- Absorption of humidity results in high mechanical features such as impact strength and resistant to distortion
- Minor in flammability and is self-extinguishing
- Plugs are suitable as a safe means of mounting in dynamic loads (pulsating, shock and alternative)

Sound absorption and solidity under temperature influences

PA6 absorbs sound transmissions between construction unit and building material.
PA6 exhibits higher strength under temperature influences compared with conventional plastics.

Long term stability, deformation and the potential of ‘creep’

Deformation, distortion or ‘creep’ as referred to in certain documentation is a potential characteristic of polyamide PA6 which means that movement after installation is possible but not in western Europe. The potential movement equates to up to a maximum of 0.7 mm over a period of 10 years when subject to conditions that promote creep. TG4:11 states that an anchor used for restraining scaffolding can move by up to 1 mm before it is deemed to have failed and as the maximum potential movement over a 10 year period if exposed to the conditions that promote creep is 0.7 mm then Apollo’s supplier does not recognise creep being an issue or its effect on performance for installations remaining in place for up to 10 years. Even for installations that remain in place for 10 years creep may not be an issue.

Creep may develop when the weather conditions offer little or zero humidity a phenomenon that is not likely to exist in western Europe. Plastic plugs or low grade polyamide have a substantially higher deformation rate of 0.8 mm within one month and up to 2 mm over a 10 year period. The features detailed above (impact strength and resistant to distortion) remain key benefits of the genuine Apollo nylon scaffold plug that are relatively ‘thick walled’, another contributor to higher performance. These benefits relate to both the 2 and 3 way scaffold plugs supplied by Apollo. A similar phenomenon can exist in metal anchors* and may be created during installation and probably exists in far more circumstances than those associated with nylon anchors. *Details available on request.

On site and in house tests. Summary of tensile performances obtained.

Material	Strength / style	Embedment mm	Size mm	Average failure tensile loads kN
1. Common Brickwork	Single skin	70	14 x 70	8-12
2. Solid Brickwork	Single skin	70	14 x 70	10-20
3. Concrete	C20-30	70	14 x 70	12-20+

A safety factor of 2 is generally acceptable for scaffolding installations.

For connecting scaffold tubes onto scaffold screws or small diameter eyenuts

The internal hook butts up to the front of a scaffold screw or eyenut. With the hook pulling away this system create little or zero movement.

The external style allows a scaffolding tube to butt up to the structure close to the fixing point.

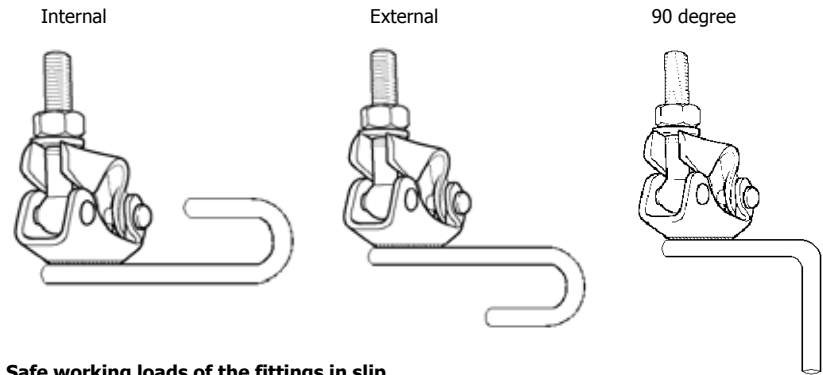
The 90 degree scaffold hook has been designed for ‘across the cavity’ application. Using either the internal or external styles in this application would provide dismantling difficulties once the outer skin to the structure has been constructed.

Hook diameter = 16 mm
Hook formed by cold forming therefore retaining its natural strength.

Coupler and hook connection: the weld is designed to produce a minimum average failure load of 25 kN.

Hook performance: When a scaffold screw is positioned correctly, that is within the curved area, the hook is designed to maintain its minimum tensile strength of 25 kN.

Information relating to the internal and external hooks only.
Should the connection onto the hook be within 10 mm to the end of the hook it will start to bend at 10 kN, rising to 17 kN at approximately 20 mm from the end. (Extract from the independent tests that were carried out by Bodycote’s material engineering). The wide internal curvature (20 mm) that exists on the Apollo hooks provides optimum performance whenever the screw is located in this area.



Safe working loads of the fittings in slip

As per NASC guidelines. Currently; pressed metal 6.1 kN,

Characteristic load performances of the coupler’s
Pressed Metal: 17 kN
Drop Forged; 22 kN

FAO: The final recipient of this document, January 2013 update. We currently are experiencing companies who are copying Apollo designed and manufactured products. Unfortunately some customers have either purchased from these other sources and then recognised that technical support from Apollo is not available or used our technical support and product information data to support the manufacturing of the copies. Code stamping on all products will slowly be introduced but should you have concerns over the origin of this supplied product please call Apollo on 01527 63999. Many thanks.

APPENDIX B.5/

- **Methodology as General Summary**

B.5: Methodology as General Summary

General specifications/ methodologies which will be followed for the works

- 1 The following advice is intended to be a brief over-view highlighting key considerations and requirements. It is not intended to be complete guidance and may be superseded/augmented by advice given on the particular building in question. Regard could usefully be had to relevant Historic England guidance in their 'Practical Conservation' series and NBS specifications/methodologies although the latter need to be modified to ensure a conservation-led approach.
 - 2 **Implementing work:** All works should be undertaken carefully by trained and experienced contractors. Works affecting the original/historic built fabric should only be undertaken carefully using hand-held, non-mechanical tools unless with prior written agreement of Planning Service.
 - 3 **Mortar:** Any use of mortar should be to an agreed detailed specification/methodology including the use of mortar that matches the original on the building in terms of composition (by chemical analysis), colour, texture and appearance of finished application. The submitted information should also, for example, include:
 - (a) The depth of mortar to be removed for any re-pointing and should confirm that mortar would not be used inappropriately such as to provide a fill where masonry is missing.
 - (b) Regard to environmental conditions.
 - (c) The need to carefully use only hand-held, non-mechanical tools for the works to avoid damage to the adjacent masonry/built fabric.
 - 4 **External building cleaning:** It is critical that building cleaning takes place prior to determining the appropriate match of existing and new materials (such as mortar, bricks and stone) needing to be introduced as a part of the works. Cleaning should aim to achieve a gentle 'lift' in the appearance of the building rather than an 'as new'. It is likely this is the intention of the proposed light wash. Cleaning should be to an agreed detailed specification/methodology which should include the use of small trial areas in discreet locations and should not include the use of abrasives or chemicals. Great care is required to ensure an appropriate clean that does not further exacerbate the deterioration of existing stonework and brickwork.
 - 5 **Leadwork:**
 - (a) As with other works, intervention should be kept to the minimum that can be justified in heritage terms and a detailed methodology/ specification should include the criteria used to determine the appropriate approach in a range of circumstances.
 - (b) Any inappropriate past repairs (including the use of non-lead products) need to be reversed.
 - (c) New leadwork should be undertaken on a like-for-like basis to take them back to their original detail/condition/appearance. They should be to Lead Sheet Association standards unless this conflicts with achieving a like-for-like outcome and where an approach should be agreed with the Planning Service.
 - (d) Existing leadwork should be re-used as far as possible. For example, where lead has become detached but is otherwise in acceptable condition it should be re-affixed.
 - (e) Where largescale replacement of existing lead is proposed it should be re-smelted and re-used in the proposed works to avoid the loss of the material from the building
 - 6 **Stonework repairs:** Stonework repairs should be to a detailed specification/ methodology agreed with the Planning Service. This would need to include the criteria to be employed when determining the type of repair to be used. For example:
 - (a) There may be small blemishes and weathering (not causing water pooling or other maintenance issues) that contribute to a patina of age of the building and that should be left.
 - (b) Descaling may be appropriate but this may lead to the need for re-dressing stone or other repair and this needs to be understood.
 - (c) An individual stone may have modest cracks or other small scale damage (such as drill holes left by removed fixings) that can be successfully repaired with an appropriate lime-based mortar/filler type system to give an 'invisible' repair. Such an approach of 'plastic' repair can also be used to restore minor damage to particular architectural features such as limited damage to capital heads.
 - (d) For larger areas of damage to individual stones the piecing-in of an element of matching new stone would become more appropriate than a plastic repair.
 - (e) Where the damage to an individual stone is significant a completely new element of matching stone may be required.
 - (f) The choice of repair technique would also need to consider the nature of the particular element - for example, a highly elaborate carved doorway feature may need a different approach than a more standard window cill feature.
 - (g) Any missing elements of stone would need to be appropriately replaced in matching stone.
- Any such detailed methodology/specification should confirm that consolidating fluids or similar surface treatments would not be used. Any proposed use of such a treatment would only usually be accepted if its use would fully comply with the detailed advice from Historic England on this matter. It would be difficult to see the use of consolidating fluids being appropriate or justifiable in this instance and any proposed use should be avoided.
- 7 **Modern sealants:** These are considered unacceptable where traditional building methods such as mortar and lead flashing provide an acceptable, alternative approach. The use of modern sealants would only be considered in other particular instances where a traditional method would be demonstrably inappropriate and these exceptional instances would need to be clearly explained, justified and avoid harm to heritage significance.
 - 8 **External redecoration:** This should be restricted to those features that are currently painted. This should be undertaken on an evidence basis with a paintwork analysis of the existing paint undertaken by someone with appropriate expertise to establish the painting history of the building. Where such evidence is found to be unclear or to no longer exist (for example due to previous removal of paint during past refurbishment) the proposed redecoration should be on a researched basis of buildings of a similar age and type.

It is noted that the paint colour 'brilliant white' and 'gloss' finishes were not available until after the Second World War so would be inappropriate for use on this building. The redecoration should be undertaken to a detailed specification/ methodology which should include the supporting evidence and/or research as appropriate.
 - 9 **Vegetation removal:** This should be undertaken to an agreed specification/methodology. The use of any chemicals would need to be undertaken with care to ensure they would not adversely affect the existing built fabric such as, for example, by causing staining. It should be confirmed that the vegetation has not become so invasive as to require any built elements to be taken down to enable removal although it is accepted that some repointing may be necessary. If this is not the case, any taking down would need to be limited and kept to the absolute minimum with the individual elements of removed built fabric being returned to their original position/orientation using traditional building methods.
 - 10 **Scaffolding:** Details should be provided of the proposed scaffolding to facilitate the proposed works. The design and type of scaffolding used should demonstrably avoid damaging intervention on the listed building such as caused by the use of wall ties. Consideration should firstly, therefore, be to use structural scaffolding or a range of other options for non-structural scaffolding to avoid wall-ties. The possibility to use a combination of these options and elements of structural scaffolding should be considered ideally to avoid wall ties or, at least to keep them to an absolute minimum. The use of wall ties should be an absolute last resort and would only be accepted where other options are demonstrably impractical and subject to an appropriate detailed specification/methodology that should, for example, confirm:
 - (a) Wall ties would be into mortar joints within areas of brickwork but only where the joints are sufficiently wide to avoid damage to the arrises of the adjacent bricks. Where the mortar joints are of insufficient width to avoid such damage then consideration should be given to the careful removal of a facing brick to enable a wall tie to be installed in the masonry behind. As the scaffolding is removed the tie would be removed, the drill hole appropriately repaired and the facing brick returned to its original position with appropriate use of mortar to achieve an 'invisible' repair. Where this approach is shown not to be feasible, ties should be located in the centre of individual facing bricks. The brick dust created by the drilling should be saved. As the scaffolding is removed the ties should be removed and the damage made good to give an 'invisible' repair using the collected brick dust to assist to achieve the matching colour and texture. The specification/methodology should include details of brickwork repair.
 - (b) Wall ties would only affect individual bricks and would not, for example, be located on any stonework or decorative brickwork/ brickwork features.
 - (c) Appropriate measures would be taken to avoid the building being abutted/damaged by scaffolding poles.