C300/410 Western Tunnels & Caverns Project
Method Statement for the London Borough of Camden
For the Construction of
Bored holes and Installation of Two 40 tonne Concrete Silos at the Kingsway Tram Tunnel

CRL Document Number: C300-BFK-C-GMS-CRT00_ST005-51803

Contract MDL reference C12.003

1. Contractor Document Submittal History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
1.0	08/10/2013	M Bonham			
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2a. Stakeholder (LU/NWR/DLR/TfL/Other* (delete* as applicable)) review required? YES ☒ NO ☐

(If NO, strike out sections 2a & 2b and go to section 3)

This document has been reviewed by R MEARS in the capacity of CONST. MANAGER for coordination, compliance, integration, and acceptance as a safe system of work, output, control, sequence. This document is acceptable for transmittal to L.B. CAMDEN for no objection to the works being executed as described.

Sign: Name: R. MEARS Date: 28/11/13

2b. Review by Stakeholder (if required):

Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					☐
					☐
					☐

3. Acceptance by *Crossrail*

	***Crossrail* Review and Acceptance Decal** This decal is to be used for submitted documents requiring acceptance by *Crossrail*.		
☑	Code 1.	Accepted. Work May Proceed	
☐	Code 2.	Not Accepted. Revise and resubmit. Work may proceed subject to incorporation of changes indicated	
☐	Code 3.	Not Accepted. Revise and resubmit. Work may not proceed	
☐	Code 4.	Received for information only. Receipt is confirmed	
Reviewed/Accepted by:(signature)	Print Name: R. MEARS	Position: C.M.	Date: 28/11/13

Acceptance by *Crossrail* does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute *Crossrail* approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier

Internal Review Statement

	Signature	Print Name	Date
Prepared by			
Reviewed by			
Approved by			
Approved by Construction Manager			

The following signatories are required to review this Method Statement prior to initial submission to Crossrail, this is to ensure the document is comprehensive, accurate and suitable for issue:

Subsequent reviews to be determined by the Construction Manager.

	Signature	Print Name	Date
Nominated Workforce Representative			
Reviewed by Temporary Works Coordinator/Engineering Manager			
Reviewed by H&S Manager			
Reviewed by Environmental Manager			
Reviewed by Quality Manager			
*Reviewed by CEM / CRE			

*Only required when working on Network Rail controlled infrastructure

Contents

1. Executive Summary

This is a proposal for the construction of 2no boreholes, 600mm in diameter and installation of two 40 tonne concrete silos, through the floor of the Kingsway Tram Tunnel (a grade II listed structure), into the Crossrail running tunnels to aid in the construction of Fisher Street crossover works as part of the Crossrail project. The boreholes and silo will be used to supply concrete water compressed air and electricity for the sprayed concrete lining works in the Crossrail Tunnels.

A grout shaft has already been installed in the Tram Tunnel and a series of protective measures are already in place and agreed between Crossrail and the London Borough of Camden as outlined in C121-OVE-T1-GMS-CR001-00001. This grout shaft will be covered with the lid onsite prior to works commencing.

As the Kingsway Tram Tunnel is a listed structure a Heritage Method Statement is required for submission to the London Borough of Camden in accordance with the Heritage Deed agreed between the London Borough of Camden, English Heritage and the Nominated Undertaker.

The Heritage Deed requires that the method statements covering the following aspects of the works are submitted for approval:

a) How the adjoining granite retaining walls and iron railings will be protected during the works; and
b) How the roadway of the tunnel entrance will be made good once the use of the tunnel is no longer required.

With relation to method statement, the adjoining walls will be protected during the works by establishing work procedures to remove the threat of collision. The method statement also addresses the protection of any rails which may need protected. The cobbles in the roadway will be protected by using track tiles.
The construction of the borehole works are not deemed to cause any structural instability to the tram way tunnel.

2. Introduction

Schedule 9 of the Crossrail Act disapplies the usual statutory controls over the demolition and alteration of listed buildings.

In light of this, Crossrail, as the Nominated Undertaker has entered into a Heritage Deed with the London Borough of Camden and the Historic Buildings and Monuments Commission for England, providing for certain details of works affecting listed buildings to be approved by Camden Council. English Heritage and the relevant National Amenity Societies, which in the case of Kingsway Tram Tunnel includes the Victorian Society and the Ancient Monuments Society, are also to be consulted on these works. Appendix 1 (Schedule 2) of the Heritage Deed for the London Borough of Camden sets out the particular requirements for the Kingsway Tram Tunnel, with part 2 of that Schedule setting out the Method Statement details.

This document will cover the site setup and protection of the grade 2 listed structure (KTT) as well as describing the proposed works involved in the boring of 2 No holes through the base slab and ground below into the Crossrail tunnels for future works at Fisher street and the installation of two 40 tonne silos.

Separate Method statement will be produced for the construction of the boreholes and for the installation of the silos outlining the method in detail, any risks and procedures involved to mitigate those risks, emergency contact details, planning resources, health and safety control measures and environmental control measures.

3. Scope of Work

3.1 Description, significance and history of the KTT

The tram tunnel was designed within the original layout of Kingsway (which replaced the narrower King's Gate Street) as part of a transport system constructed between 1904-06 by London County Council. The subway originally ran from the Embankment to Holborn and had a number of subterranean 'stations'. The interior of the tunnel and its portals were substantially altered 1929- 31 when the internal height of the tunnel was increased to accommodate double-decker trams.

As part of these works the subway north of Holborn Station was opened up and the original twin tunnels replaced by a single wide cut and cover passage with a steel girder roof. The walls were formed in in-situ shuttered concrete, the impression of the shuttering being visible in the concrete finish, and the track was replaced with standard track-work with yokes and slot rails set in concrete in place of the special type designed for the original construction. The tunnel was closed in 1952 and the southern end was adapted as a traffic underpass in 1964.

The tramway has two sets of rails. The roadway above is supported on a steel trough shuttered deck (currently painted yellow), below which is the steel frame that previously supported the structure of the tunnel's sloping ceiling. There is very little of architectural significance in the area between the portal and the tram station, located south of Holborn. Decorative finishes such as the glazed brick, travertine marble, and ironwork which feature elsewhere in the subway, are absent north of Holborn Station; here the finish is of concrete throughout, except around the entrance ramp. Appendix 4 shows 2 drawings of the enlargement of the Kingsway Tram Tunnel.

The tunnel entrance ramp's retaining walls are faced with white glazed bricks and the tunnel entrance ramp retains its original cobbled road surface and tram rails, with a granite clad portal, and granite surrounds at street level surmounted by cast iron railings. Within the tunnel the side walls are of concrete, with a series of recesses set into the tunnel sides, presumably added to provide safe refuge to those walking through the tunnel. The tunnel floor is also concrete, with most, although not all, of the original rails surviving. It is not known when the concrete flooring within the tunnel was inserted. It would have been laid either during 1929-1931 or afterwards. The concrete was either laid over the existing granite setts or the setts were removed around the rails and concrete laid instead. A cast and wrought iron gas lamp stand also survives above the tunnel portal above street level.

The northern section of the tramway, outside the tunnel itself has considerable streetscape value for the quality of its granite finishes and ironwork decoration as well as having particular historical significance as the only underpass specifically built for trams.

3.2 Drawings of existing KTT Structure

The following drawings in Appendix 3 show the existing structure;

- Plan showing the existing structure at tunnel level, A3/C122-OVE-C2-DDA-CR001_Z-51005
- Elevation of the tunnels west wall, A3/C122-OVE-C2-DDA-CR001_Z-54001
- Elevation of the tunnels East wall, A3/C122-OVE-C2-DDA-CR001_Z-54002
- Section at the tunnel portal entrance, A3/C122-OVE-C2-DDA-CR001_Z-54003

3.3 C.3 KTT Site

BAM/Ferrovial/Kier (BFK) Fisher Street site is located as indicated in Figure 1 and has restricted size and access. The dimensions of the access create serious logistic problems to the construction of an already extremely difficult crossover.

Figure 1 - Fisher Street location

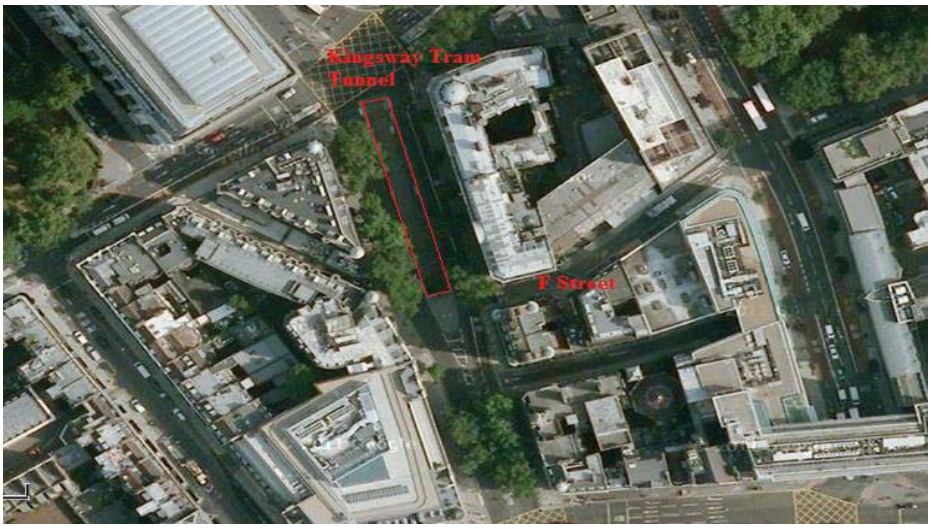


Figure 2 – Location of Kingsway Tram Tunnel

The Kingsway Tram tunnel located below Southampton Row will be used to supply concrete and services into the Crossrail running tunnels to enable construction of the Crossover caverns by sprayed concrete lining techniques. (Figure 2)

The KTT will be accessed via the ramp (shown on figure 3) there is a set of gates located at the North of Southampton row, the gates will only be opened for access and will be kept closed at all other times. There is another set of gates at the bottom of the ramp which will be permanently opened for access (Figure 4) whilst the works are ongoing. These gates have a monitoring security alarm if front of them which will be switched off whilst the works are ongoing. BFK will have Traffic management in place to control access and egress into the Tram way tunnels. The keys for the gates will be kept with Security in the main site office of 8-10 Southampton Row, Holborn, London, WC1R 4QA.

Figure 3 - Kingsway Tram tunnel entrance ramp facing North

Figure 4 - Kingsway Tram tunnel entrance portal

In case of an emergency there is an exit located 150m into the tunnel which can be used. This exit was the old access steps to the tram platform, the steps lead out onto Kingsway.

3.4 Method Statement – for the protection of the Kingsway Tram Tunnel during boring and concrete delivery.

3.4.1 Description of Proposed works

This method statement will cover the safe construction of 2no bored holes and the foundation for two 40tonne concrete supply silos in the Kingsway Tram tunnel to the newly constructed Crossrail Eastbound and Westbound running tunnels.

One of the holes, as shown in appendix 1 is located 45-50m into the KTT tunnel and will supply the Westbound running tunnel. A second borehole located at 20-25m into the KTT are shown in appendix 1 will supply the Eastbound running tunnel. Both of the holes will be located to the left hand side of the tunnel when facing south. Great consideration has been giving to the positioning of the boreholes with particular emphasis given to limiting the damage to the existing structure:

• Both of the openings are located on the the same side of the tunnel which will minimise the amount of holes drilled for the concrete brackets and hence causing less damage to the tunnel floor.
• The position of the holes will not create an obstruction to vehicles.
• The silos and the boreholes are in the same side reducing the amount of pipes and brackets needed
•The sixth rail at this location is already protected as it is embedded in concrete minimising potential damage.
• The holes are in a location that would not interfere with radial joints in the segmental tunnel

3.4.2 Concrete Coring and augured borehole Works

Although great consideration was given to placing the boreholes in a location where no part of the tracks would be damaged this was not achieved. This was mainly due to our designers requirements where the boreholes could not be placed in area where it will fall within two sections of a tunnel segment.

It was decided that the best cause of action to minimise damage to the existing rail would be to carefully expose the section of rail where the boreholes are located and to remove the section of rail that falls within the borehole (900mm). This will ensure the rail outside this zone is not influenced by the works. The rail will be stored securely and reinstatement agreed with Camden Council.

A piling subcontractor with the capacity to use a diamond coring bit will be appointed to carry out the works. A drill rig will be set up in a location which has been set out by a surveyor. The perimeter of the borehole will be cored through the concrete; this will ensure that no concrete beyond the perimeter of the cored drilling is damaged. The core drilling will form a 660mm diameter core which will facilitate construction of the borehole and enable access to the borehole.

The same subcontractor will be carrying out the augered boreholes. They will take into account the site constraints when using there boring rig such as height. Appendix 2 shows a section view of the proposed works. The marked out locations will allow the rig to core into the Cross rail tunnels. The drill rig will be set up so that it does not disturb the existing tram lines, if required the tram lines will be protected.

The drill will core/ bored 2 No holes 660 mmOD. The location can be seen in appendix 1 and 2 for the bored holes. The bored holes will be lined with a sleeve and will be approximately 7.5m (Westbound) and 11m (Eastbound) in depth.

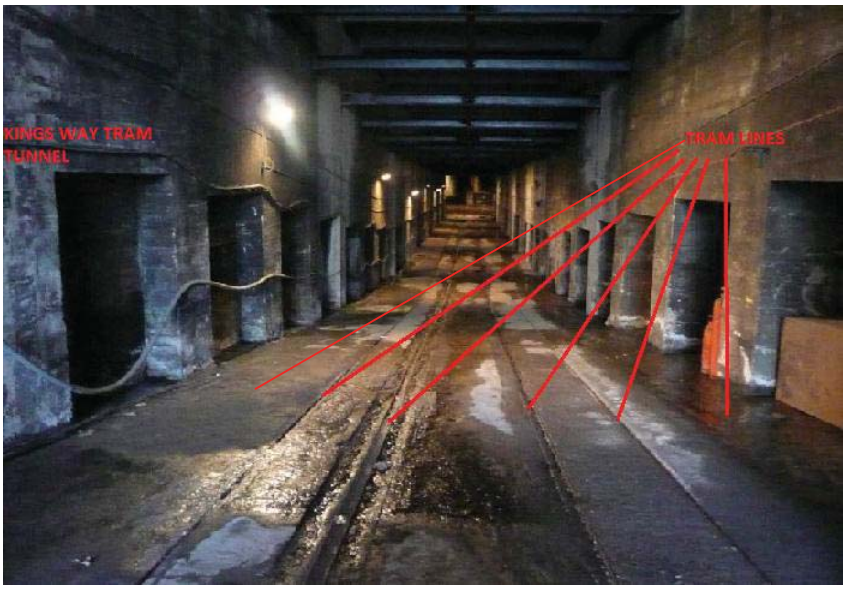


Figure 5 - Kingsway tram tunnel

Once the bored holes have been completed concrete will be brought into the KTT and deposited down the holes into to Cross rail tunnels either gravity fed or using a concrete pump. Vehicle movement will be controlled by the traffic marshals into the KTT tunnels.

3.4.3 Installation of Silos

Due to requirements set out in the specification we are required to have an alternative supply of concrete in order to be able to support the ground in case of an emergency. This will be provided by the 40 tonne Cemex silos which will be filled with a dry concrete blend. There will be two 40 tonne silos sitting in a concrete slab discharging into an electric pump. Should mix from this silos be required the silos water will be added to the preblended mix at the auger screw turning it into a pumpable wet mix and discharged into a concrete pump. A 4 inch concrete supply line will be bolted the floor with brackets ensuring that no cobbles are damaged in the process. The line will run as far as the boreholes.
Brief Sequence for installation of silos:

- Two 250mm minimum slab will be cast over on polythene membrane over the existing surface of the ramp to protect the surface.
- The silos will be will be delivered to site and stood upright by the delivery lorry.

- A 8 tonne crawler crane with rubber tracks will be used to lift and position the silos, Once in position they will be fixed to the slab.

3.4.4 Protection

Adequate protection consisting of a combination of site working practices and physical protections will be in place to ensure no damage is incurred on the Tram tunnel.

The slab for the concrete silos will be cast on a polythene membrane over the existing surface of the ramp to protect the surface. The slab will be approximately 250mm thick at the highest end, which will make it approximately 550mm thick at the lower side. If shear connections are required between the slab and the cobbles holes will be drilled in the grout between cobbles to minimise damage.

The railings, which are located at street level, will be safeguarded from potential damage by working practices. The lifting of materials or objects over the railings and any other similar crane operations will not be permitted. All access into the tunnel will be by road, through the gates at the top of the access ramp. Traffic marshals will be on site to aid in the arrival and departure of any vehicles.

The glazed bricks to the ramp walls will be protected from vehicular impact by the placement of polystyrene with ply boards secured to them and placed against the side of the walls. The plywood will be propped to the ground and secured in place with bolts, bolted between the cobble stones.

Figure 5 – KTT ramp and glazed brick walls that need protecting

The ramp will be used as a holding / passing area for concrete wagons with a 5mph speed limit and banksman / traffic marshals onsite to aid in the safe manoeuvre of vehicles to and from the KTT. The ramp is 6m wide allowing for safe passage of vehicles.

The concrete walls and floor inside the KTT do not require protection. If the rig has to move then the rig will move so that the tracks are not on the rails but inside or on either side of the rails. This methodology has been devised to ensure that sensitive heritage assets are not impacted by the works. In the event of changes to the methodology which may impact heritage elements such as the tram rails, cobbles or glazed brick walls, BFK will further consult with the London Borough of Camden to agree methods for mitigation, removal and storage of heritage elements, and any consent requirements.

On completion of the works all temporary protection and associated fixings will be removed and all bore holes made good and filled in with concrete.

Only pneumatic tyred or with rubber tracked vehicles will be permitted to traverse the entrance ramp and tunnel floor. The only exception to this will be the small tracked rig that will undertake the coring work. Protection of the floor and ground surfaces will not be required for the tyred vehicles but will be in place at the bottom of the ramp for the rig to traverse onto when being delivered.

The entrance gates to the tunnel entrance ramp, which are late 20th century, steel and not of historic interest, are to be protected on both sides by timber boarding to prevent damage from collision and abrasion.

A cordoned off storage area located further into the tunnel (the location to be determined with the London Borough of Camden) will be sought. This area will need to be dry and will be used to store rails previously taken up, inspection covers and any other items kept for reinstatement.

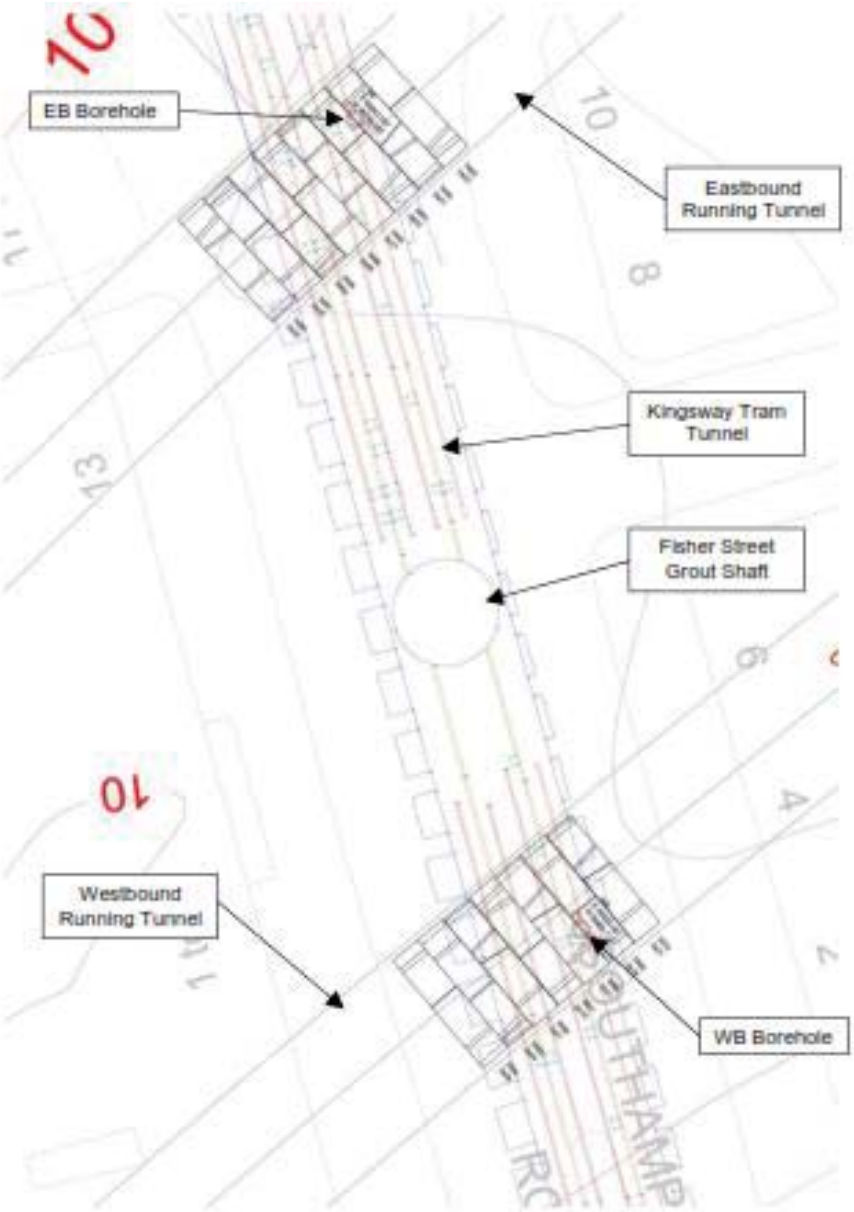
As described above, only pneumatic tyre vehicles will be allowed to traverse the granite setts, except for the small tracked rig that will undertake the coring. In areas where materials are to be unloaded and skips located, the setts and rails will be protected with plywood sheeting laid on extruded polystyrene on a separating layer of geotextile fabric. On completion of all site operations, all temporary protection measures will be removed and the working areas made good. The ramp will, however, provide access to the worksite and afford part of the contractor's compound for the handling of plant, materials, and excavated material.

In areas where materials are to be unloaded or stored, and skips are located, the setts and rails will be protected with plywood sheeting laid on extruded polystyrene on a separating layer of geotextile fabric. Plywood sheeting laid on extruded polystyrene surface will also be installed around the bored hole working area.

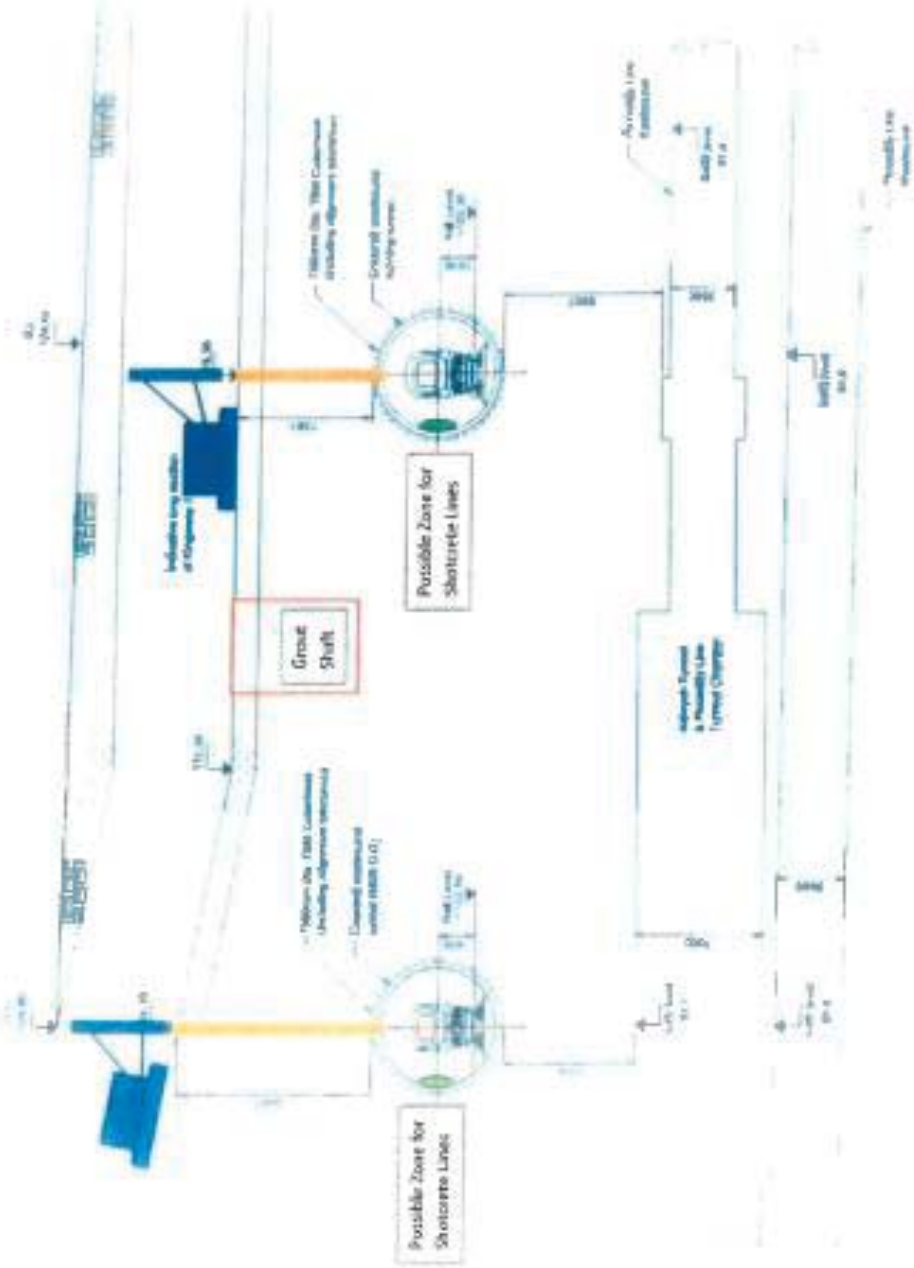
For concrete works, a pump will be located in the KTT, this area will be bunded off with sandbags and spill kits will be present in case of any concrete spills. The concrete wagons will wash out into one of the bored holes were a dumper will be waiting to collect the washout.

On completion of the works within the tunnel, all temporary protection measures will be removed and the working areas made good. Any previously set aside iron tram rails will be reinstated to their original locations and cast into the floor of the tunnel.

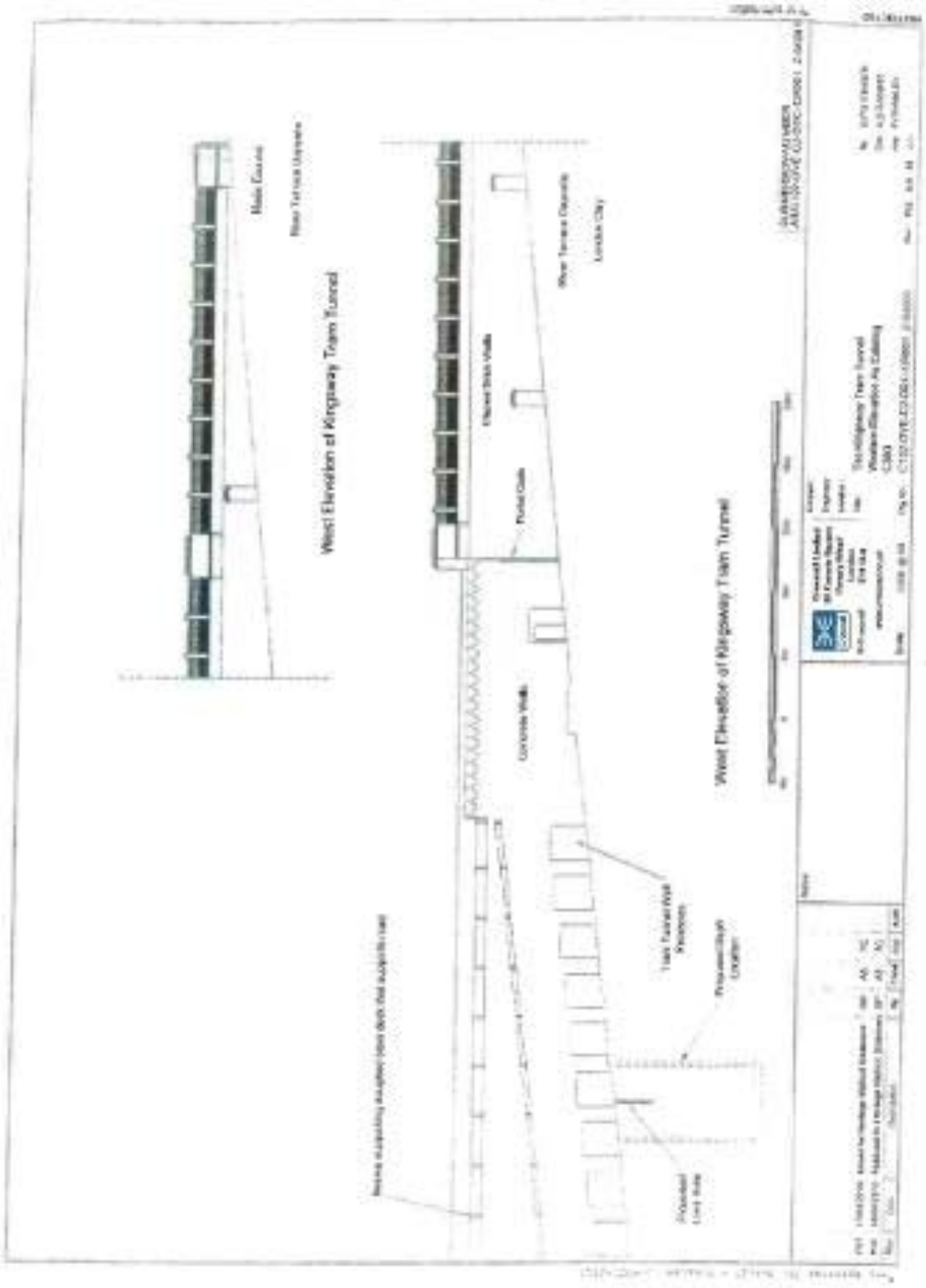
Appendix 1 Westbound & Eastbound bored hole locations



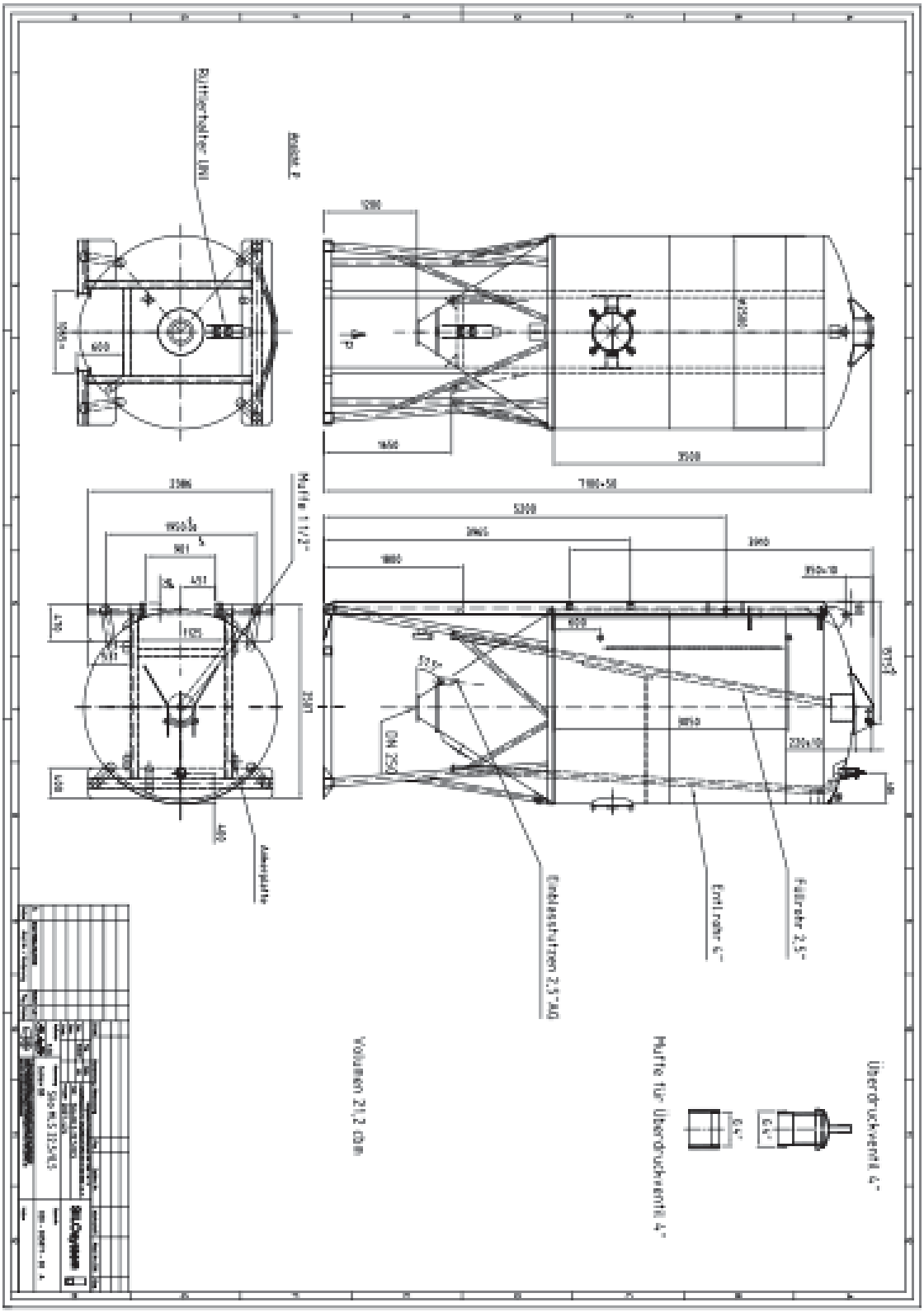
Appendix 2 Section view of KTT Boreholes



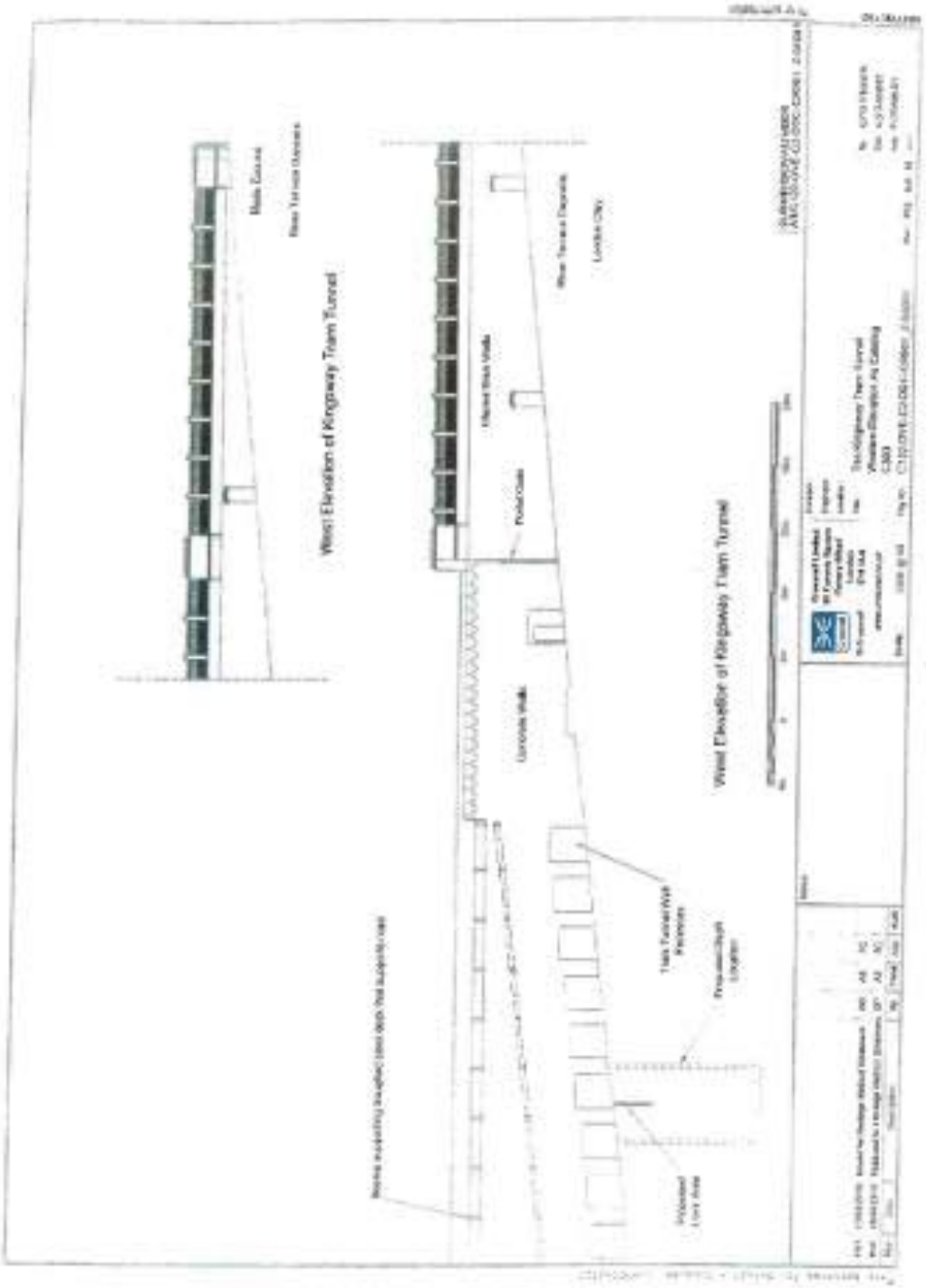
Appendix 3 Drawings of existing KTT

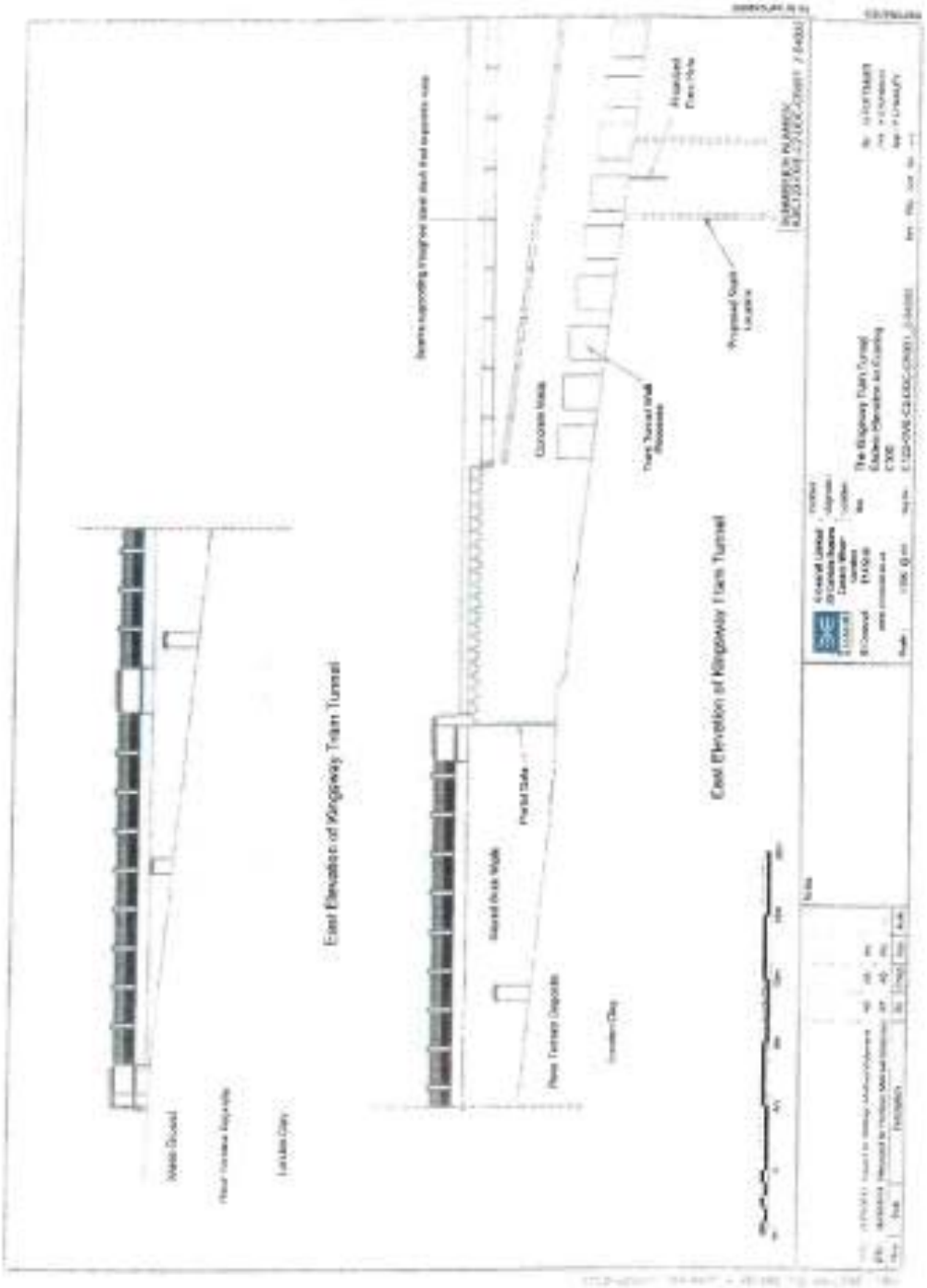

West Elevation of Kingsway Tram Tunnel
West Elevation of Kingsway Tram Tunnel

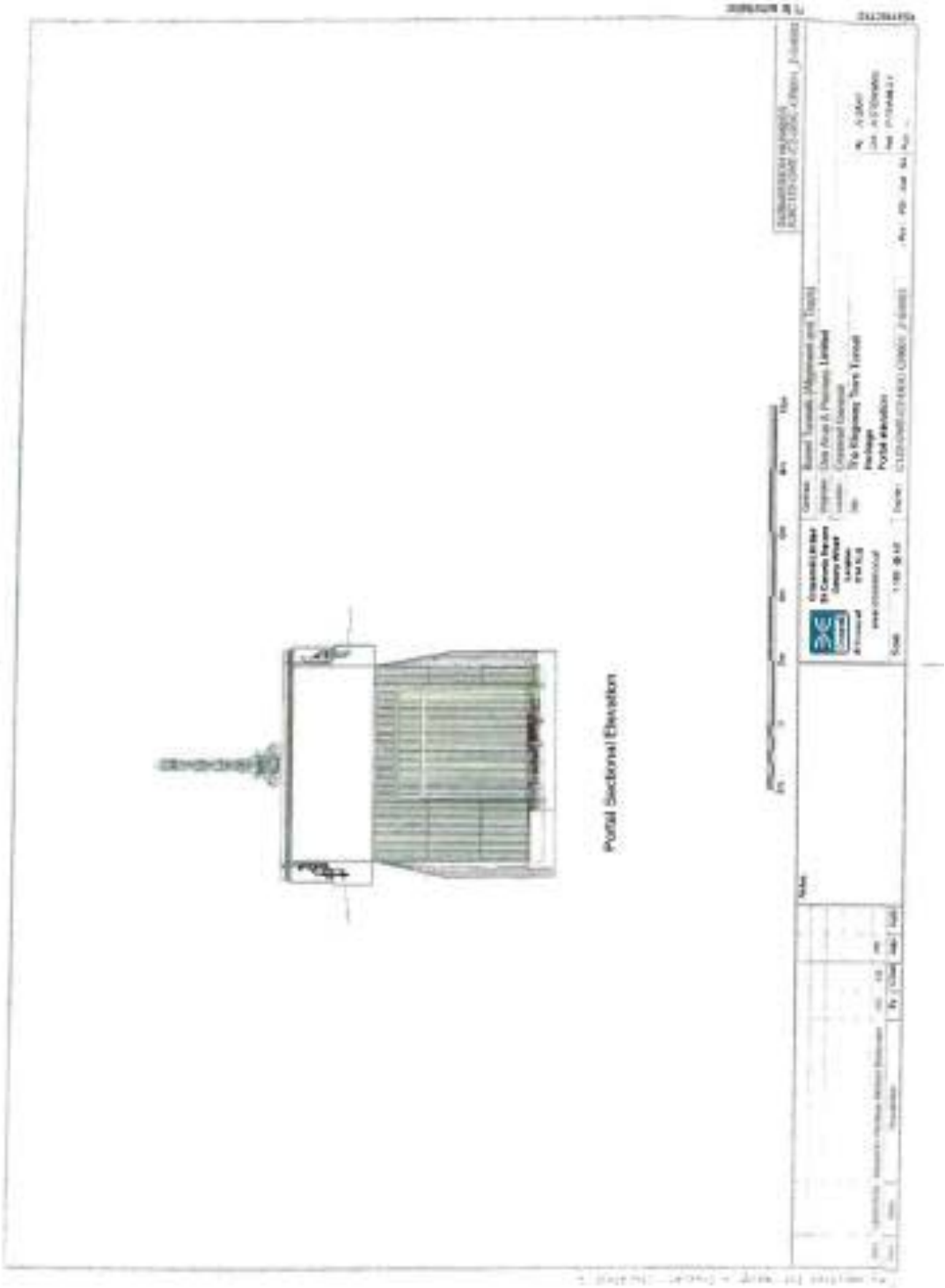
Appendix 4 Drawings of 40 tonne Silo



Appendix 5 KTT Enlargement drawings


West Elevation of Kingsway Tram Tunnel
West Elevation of Kingsway Tram Tunnel


East Elevation of Kingsway Train Tunnel
East Elevation of Kingsway Train Tunnel


Portal Sectional Elevation


L.C.C. ENLARGEMENT OF TRAMWAY SUBWAY.
LONGITUDINAL SECTION AND PLAN.


L.C.C. DELARGEMENT OF TRAMWAY SUBWAY
SECTION J. TUNNEL UNDER HIGH HOLBORN

Appendix 6 Proposed Position of Silos