



Midland Metro Phase 2 Birmingham Eastside Extension

Construction Strategy - High Street Deritend Route
MMD-300207-HS16-DOC-0000-0002 Rev B

December 2015

Centro

Midland Metro Phase 2 Birmingham Eastside Extension

Construction Strategy - High Street Deritend Route
MMD-300207-HS16-DOC-0000-0002 Rev B

December 2015

Centro

Centro House
16 Summer Lane
Birmingham
B19 3SD

Issue and revision record

Revision	Date	Originator	Checker	Coordinator	Approver	Standard
A	November 2014	J Ship	C Searson	C Searson	G Last	First Issue
B	December 2015	J Ship	C Searson	C Searson	G Last	Changes due to shortened route.

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it..

Contents

Chapter	Title	Page
1	Introduction	1
1.1	General	1
1.2	Purpose of Report	1
1.3	Proposed Route	2
2	General Principles	3
2.1	Code of Construction Practice	3
2.2	Stray Current Protection	3
2.3	Electro-Magnetic Connectivity (EMC)	3
2.4	Site Safety	3
2.5	Environmental Issues	4
2.6	Interface with Other Developments	5
2.6.1	High Speed 2 (HS2)	5
2.6.2	Martineau Galleries Development	6
2.7	Public Relations	6
2.8	Local Highway Authority / Planning Authority Approvals	6
3	Construction Appraisal	7
3.1	General	7
3.2	Site Clearance	8
3.3	Removal of Existing Hard Landscaping to Store for Reuse	8
3.4	Demolition	8
3.5	Utility Diversions	9
3.6	Earthworks	9
3.7	Drainage and Ducting	10
3.8	Track and OLE Foundation Construction	11
3.8.1	On- Street Track Construction	11
3.9	Off-Highway Construction	15
3.10	Construction of Junctions and Crossings	15
3.11	Construction Across Accesses	16
3.12	Power Supply and Overhead Line Equipment (OLE) Installation	16
3.13	Tram Stops	19
4	Traffic Management	20
4.1	General	20
4.2	Traffic Management Principles	21
4.3	Construction Sequencing	21
4.4	Summary of Programme Restrictions Imposed by Traffic Management Issues	31
4.4.1	With HS2 on Site	31
4.5	Traffic Diversions	32
4.6	Construction Traffic	33
4.6.1	General	33
4.6.2	Indicative Construction Traffic Volumes and Movements	35

4.6.2.1	General Assumptions	35
4.6.2.2	Level of Resources Required to Achieve the Indicative Programme	35
4.6.2.3	Traffic Generated by Construction Activities at Work Sites	36
4.7	Provision of Information	38
5	Pedestrians, Cyclists and Public Transport	40
5.1	Pedestrians and Cyclists	40
5.2	Public Transport	40
6	Utilities Diversions	42
6.1	Overall Strategy	42
6.2	Implementation	43
6.3	Utilities Report	43
7	Structures	44
8	Construction Compounds and Work Sites	45
8.1	Principal Site Compounds and Facilities	45
8.2	Opportunities for Principal Site Compounds	45
8.2.1	Site 1: Existing Balfour Beatty compound in Lionel Street currently being used for the construction of the BCCE.	45
8.2.2	Site 2: Existing BCCE Compound on the Northwest Corner of Albert Street/Moor Street Queensway.	46
8.2.3	Site 3: Area Adjacent to Work Stage 3 and Within the HS2 Site.	46
8.2.4	Site 4: Area on the South East Corner of the Junction of New Canal Street/Fazeley Street	47
8.2.5	Site 5: Area Adjacent to Work Stage 4 on the West side of Oxford Street Immediately North of the Railway.	47
8.2.6	Site 6: Area on the north east corner of Meriden Street/High Street Deritend Junction currently the site of The Birmingham South of City College Building.	47
8.2.7	Site 7: Area on the North East Corner of the Junction of Rea Street/Bradford Street.	48
8.2.8	Site 8: Area Adjacent to Work Stage 5 on the North Side of Lower Trinity Street Immediately to the East of the Derelict Railway Viaduct.	48
8.2.9	Site 9: Area on the South West Corner of the Junction of Adderley Street/New Bond Street	49
8.3	Preferred Sites for Use as Principal Compounds	49
8.4	Work Sites	50
8.5	Access to Work Sites and Site Compounds	50
9	Construction Programme	51
9.1	Construction Timetable and Key Dates	51
9.2	Programme Constraints	51
9.2.1	General Issues	51
9.2.2	Seasonal Issues	51
9.3	Basis and Development of Programme	52
9.4	Rates of Construction	52
9.5	Restrictions to Working Times	53
10	Construction Methodology	55

10.1	General	55
10.2	General Sequence of Track Construction	55
10.3	Work Stage 1	56
10.3.1	Key Elements	56
10.3.2	Traffic Management	56
10.3.3	Maintenance of Vehicular and Pedestrian Access	57
10.3.4	Work Stage 1 Sequence of Construction	57
10.4	Work Stage 2	58
10.4.1	Key Elements	58
10.4.2	Traffic Management	58
10.4.3	Maintenance of Vehicular and Pedestrian Access	59
10.4.4	Work Stage 2 Sequence of Construction	59
10.5	Work Stage 3	60
10.5.1	Key Elements	60
10.5.2	Traffic Management	60
10.5.3	Maintenance of Vehicular and Pedestrian Access	61
10.5.4	Work Stage 3 Sequence of Construction	61
10.6	Work Stage 4	62
10.6.1	Key Elements	62
10.6.2	Traffic Management	62
10.6.3	Maintenance of Vehicular and Pedestrian Access	63
10.6.4	Work Stage 4 Sequence of Construction	63
10.7	Work Stage 5	63
10.7.1	Key Elements	63
10.7.2	Traffic Management	64
10.7.3	Maintenance of Vehicular and Pedestrian Access	64
10.7.4	Work Stage 5 Sequence of Construction	65
Appendix A.	Construction Sequencing Drawings	67
Appendix B.	Preliminary Construction Programme	68

1 Introduction

1.1 General

The provision of a Light Rail Transit (LRT) System is a core element of the Local Transport Plan for the West Midlands. Centro (The West Midlands Passenger Transport Authority) is developing various extensions to the existing Midland Metro Line 1, one of these being the Birmingham City Centre Extension (BCCE). The BCCE is currently undergoing construction and is due to open in 2015. Centro are currently developing an extension (Birmingham Eastside Extension, BEE) to this route which will serve the proposed High Speed 2 rail station and the further development of the Eastside area of Birmingham.

BEE will run for approximately 1.7 km from Corporation Street to High Street Deritend via New Canal Street, Meriden Street and Digbeth terminating in High Street Deritend. Tracks terminate at the junction with Heath Mill Lane whilst highway work continues to the junction with Adderley Street. The proposed route is shown on Drawing No. MMD-300207-HS27-DRA-0000-0010 to 0017 included in Appendix A of this Report. It will be served by the existing maintenance depot facility located in Wednesbury adjacent to the existing Line 1 of the Midland Metro. The depot has been expanded to provide the additional stabling and servicing facilities required for the proposed extensions.

Development of the High Speed 2 rail station and associated infrastructure has a significant effect on traffic movement and accessibility in the vicinity of the new station. This report will assume that the closures and diversions associated with the rail project are in place prior to the commencement of the Metro works in the area, but will comment on the implication of the diversions and closures not having taken place at the time of construction.

Similarly, the proposed Martineau Galleries development would affect traffic movement on the southern side of the city centre. Given the limited availability of information on the project, this report will be based on the existing infrastructure being in place but will again comment on the effects the development might have on construction. No other developments are known along the route so none have been considered as part of this document.

1.2 Purpose of Report

The Metro scheme will require a Transport and Works Act Order (TWAO) to provide the powers to construct, maintain and operate the Tramway between Corporation Street and High Street Deritend. This report is provided to support the TWAO in general and to provide construction information which will be used in the development of the Environmental Impact Assessment for the scheme. It will also inform affected third parties of the timescales and construction processes likely to be associated with the construction of the tramway.

This report considers the construction methodology for the implementation of the HS2 Metro extension and describes a possible construction method and sequence of work. It also identifies access points, comments on possible areas of land for use as construction work sites, and gives an appreciation of the duration of construction. It should be borne in mind, however, that the Contractor appointed for the scheme will bring his own knowledge and expertise to the construction of the works, and as a consequence, the

methods actually adopted for construction will not necessarily be the same as those described in the following paragraphs. On the basis that this strategy will be used as a basis for agreement to traffic management proposals with the Local Highway Authority, any deviations from the strategy are likely to require the approval of the Highway Authority.

The document is also intended to provide information for those responsible for the design, procurement and construction of the works. It is expected that it will be updated periodically, incorporating appropriate construction strategies for the design as it is developed.

This document is not intended to be a Specification for the Works and will need to be read in conjunction with the Works Information documentation prepared by Centro and the associated documents indicated in Section 1.1 below.

1.3 Proposed Route

The HS2 Metro extension will run for approximately 1.7 km from the BCCE extension in Corporation Street; south east along Bull Street, east along Kings Parade, across the lower section of Albert Street and then Moor Street Queensway, continuing north east along Eastside promenade and south into New Canal Street. It then runs south along New Canal Street and Meriden Street to the junction with High Street Deritend (Digbeth) turning east along High Street Deritend (Digbeth and High Street Deritend) to the junction with Adderley Street.

The scheme will include four Tram Stops as follows:

1. A Stop to the east of Moor Street Queensway serving the main entrance to the HS2 station and Birmingham Moor Street train station.
2. A Stop under the proposed HS2 station in New Canal Street.
3. A Stop adjacent to the junction of Bordesley Street with Meriden Street.
4. A Stop adjacent to the junction of High Street Deritend (Digbeth and High Street Deritend) and Milk Street.

The route passes under the West Coast Main Line in New Canal Street, and the Dicot and Chester Line in Meriden Street. It crosses over the River Rea adjacent to Rea Street on High Street Deritend (Digbeth) and High Street Deritend).

It will also pass under the viaduct carrying the proposed HS2 rail line across New Canal Street.

The proposal will require the demolition of a number of buildings in Dale End and Meriden Street.

2 General Principles

2.1 Code of Construction Practice

A Code of Construction Practice (CoCP) Part 1 was developed for the construction of the Midland Metro Birmingham City Centre Extension which addresses the Contractor's general obligations with respect to the impact of construction activities on local residents, businesses, the general public and the surroundings in the vicinity of the works. It applies to the construction phase and is in addition to statutory regulations and other contractual requirements. The BCCE Contractor was required to expand this document into a Code of Construction Practice Part 2.

A similar document will be produced for the HS2 Metro extension and it is anticipated that the requirements of the CoCP will be similar to those of the BCCE.

2.2 Stray Current Protection

The proposed extension will be designed, constructed and operated in a manner that will, as far as possible, provide protection against stray current. All reasonable measures will be taken to eliminate any interference with either the system or any third party infrastructure including structures, pipes, lines, cables and other buried metallic structures. Consideration will need to be given to position of electrical cabinets located at tram stops as experience on other schemes has shown that these can be of a significant size.

2.3 Electro-Magnetic Connectivity (EMC)

The proposed extension will be designed, constructed and operated in a manner that will, as far as possible, provide electro-magnetic compatibility with the existing system and third parties. If required, practical measures will be taken to reduce any:

- Interference from the extension to either the existing system or any affected third party system.
- Reasonable interference from the existing system or any interfering third party system to the extension.

2.4 Site Safety

The construction contractor will be expected to comply with all current legislation regarding site safety including the Health and Safety at Work Act 1974 and the Construction (Design and Management) Regulations 2007, or any updates to these prior to work starting, which will be implemented during the design and construction stages of the project. These regulations place legal obligations on the various parties involved in the design and implementation of the project (including the Client, Designer and Principal Contractor) as to the identification, consideration and management of safety during the construction phase. The main construction contractor will be appointed as the Principal Contractor for the Works.

Construction of the Works will impact on the safety of the general public especially on or adjacent to roads, footways and cycle ways. This impact will be most severe where room for construction is limited. The Contractor will need to give very careful consideration as to the measures required to ensure the safety of the public and the workforce during all phases of the project. Measures that will be required will include:

- Restricting public access to the areas of construction and site compounds including the erection of effective fencing and barriers to prevent unauthorised access and reduce the environmental impact of the works (noise, dust etc.).
- Provision of adequate footways for pedestrians and carriageways for vehicles around work areas, with clearly marked signage taking into account the requirements of special needs users and where possible local stakeholder requirements.
- Provision of safe access to and from construction sites and compounds for construction workers and traffic at all times.
- Provision of adequate security to construction and storage areas, construction traffic and site compounds.
- Provision of adequate support to excavations.
- Loading and unloading of materials in a safe manner that does not obstruct use of live footways and carriageways.
- Provision of adequate health and safety facilities for construction workers particularly in areas remote from the site compounds.
- Provision of safe and adequate storage facilities for fuel, chemicals and other potentially dangerous materials.

The provision of safe diversion routes, be they pedestrian cyclist or vehicular traffic, will need to be carefully planned and agreed with the local highway authority's Traffic Manager prior to implementation. Ensuring that construction areas and any diversions are adequately signed will require particular attention to the Department of Transportation Traffic Signs Manual, Chapter 8, "Traffic Safety Measures and Signs for Roadwork and Temporary Situations." No section of work will be allowed to commence until an agreed traffic management and safety plan has been agreed with the Employer and the Traffic Manager and implemented for that section.

2.5 Environmental Issues

The Contractor will have to comply with all current legislation with regard to environmental protection issues including:

- The Environmental Protection Act 1990.
- The New Roads and Street Works Act 1991 (NRSWA).
- The Control of Pollution Act 1974.

There are a number of potential environmental impacts associated with the construction of an LRT system and the measures that will be required to limit their effect will include:

- Controlling the amount of dirt / mud and debris produced during construction.
- Controlling the amount of dust, emissions from vehicles and other atmospheric pollution produced during construction.
- Preventing the pollution of groundwater, sewers, watercourses and potable water supplies.
- Controlling noise and vibration during construction.

- Provision of adequate containment facilities in fuel and chemical storage areas in case of accidental spillage.
- The removal of contaminated materials in accordance with all statutory regulations to suitably licensed disposal facilities.
- Limiting landscape and visual impacts.
- Dealing with ecological issues.
- Protection of areas of archaeological and cultural importance.
- Considering noise and light pollution when working at night near residential properties.
- Considering the delivery routes and methodology for deliveries to site and storage of materials within work sites.
- Consideration of pre-fabricated elements to reduce the impact and duration of on-site works.

Each of these issues will be considered in more detail in the Code of Construction Practice and the Environmental Statement.

There are a number of locations where work is to be carried across accesses and building entrances. Where possible, Centro will seek agreement with the relevant owners to close the access for a period of time (in general weekend closures will be preferred). For other accesses, including entrances to industrial premises and residential properties, agreements will be required as to when works can be undertaken. Work for each entrance will have to be evaluated on a case by case basis. This would aim to balance the requirements of the Traffic Manager with those of the property owner/tenant and environmental impacts in terms of noise, dust, air quality, visual intrusion and vibration. It should be possible to simplify the discussions by grouping entrances together for particular areas.

2.6 Interface with Other Developments

Construction of the Metro will have to interface with other developments planned for the City Centre as discussed below.

2.6.1 High Speed 2 (HS2)

The construction of the infrastructure for the High Speed 2 rail link is expected to commence in 2017 and be commissioned by 2026. Construction is therefore expected to be ongoing throughout the construction of the Metro extension. This will apply particularly to the HS2 terminus buildings, viaduct structures, utility diversions and access infrastructure. If the current programmes for construction are adhered to, construction of HS2 will be on site well in advance of the Metro extension and the management of traffic for construction to the east and south of Moor Street will already be well established. Traffic management proposals for the Metro extension will have to fit in with that already in place for the HS2 development, and particular consideration will need to be given to maintaining access for the construction of both projects.

2.6.2 Martineau Galleries Development

The proposed Martineau Galleries development comprises the area of land / buildings between Corporation Street, Bull Street, Kings Parade, Moor Street Queensway and Priory Queensway. It takes in the former Toys R Us store and the Priory Square Shopping Centre and incorporates Dale End and Albert Street.

The main interaction between the Martineau Galleries development and HS2 Metro works will be in relation to the construction of the section of the route between Corporation Street and Moor Street Queensway where the proposed alignment impinges upon the development site.

The complexity of the Metro construction works in this area will be dependent upon the status of the development at the time of construction. For the purposes of this construction strategy, it has been assumed that the existing scenario remains, which is likely to be the most onerous case.

2.7 Public Relations

As part of the TWAO process, Centro will hold discussions with frontagers and other parties likely to be affected by the construction works and / or advance utility diversions to understand their aspirations and any servicing or access requirements. During construction, however, the Contractor will be the principal conduit for communication.

Centro will agree a Communications Strategy with the Contractor which the Contractor will adopt as the basis of his public relations strategy. It should be noted that for similar tram schemes, a permanent public relations team, on call 24 hours a day, has been employed to liaise with all third parties on any issues that affected them. As part of BCCE a mobile consultation unit has been provided at regular intervals, manned by Centro and the Contractor, at which members of the public can raise queries or concerns regarding the project. It is likely that a similar strategy will be necessary for the construction of the BEE.

2.8 Local Highway Authority / Planning Authority Approvals

Prior to the construction of the BEE, approvals will be required from Birmingham City Council (BCC) both in terms of the permanent works design and also the temporary traffic management arrangements. Centro will endeavour to agree single principal points of contact with authority for these processes. This will enable the authority to give a consistent and coordinated response.

3 Construction Appraisal

3.1 General

The support for the tramway is expected to consist of a reinforced concrete track slab at an appropriate depth to support the rails while allowing for the required surface finishes. The track slab is likely to be of in-situ construction, and be founded on a base of cement bound or compacted granular material with an overall excavation depth of between 0.6m and occasionally up to 1.2m. The shallower depths will generally occur where the subgrade bearing capacity is high.

In areas where depth of construction is limited, such as over the existing canal and river structures, as well as near noise sensitive buildings, such as Hotel La Tour, a different form of construction is likely to be required.

Statutory Undertakers' plant and services lying within the excavation zone beneath the tram alignment will be diverted or lowered where required in order to reduce future disruption to the operation of the Metro resulting from service repairs. Other services may also require diversion due to clashes with other Metro infrastructure such as Overhead Line Equipment (OLE) poles, tram stop foundations etc.

The sequence of the works at any one location will be governed by the detailed layout of the street and its buried services. Services will normally be diverted in advance sequentially as a co-ordinated process under the provisions of NRSWA. Works on the track bed and street surface, in well-defined sections, would follow.

For the on street sections, the length of alignment that can be constructed in a continuous length will be defined by the requirement to maintain access and compliance with restrictions imposed by the Local Highway Authority and Emergency Services, especially the Fire Brigade. Experience on other LRT schemes has shown that in narrow streets in urban areas or in wider streets where access has to be maintained, the lengths of continuous track construction rarely exceed 100m because of the constraints and restrictions imposed. In these circumstances, the track will have to be constructed in pre-defined bays with construction joints between adjacent bays. The majority of the proposed alignment runs on-street and bearing the above in mind, it is unlikely that the use of 'Slipform' procedures or a paving train will be practicable. Details of possible construction sequencing are included in Appendix A.

New drainage collection will replace or supplement the existing surface drainage, but with the addition of outlets for track drainage at the low point of vertical curves and at regular intervals on straight track in between. Drainage pipes and connections away from the track bed, or at an adequate depth beneath it, will continue in use.

As a result of the likely disruption to the street surface caused by the diversion of Statutory Undertakers' plant and construction of the track slab, it is likely that the whole width of Bull Street, Albert Street, New Canal Street and Meriden Street carriageways will need to be reconstructed. The benefit should be an improvement in the appearance of the general 'streetscape'. The width of reconstruction on other areas will be a function of adjacent features, levels and planning requirements.

Bearing the above in mind, the following sections briefly describe the likely construction activities for the project and their anticipated effects on the local community.

3.2 Site Clearance

The site clearance required along the proposed route will not generally be extensive and will consist of the removal either to tip or to store of fences, street furniture, signs, lamp columns, bus stops, bus shelters, advertising hoarding and the like.

Details of structures affected by the works are contained in Section 7.

3.3 Removal of Existing Hard Landscaping to Store for Reuse

During recent years Birmingham City Council has invested heavily in hard landscaping in the streets and areas to the west of New Canal Street. In order to mitigate costs and to maintain the standard of finishes within the city core, wherever possible, existing hard landscaping materials will be taken up and stored for reuse in the reinstatement of the areas affected. To the east of New Canal Street, finishes are more traditional and retention of materials for re-use is less likely.

3.4 Demolition

The demolition that is currently anticipated as part of the scheme is as follows:

- Nos. 1 to 5 Dale End.
- Partial or full demolition of The Birmingham South of City College Building at the junction of Meriden Street and High Street Deritend (Digbeth).
- River Rea Bridge High Street Deritend.

The general public will need to be excluded from the vicinity of any demolition works. It is likely that the Contractor will employ a specialist demolition sub-contractor to carry out these works.

For High Street Deritend River Rea Bridge it is assumed that:

1. Partial replacement of the existing deck will be required, but that this will be limited to the area within and adjacent to the centre reserve.
2. No works are needed to the existing abutments.

If more extensive structural works to the bridge should subsequently prove to be necessary, the programme for the construction of the route along High Street Deritend is likely to be severely affected.

3.5 Utility Diversions

Utilities are an integral part of the present city infrastructure and a number will have to be diverted away from the route of the Metro. In a number of cases, service diversion routes may not follow the Metro corridor.

The diversion of Statutory Utilities' apparatus required by the introduction of the tram is covered in more detail in Section 7 of this Report. Centro are currently liaising with the utilities companies and a Utility Diversion Management Strategy will be prepared detailing the diversions necessary for the construction of the extension, and the strategy for undertaking the diversions. The full extent of the diversionary work required will depend on the detailed alignment and the exact position and depth of the existing services.

These diversions will need to be co-ordinated with the other ongoing projects such as HS2 to ensure that utilities do not later have to be diverted again as part of a subsequent project.

It is anticipated that the majority of diversions will take place in advance of the main construction. Diversion works themselves are likely to result in considerable local traffic disruption and will require extensive discussions and agreement with the highway authority.

3.6 Earthworks

Earthworks activities will generally consist of excavated material being removed from site and suitable imported material being imported, unloaded and compacted by vibrating rollers. There will consequently be a steady flow of vehicles to and from the areas of construction during the course of the earthworks together with the attendant noise and vibration from the compaction process.

The condition of the existing highway sub-grade is unknown as is the strength of the sub-grade for the off carriageway sections of the alignment. These will need to be determined for detailed design purposes, as will the acceptability of excavated materials for reuse as engineering fill. Excavated material will be used wherever feasible in areas where fill is required to minimise traffic movements to and from the site.

Excavated materials will need to be tested for contamination as well as to establish engineering properties and suitable sites will need to be identified for the disposal of surplus material. Access to and egress from the areas of construction for vehicles and plant will require careful consideration.

Generally, the sides of excavations will only require support where they extend significantly below the formation level for track construction (for example for the construction of drainage, ducts and overhead line equipment (OLE) support foundations). Where space is limited and buildings and /or other structures may be affected, support measures for the general earthworks may be required. The degree of support required will depend on the depth of excavation, the nature of the ground, the proximity of adjacent structures and the nature of their foundations. It is likely that the foundations for the OLE supports will be auger bored piles wherever possible which will avoid any problems in this respect.

Provision of adequate temporary drainage during the construction period will also need to be considered and appropriate measures taken if necessary.

3.7 Drainage and Ducting

Surface water draining from the tram tracks will be collected either via a series of purpose made drainage units or a series of drainage slots, both of which will connect into the existing drainage system via a system of gullies / catchpits and collector drains. New gullies and associated pipework will also be required where existing roads are realigned / re-levelled or the tram alignment runs segregated off-street and drains independently of the adjacent highway.

The tram tracks incorporate extensive ducting beneath or adjacent to the track slab and this will be laid concurrently with the drainage. Connecting ducts/pipes across the tram tracks above the base slab will normally follow laying of the rails (see typical detail below).

Figure 3.1: Slab Beneath Rails Lowered Locally to Enable the Installation of Ducts and Pipes



Source: Mott MacDonald

3.8 Track and OLE Foundation Construction

3.8.1 On- Street Track Construction

Over the majority of the proposed route, the alignment runs on-street. In some areas vehicular traffic will be excluded from the route but for the majority of the route, the tramway shares the carriageway with vehicular traffic.

Construction of on-street tram track will follow completion of the service diversions, earthworks, drainage, ducting and depending on the location, will be constructed either over their full width or where access or through traffic needs to be maintained, in two sections. Construction over the full width is the preferred option both in terms of construction efficiency and the risk to adjacent road users.

In some areas it may be feasible for the OLE to be attached to adjacent properties. Where this is not possible, the foundations for the OLE supports will also be constructed at this stage unless construction problems exist which prevent it, i.e. the proximity of buildings with unsuitable foundations and/or basements.

For on-street sections of track, the anticipated construction sequence is given below.

- Sub-base material is laid and compacted prior to the positioning of the reinforcement mesh.

Figure 3.2: Sub-base material construction



Source: Nottingham Express Transit

- Reinforcement mesh is placed and the concrete track slab cast to the underside of rail level. Reinforcement is laid in discreet bays to facilitate the stray current protection system.

Figure 3.3: Reinforcement Mesh



Source: Nottingham Express Transit

- The rails are clipped to the base slab, set in position and welded together. The clips are required for fixing only and have no structural purpose. The rails are pre-coated with a polymeric insulating material. An alternative approach, which is used on the BCCE scheme, is to use a twin block concrete sleeper arrangement to bolt the rails to. These are spaced at regular intervals (of the order of 1500mm). This system helps to maintain the gauge of the rails. The block system has adjustment devices fitted to allow fine adjustment of the final rail level.
- Track drainage, ducting, stray current protection and traction bonding is completed following installation of the rails.

Figure 3.4: Metro utilities ducting



Source: Nottingham Express Transit

- A second layer of concrete is poured around the rails to a level that allows for road surfacing to be laid.

Figure 3.5: Concrete pour around the rails



Source: Nottingham Express Transit

- New kerbs, parking bays and OLE base supports will be constructed following completion of the slab construction.
- The section of the route between the city centre and the HS2 station is likely to require a high quality finish such as exposed aggregate concrete, imprinted concrete or stone paving materials. This would be introduced as a third concrete pour around the rails or by laying the paving on a rigid base. The eastern end of the scheme is more likely to have blacktop finish to match existing carriageways which is likely to require the introduction of concrete haunches adjacent to the rails to bound the blacktop. A sacrificial sealant to allow for tram tyre overrun will be introduced between the rails and the finished carriageway surface which will require appropriate skid resistance for its location.

3.9 Off-Highway Construction

The tram is located in off-highway sections between Moor Street Queensway and New Canal Street, and possibly between Dale End and Moor Street Queensway depending upon the detail and progress of the Martineau Galleries development.

For these sections the tracks are again placed in concrete using the same construction procedure as for on-street construction. Off-street, it should be possible to construct inbound and outbound tracks concurrently. Unbound surface finishes may be an option in areas which are totally un-trafficked to provide a more natural appearance.

3.10 Construction of Junctions and Crossings

It is not envisaged that significant additional disruption will be caused by the construction of the tram alignment at minor junctions such as the side road intersections with New Canal Street and Meriden Street. It is likely that construction can be achieved in these cases either by using conventional traffic management techniques or where space is limited, by the use of temporary road closures, provided acceptable alternative routes can be provided and access can be maintained.

Construction of the tram alignment at major junctions and road crossings, however, will be more difficult. These are principally:

- Corporation Street/Bull Street.
- Bull Street/High Street.
- Moor Street Queensway/Albert Street.
- Moor Street Queensway.
- New Canal Street/Fazeley Street.
- Meriden Street/High Street Deritend.
- High Street Deritend/Rea Street.
- High Street Deritend/Heath Mill Lane.

Construction within Moor Street Queensway and High Street Deritend corridor will be particularly problematic as these are main routes in to the City Centre from the conurbations to the north and east respectively.

The use of conventional construction techniques is likely to produce significant congestion, and special construction methods may have to be adopted so that disruption can be minimised. For example, out of hours working and temporary closure/possession coupled with the use of prefabricated track elements may provide one solution. Before a construction method can be adopted, however, the impact on traffic flows will have to be assessed and compared for each alternative. All practical methods of construction for the major junctions will need to be considered, and congestion assessed both at the junction and within the wider highway network. Approval of the local authority will be required for whichever construction method is adopted.

The period required to complete construction at a junction will depend on the junction size, type, complexity and the traffic flow(s) to be dealt with.

It should be noted that the BCCE scheme has built in passive provision for a delta junction at Bull Street / Corporation Street for the BEE route which will assist in minimising disruption as follows (this should be confirmed by obtaining the final as-built information for the BCCE from Balfour Beatty):

- The BCCE alignment has been constructed in a plane which facilitates future switch installation.
- The track slab foundations have been extended an appropriate distance outside of the BCCE tram DKE.
- Where possible utilities have been set away from the future track positions at the junction.
- Drainage outfalls have been provided from the future switch locations on 'Upper' Bull Street and 'Lower' Corporation Street to the highway drainage system.

3.11 Construction Across Accesses

Construction works across accesses will generally require temporary closure of the access. In some cases agreement will have been reached between Centro and the frontagers and in others detailed agreement will be a matter for the Contractor. In most instances, temporary reinstatement will be required to permit periodic access during construction.

A number of accesses, particularly along New Canal Street and Meriden Street provide access to industrial premises, and particular consideration will need to be given to the amount of manoeuvring space that will be required for vehicles in these locations. Also, as the time taken to construct switches and crossings is generally significantly longer than plain straight sections of track, the location of these features will need to be carefully considered to minimise access disruption times and avoid excessive overrunning by heavy vehicles.

3.12 Power Supply and Overhead Line Equipment (OLE) Installation

Power (750 volts dc) will be directed to the Light Rail Vehicles via a ducted supply and overhead line equipment (OLE). All practical measures will be incorporated within the track construction, power supply and return cable, to protect underground services from stray currents and to protect sensitive telecommunications signal cables from interference arising from the tramway power supply system. Construction will include suitable insulating and shielding materials in the track form design and/or stray current collection systems in the track-bed.

Installation of OLE will follow completion of the track construction and will involve:

- Erection of the supports.
- Laying any parallel feeder cables and track bonding connections
- Suspension of the contact wire from the OLE supports

- Connections to existing network, feeds from new substations (if required) and energisation.

The contact wire will be supported from poles or shared lighting/OLE columns situated along the outside edges, or centrally from poles positioned between the lines of tracks. Alternatively and where permissible, the contact wires will be suspended from building fixings particularly in the more built-up areas where space is limited. Centro's preference is likely to be to utilise building fixings within the city core where agreement can be reached with building owners and tenants. Where agreements cannot be reached with stakeholders or the buildings are structurally incapable of accepting a fixing, the support for the overhead conductors will be poles at approximately 30m centres on straight track. The spacing of the supports will be determined by the design speed of the tram, curvature and the gradient of the track. Additional supports may be required at highway junctions and closer spacing will be required on bends.

The foundations required for the OLE support poles may coincide with services, especially where supports lie outside the tram tracks. Generally, support poles will be positioned to avoid services, but this may not be possible in some areas. Where this cannot be avoided, the services will have to be diverted or protected. In extreme cases where space is limited, bespoke foundations may have to be designed so that the services remain unaffected.

If necessary, the supports for the contact wire can be erected during the construction of the track, but this is not normal practice because of the possibility of damage. Normally the support poles will be erected following completion of track/highway/accommodation works, but prior to the surface finishes to the footpaths. Similarly, the contact wire for each section will not generally be suspended in position until all civil construction activities have been completed on that section.

Figure 3.6: Typical Overhead Line Equipment (OLE) Wolverhampton Midland Metro



Source: Mott MacDonald

3.13 Tram Stops

Four Stops are proposed for the planned extension. The Stops are likely to be of similar construction to each other though finishes may vary to reflect the surrounding public realm, particularly the stop adjacent to the proposed HS2 station which is likely to have a high quality finish. Generally, platform construction is envisaged to begin following completion of the track work in each location, with final installation of platform infrastructure and equipment being carried out shortly prior to opening of the relevant section to avoid the risk of damage. It is anticipated that each stop will take between 2 and 3 months to construct depending on location and design.

4 Traffic Management

4.1 General

The Traffic Management Act 2004 places a duty on the local transport authority to ensure the “expeditious movement of traffic”. Traffic in this context includes pedestrians and cyclists. The duty in this instance falls on Birmingham City Council and in particular its’ Traffic Manager.

Any traffic diversions or related measures required for the construction of the HS2 Metro will therefore have to comply with the requirements of the City Council’s Traffic Manager. Traffic management layouts will be required to comply with the standards set out in the Traffic Signs Manual – Chapter 8, Traffic Safety Measures and Signs for Road Works and Temporary Situations, 2009 or subsequent updates. This manual gives details concerning required minimum safe widths and heights for running carriageways, safety clearances from road works, layout of cones, temporary signs, traffic lights and speed limits.

Works in the carriageway will restrict traffic capacity, while access past the works and to property is maintained. Certain elements of the work will affect vehicular access to frontages, for example laying crossovers in a safe manner will involve construction activity over the whole width of the street. Where existing vehicular access is to be retained on completion of the scheme, every effort should be made to maintain access during construction. It should be noted that not all the current on street loading and parking provision can be provided on completion of the scheme. Where permissible the work which affects access will be carried out either at night or weekends, or in some other manner agreed to by those affected and the Local Highway Authority if required.

Access for Emergency Services will need to be maintained at all times, and agreements with the relevant bodies will need to be made as to how this can best be achieved.

The works will also constitute an interruption to the ability of the pedestrian public to move freely around the affected sections of the route. The city centre end of the scheme in particular is used by great numbers of pedestrians and all efforts will be required to be made throughout the works to maintain pedestrian circulation by the shortest and simplest reasonable route. In planning the construction through the area, careful consideration will be needed to ensure that the works cause the minimum disruption to pedestrians, shoppers, residents and commercial activity. Extensive discussions with owners/tenants will be required so that access to premises can be preserved and the impact on pedestrian movements minimised. The nature of the work dictates that access to premises cannot be maintained all the time. As the city centre in particular moves towards a 7 day 24 hour operation, it cannot be assumed that disruption to access will more readily available on Saturdays and public holidays than during the working week. This may place a limit on the extent of weekend working.

All restrictions to the use of roads by traffic require the authority of a Traffic Regulation Order made by the Local Highway Authority. Temporary orders will need to be agreed with the Local Highway Authority for the short-term closures or diversions required by works in the highway. It should be noted that in Birmingham there is a PFI Highway Maintenance contract in place and the Service Provider will also need to provide authorisation for the works on the public highway. Where the works interface with the

operational tramway then there may also be a need for possessions of the tramway which would need to be agreed with the tramway operator.

4.2 Traffic Management Principles

It is proposed that the highway under the West Coast Main Line underbridge on New Canal Street will become tram-only. The facility to turn right in to Rea Street from High Street Deritend will also be removed. Other than these, no other permanent road closures or access restrictions are currently proposed for the operation of the BEE The HS2 rail project however does require the closure of a number of sections of highway in the vicinity of the new station including parts of New Canal Street, Park Street, Banbury Street and Fazeley Street. These closures are likely to be required either prior to or at a fairly early stage of the construction of the HS2 rail project.

Temporary closures may, however, be necessary for the construction of the Metro, particularly in areas where there is insufficient width for traffic to safely pass when construction of the inbound or outbound track is ongoing.

Two-way operation under signal control would be feasible, however, for the majority of the route but would limit the length and width of individual work sites. One-way traffic operation would be preferable with traffic travelling in the reverse direction being diverted along parallel routes.

4.3 Construction Sequencing

The Strategy divides the route into a number of Work Stages to enable better co-ordination between temporary traffic management requirements, bus routes and general access requirements as follows:

Table 4.1: Construction Sequencing

Work Stage No.	Description
1	Corporation Street to Moor Street Queensway
2	Crossing of Moor Street Queensway
3	Moor Street Queensway to just south of the junction of New Canal Street and Fazeley Street (Interface with HS2 Works)
4	New Canal Street and Meriden Street from just south of the junction with Fazeley Street to just north of the junction with High Street Deritend
5	High Street Deritend from the junction with Meriden Street to the junction with Heath Mill Lane.

The Work Stages are shown on Drawing Nos. MMD-300207-HS16-DRA-0000-0002 & 0003 included in Appendix A of this Report.

The general approach to sequencing of the works has been to minimise the number of traffic management changes affecting road users and frontagers.

Work Stage 1 – Bull Street Tie-In to Moor Street Queensway

It is assumed that no work will be allowed in Bull Street/High Street and Albert Street during the BCC Christmas blockade period. Other than this Work Stage 1 can be undertaken at any time but may be influenced by construction work being undertaken on the Martineau Galleries development.

Under the current proposals, the East Side Extension ties-in with the BCCE at a new three way delta junction where Bull Street meets Corporation Street. The track at the new junction will be configured to enable all tram movements. Sufficient information has been provided to the design and build contractor on the BCCE scheme to enable the track constructed at the junction to tie-in with the proposed track alignment for the East Side Extension. It is understood that in order to minimize the disruption caused by construction of the BEE at the junction that:

- The BCCE alignment has been constructed in a plane which facilitates future switch installation.
- The track slab foundations have been extended an appropriate distance outside of the BCCE tram DKE so as not to interfere with the operation of the BCCE.
- Where possible utilities have been set away from the future track positions at the junction.
- Drainage outfalls have been provided from the future switch locations on 'Upper' Bull Street and 'Lower' Corporation Street to the highway drainage system.

For the purposes of this report it is assumed, therefore, that the new track will tie-in at the locations shown on Balfour Beatty Drawing No. SMS-0870-100-I01 (see appendix A) and that no alterations to the BCCE track foundations will be required.

Notwithstanding the incorporation of the above in the construction of the BCCE scheme, construction of the new three way junction will still be challenging due to the complexity and proximity of the numerous track elements required to cater for all tram movements at the junction. Without a detailed design being available for the junction showing the relative positions and dimensions of the various track elements, it is not possible to determine whether or not single width track construction might be possible for some elements of the junction alignment. Experience with similar junctions, however, shows that because of the number and proximity of the track elements required, that single width track construction is unlikely to be practical. This assumption should, however, be reassessed and updated, once more detailed information of the junction design is available.

Accommodation works are required in Bull Street/Corporation Street to accommodate the introduction of the tram and these works will need to be sufficiently completed before construction of the track can commence. The carriageway is to be widened and realigned and the subway ramp on the outbound side of the junction filled. A retaining wall is also required to be built between the subway infill and the adjoining frontages. These works should be phased to suit construction of the adjoining track in Bull Street and its accompanying traffic management. This applies particularly to the filling in of the subway ramp which will need to be carried out while the outbound Lane in Bull Street is closed for construction.

Bearing the above in mind, it is envisaged that twin track construction will be required at the junction and that this will be carried out in two phases:

- Phase 1 will roughly incorporate the construction of the turn-outs in Bull Street and the track as far as the immediate tie-ins with the BCCE foundations in Corporation Street/Bull Street.
- Phase 2 will incorporate the immediate tie-in works to the BCCE. It will require the removal of the existing surfacing and track and the provision of new ducting, track and reinstatement of the surfacing.

The junction of Bull Street and Corporation Street will need to be closed to vehicular traffic for both phases of construction at the junction, but it should be possible (assuming that the track foundations constructed as part of BCCE extend outside of the DKE as they should) to maintain tram services through the junction during Phase 1.

With the Junction of Bull Street and Corporation Street closed, a through route will need to be maintained off Moor Street Queensway for access/egress to the area, either via:

- Carrs Lane/High Street/Dale End and Albert Street/Dale End (depending upon the availability of Dale End).
- Carrs Lane/High Street/Albert Street

While egress via Bull Street is not available, therefore, the junctions of High Street/Dale End and Albert Street/Moor Street should remain open.

Although twin track construction will be required for the delta junction at Corporation Street and the tie-in in Bull Street (Work Stage 1A), single width track construction should be possible for the remaining lengths of track in Bull Street as far as the junction with High Street (Work Stage 1B). The filling of the subway ramp and construction of the retaining wall at the junction should consequently be carried out while the outbound track is constructed in this section.

Construction of the track across the High Street/Bull Street/Dale End junction will be particularly problematic as it provides access to both Bull Street and the properties off Kings Parade from Carrs Lane and Moor Street/Albert Street alternatively. In order for access to be maintained through the junction during construction, it is envisaged that temporary widening will be required to the carriageway in High Street. This will enable completion of the track in Bull Street while High Street through to Dale End remains open. Single width track construction will be required in order to maintain emergency vehicular access to the frontages in Bull Street if required. Ideally this short section of track should be constructed while Bull Street/Corporation Street is closed as it will not add to the disruption already in place.

The High Street/Dale End carriageway will need to be closed, however, for completion of the track across the three way junction with access being maintained either side of the closure via:

- Carrs Lane/High Street/Bull Street
- Moor Street/Albert Street/Dale End.

While the High Street/Dale End carriageway is closed therefore, the Bull Street/ Corporation Street and Moor Street/Albert Street junctions will need to remain open in order to provide access/egress routes either side of the closure.

Vehicular access to the rear of the properties off Kings Parade will have to be maintained during construction across High Street Dale/End and in New Meeting Street and Albert Street. Temporary access will be available from the west via Carrs Lane/High Street and through the demolition area of Nos. 1-5 Dale End. To ensure that access to Kings Parade is available at all times, construction between High Street and the Moor Street/Albert Street junction will need to be phased, therefore, to ensure that High Street and the demolition area in Dale End remain open while construction takes place in New Meeting Street and Albert Street.

Bearing this in mind, it is anticipated that construction in Work Stage 1 will be carried out in eight phases as follows (excluding accommodation works and demolition which will be programmed to suit the traffic management requirements for each phase):

- Work Stage 1A -Ch10107m to Ch10200m – Bull Street Tie-In and Corporation Street Delta Junction:
 - Phases 1 - Tie-In with BCCE foundations to Ch10200m
 - Phase 2 – Ch10107m Bull Street Tie-In to Tie-In with BCCE Foundations.
- Work Stage 1B – Ch10200m to Ch10275m - Corporation Street Delta Junction to High Street Junction
 - Phases 1 – Ch10200m to Ch10260m – Bull Street
 - Phase 2 – Ch10260m to Ch10275m – Bull Street/High Street/Dale End Junction (Part).
- Work Stage 1C – Ch10275m to Ch10325m - High Street Junction to New Meeting Street
 - Phases 1 – Ch10275m to Ch10290m – High Street/Dale End Carriageway
 - Phase 2 – Ch10290m to Ch10325m - Demolition Area Nos. 1 -5 Dale End.
- Work Stage 1D – Ch10325m to Ch10435m - New Meeting Street to Moor Street Queensway:
 - Phases 1 – Ch10325m to Ch10385m – New Meeting Street and Albert Street (Part).
 - Phase 2.- Ch10385m to Ch10435m – Albert Street to the Moor Street.

The following restrictions are also likely to be imposed on the phasing of construction and these are reflected in the indicative programme:

- Work Stage 1A and 1B can be carried out concurrently.
- Work Stages 1A and 1B Phase 2 should not be carried out at the same time as Work Stage 1C Phase 1 and 1D Phase 2.
- Work Stage 1C Phase 1 should not be carried out at the same time as Work Stage 1D Phases 1 and 2.
- Work Stage 1C Phase 2 should not be carried out at the same time as Work Stages 1D Phases 1 and 2.

Bus routes through the area will obviously be disrupted during construction and diversions will be required either via Carrs Lane/High Street/Dale End/Albert Street (when Work Stage 1A Phases 1 and 2 and Work Stage 1B Phase 2 are ongoing) or Carrs Lane/High Street/Bull Street (when Work Stage 1A Phases 1 and 2 and Work Stage 1B Phase 2 have been completed).

Finally, the taxi rank in High Street will be reduced in length.

It is not envisaged that the traffic management/programming requirements for this Work Stage will be affected if HS2 is not on site.

Work Stage 2 – Moor Street Queensway

Work Stage 2 crosses Moor Street Queensway. This is a major artery and bus route to/from the city centre and as much of the construction as possible should preferably be carried out during a period of reduced traffic flows. It is also assumed that no work on this carriageway will be permitted during the BCC Christmas blockade period. The July to September school holiday period would, therefore, be the likely preferred time for construction. It is assumed that a complete closure of the carriageway will not be permitted and that construction will be carried out under lane closures with a minimum of two lanes being maintained in each direction at all times. Given the distance across the junction and the limited window likely to be available for construction, it has been assumed that the majority of Work Stage 2 will be carried out in two phases over successive summers. However, the feasibility of constructing the crossing in one summer should be discussed with BCC and other key stakeholders. This would minimise the risk of damage to partially completed infrastructure and allow the whole crossing to be tested.

In order for a minimum of two lanes to be maintained in each direction at all times, as much of the available road space in Moor Street Queensway will need to be used to accommodate traffic, including the centre reserve. Temporary widening of the outbound carriageway is also likely to be required at the junction with Albert Street. The junction with Albert Street will need to be closed during construction of the section of track tying in with Albert Street, with local outbound traffic being diverted either via:

- Dale End except for high sided vehicles (due to the height restriction at the bridge on Dale End).
- Dale End/High Street/Bull Street/Corporation Street

The junctions at Dale End/High Street/Bull Street and Bull Street/Corporation Street will therefore, need to be open while the tie in at Moor Street/Albert Street is constructed. Ideally, the section of track on the Moor Street side of the junction with Albert Street should be constructed at about the same time as the adjoining track in Albert Street when the junction will also be closed.

Bearing this in mind, it is expected that:

- No construction activities that affect the carriageway will be permitted during the BCC Christmas Blockade periods.
- Generally, Moor Street will be needed for access to the areas in Work Stage 1, so ideally construction in Work Stage 1 should not be carried out at the same time as that in Work Stage 2. An exception to this requirement will be for the works in:
 - Work Stage 1D Phase 1 in New Meeting Street which is not a strategic part of the local highway network. Alternative access/egress to New Meeting Street will need to be available, however, via Carrs Lane/High Street and Dale End/High Street.
 - Work Stage 1D Phase 2 in Albert Street which ideally should be programmed to coincide with closure of the Moor Street/Albert Street junction required for the adjacent construction in Work Stage 2. Alternative access/egress to all areas in Work Stage 1 will need to be available via Carrs Lane/High Street/Bull Street/Dale End.
- Construction of the track across Moor Street Queensway will be carried out in two phases over successive summer holiday periods.

- A minimum of two lanes in each direction will need to be maintained on Moor Street Queensway during construction which will require:
 - Temporary surfacing of the centre reserve.
 - Temporary widening at the junction with Albert Street.

The following restrictions are, therefore, likely to be imposed on the phasing of construction for Work Stage 2 and these are reflected in the indicative programme:

- Construction will be carried out from middle of July to the end of August over successive summers (or as close as is practical depending on the availability of resources).
- The section of track tying in with the track in Albert Street will require the Moor Street Queensway/Albert Street junction to be closed and should:
 - Not be carried out at the same time as Work Stages 1A, 1B and 1C.
 - Be constructed at about the same time as the adjoining track in Albert Street when the junction will also need to be closed.

It is not envisaged that the traffic management/programming requirements for this Work Stage will be affected if HS2 is not on site.

Work Stage 3 – Moor Street Queensway to New Canal Street/Fazeley Street Junction

Work Stage 3 extends from the Moor Street Queensway crossing to just south of the junction of New Canal Street/Fazeley Street. It crosses the Seymour Street cul-de-sac at the western end of Fazeley Street and Park Street close to its junction with Fazeley Street. If the HS2 rail project is on site at the time of construction of the BEE, it is assumed that:

- Seymour Street will be extinguished.
- Park Street will be extinguished north of its junction with the new HS2 Service Road.
- Fazeley Street will be extinguished north of its junction with the new HS2 Service Road.
- New Canal Street will be extinguished north of its junction with the new HS2 Service Road.
- Banbury Street will be extinguished north of its junction with the new HS2 Service Road.
- Fazeley Street railway underbridge will be closed to all but construction traffic.
- New Canal Street railway under bridge will be closed to all but construction traffic.
- Andover Street railway under bridge will be closed to all except for access and construction traffic.

If the HS2 rail project is not on site temporary closures of Seymour Street, Park Street and New Canal Street will be necessary. The preferred alternative route for the Park Street closure is via Masshouse Lane and Moor Street Queensway. For this reason, if HS2 is not on site, it would be preferable for construction across Park Street not to take place at the same time as construction in Work Stage 2. Further, with Park Street closed, local traffic would use New Canal Street and Fazeley Street to access the local area, so preferably construction in Park Street should not take place at the same time as that in Fazeley Street/New Canal Street.

If HS2 is on site, construction in this section will be entirely dependent upon the construction programme for the HS2 works and available access to the tram corridor. The planning and construction teams on both projects will need to work together closely to ensure access to work areas is provided when required and delays avoided wherever possible. Preliminary plans for the HS2 development show a service road to the north of and immediately parallel to the railway between Andover Street and Park Street with junctions at Andover Street, New Canal Street and Fazeley Street. Access will be required to the Proof House off Banbury Street to the north of the railway and will be available either from the north via the new service road or the south via Fazeley Street/Andover Street. If HS2 is not on site, then alternative access to Banbury Street can be gained via Fazeley Street/Andover Street.

The corridor occupied by the service road will likely be established prior to the construction of the tram and it is assumed that it will function as one of the main access routes for construction activities on the HS2 site. The tram route crosses the service road corridor as it approaches the New Canal Street railway under bridge. Construction of the tram across the corridor and through the railway under bridge on New Canal Street will need to be programmed and carried out in a manner that minimizes any problems regarding access to the HS2 works. For the purposes of this report, it has been assumed that a short diversion of the service road in the area of the tram crossing will be practicable within the HS2 site and that both the railway under bridge and the junction of New Canal Street/Fazeley Street can be closed while the service road crossing is constructed. If access cannot be maintained within the HS2 site, however, then alternative access is available via Andover Street, Fazeley Street, Pickford Street and Bordesley Street, but this will be subject to height restriction at the railway under bridge on Andover Street.

If HS2 is on site, it has been assumed that the closure of New Canal Street will be in place as part of the HS2 construction works. Depending upon the extent of the works that are required to the bridge, a possession of the West Coast Main Line railway may also be needed. In this scenario, co-ordination will be necessary with any possessions put in place for the HS2 rail works. If HS2 is not in place and the works required affect the railway, then programming of these works could cause significant problems to the programme.

It is envisaged that the track across the junction of New Canal Street and Fazeley Street will be constructed in single widths to facilitate access; first the outbound track following the road widening on New Canal Street to the south and then the inbound. Fazeley Street will, therefore, need to be closed for construction at the junction with New Canal Street first on the east side and then the west. Access to Fazeley Street from Meriden Street to the south can be maintained via Bordesley Street and/or Coventry Street. At least one of these junctions should, therefore, be kept open while the Fazeley Street junction is closed. Also, Bartholomew Street is presently one way in the direction of Bordesley Street. If HS2 is on site, Park Street will not be available as an alternative route for access to the north end of New Bartholomew Street. The one way system currently operating in New Bartholomew Street will, therefore, have to be reversed while the Fazeley Street junction is closed.

Bearing the above in mind, it is envisage that construction in Work Stage 3 will take place in three sections as follows:

- Work Stage 3A – Off-line section from Moor Street to New Canal Street.

- Work Stage 3B – On Street section in New Canal Street to the junction with Fazeley Street.
Construction of the section of track across the new HS2 Service Road to be carried out as quickly as practicable.
- Work Stage 3C – New Canal Street/Fazeley Street junction.

At this stage insufficient information is available to be able to comment on any specific restrictions that may apply to the traffic management/programming of construction in this work stage, other than that the short section of track across the HS2 service road should be completed as quickly as possible and at a time to be agreed with HS2. As the programme for the construction of HS2 is developed, however, further information will become available and the strategy/programme will need to be updated accordingly.

Similarly, If HS2 is not on site then the traffic management/programming for the works in this section will need to be reassessed.

Work Stage 4 – New Canal Street and Meriden Street (From the junction with Fazeley Street to the junction with High Street Deritend)

Work Stage 4 incorporates New Canal Street and Meriden Street from the New Canal Street/ Fazeley Street junction to the junction of Meriden Street and High Street Deritend. Existing parking restrictions will need to be enhanced to ensure no parking will be available on either side of the carriageway both during the construction phase and the operation of the tram. The existing carriageway is generally wide enough to accommodate single width track construction which will facilitate access to the industrial premises along this section of the corridor. In addition, New Canal Street between Fazeley Street and Bordesley Street is to be widened and realigned which will assist the construction process on this section.

One way traffic systems will need to be introduced on the sections of New Canal Street and Meriden Street where construction is taking place. The direction of traffic in each one way section will need to best suit local access arrangements. If HS2 is on site New Canal Street north of Fazeley Street is likely to be closed for construction access only and diversion routes for pedestrians and vehicles will already be in place. Only construction traffic will need to enter New Canal Street from the Curzon Street end and, as a consequence, traffic flows from the north should be significantly lower than at present. If this is the case, then New Canal Street could be made one way in the direction of the HS2 site with traffic exiting via New Bartholomew Street and/or Fazeley Street while construction is ongoing between Fazeley Street and Bordesley Street. Parking restrictions along the diversion routes will, however, need to be introduced if larger construction vehicles are to be allowed to use these routes.

Track construction across the junctions with Bordesley Street and Coventry Street should be phased to facilitate access to the properties off the streets to the east and west of the corridor. It is advisable, therefore, that construction across one of these junctions should not take place at the same time as construction across the other. Consideration will also need to be given to imposing parking restrictions on Bordesley Street and Coventry Street both in the vicinity of these junctions and the wider area to ease any possible congestion problems.

Demolitions are required in Meriden Street at the junction with High Street Deritend together with amendments to the highway alignment, and the junction will need to be closed for these activities. These works will also need to be completed before construction of the tram in this section can proceed.

Bearing the above in mind, it is envisaged that construction in Work Stage 4 will take place in three sections as follows:

- Work Stage 4A – From the interface with Work Stage 3 just south of the Fazeley Street junction to just north of the junction with Bordesley Street.
- Work Stage 4B – From the junction with Bordesley Street to just north of the junction with Coventry Street.
- Work Stage 4C – From the junction with Coventry Street to just north of the junction with High Street Deritend.

With regard to the restrictions imposed on the traffic management/programming of the works in this section, it is anticipated that:

- Single width track construction will apply throughout the section so that access can be maintained.
- Construction across Bordesley Street should not take place at the same time as that across Coventry Street.
- The junction of Meriden Street/High Street Deritend will need to be closed for demolitions and realignment of the highway at the junction, and these works will need to be completed before construction of the tram in the area of the junction can proceed.

If HS2 is not on site it is not envisaged that the traffic management/programming for the works in this section will be significantly affected. However, the volumes of traffic that will need to be accommodated within the section are likely to be greater.

Work Stage 5 – High Street Deritend from the Junction with Meriden Street to the Junction with Adderley Street (including both junctions).

As with Moor Street Queensway, High Street Deritend is a major artery and bus route in to the City Centre and any work on this carriageway is likely to cause significant disruption to traffic both locally and on the wider highway network. It is assumed that no work will be permitted within High Street Deritend corridor during the BCC blockade.

Ideally, construction within High Street Deritend should, as with Moor Street Queensway, be carried out during a period of reduced traffic flows, but due to the extent of the works required this will not be practical. Construction of the sections of track traversing the outbound carriageway at the junction with Meriden Street, however, should be carried out during the summer holiday periods (as with Moor Street Queensway). Generally, it is likely that the permitted working hours within High Street Deritend will be restricted to off peak hours at least until the necessary carriageway widening works have been completed and construction of the tram can be safely accommodated within the widened central reserve.

There are a number of traffic signal junctions on this section of the route which facilitate vehicles using the surrounding side roads turning on to and from High Street Deritend, notably at the junctions with Meriden

Street, Rea Street and Heath Mill Lane. It is assumed that closure of these junctions will not be permitted for construction of the tram, and temporary traffic lights will have to be provided at these crossings. The works will need to be phased so that turning movements at these junctions can be accommodated and maintained during construction.

As stated above, demolitions are required in Meriden Street at the junction with High Street Deritend together with amendments to the highway alignment at the junction. These works will need to be completed before construction of the tram crossing High Street Deritend at this location can commence.

Further, significant re-alignment of the carriageways in High Street Deritend will accompany the introduction of the tram. These works will need to have progressed at least to a stage where the widened area within the centre reserve is accessible for construction before construction of the track can proceed

Bearing this in mind, it is envisaged that construction of Work Stage 5 will take place in four sections as follows:

- Work Stage 5A - The section of track crossing High Street Deritend outbound carriageway at the junction with Meriden Street
- Work Stage 5B - Meriden Street to Rea Street in the centre reserve
- Work Stage 5C - Rea Street to Heath Mill Lane in the centre reserve.
- Work Stage 5D - Highway works up to Adderley Street junction.

The above represents a worst case scenario with all crossing points being maintained during construction. It may be the case that the crossing at Rea Street can be closed during construction in which case the number of work stages will reduce and construction can be carried out more efficiently. The local Highway Authority may agree to this if significant savings in time can be made.

With regard to the restrictions imposed on the traffic management/programming of the works in this section, it is anticipated that:

- No construction activities that affect the carriageway will be permitted during the BCC Christmas Blockade periods.
- Construction of the track across the outbound carriageway of High Street Deritend will (as far as possible) be carried out during successive summer holiday periods (as with Moor Street Queensway).
- Working hours will be restricted to off-peak for the highway works in High Street Deritend.
- The highway works in High Street Deritend will need to have progressed sufficiently to a point where access to the widened area in the centre reserve is available and construction of the track can commence.

If HS2 is not on site it is not envisaged that the traffic management/programming for the works in this section will be significantly affected,

4.4 Summary of Programme Restrictions Imposed by Traffic Management Issues

Bearing the above in mind, the restrictions imposed on the programme due to traffic management and access issues are summarized as follows:

4.4.1 With HS2 on Site

- Construction in Work Stages 1, 2 and 5 will be prohibited during the BCC Christmas Blockade i.e. between mid-November and early January.
- Work Stage 1A and 1B can be carried out concurrently.
- Work Stages 1A and 1B Phase 2 should not be carried out at the same time as Work Stage 1C Phase 1 and 1D Phase 2.
- Work Stage 1C Phase 1 and 2 should not be carried out at the same time as Work Stage 1D Phase 1 and 2.
- Generally, Work Stage 1 should not take place at the same time as Work Stage 2 except for the works in the area of the Moor Street Queensway/Albert Street junction.
- Construction of Work Stage 2 will be required to be carried out in two phases over successive summers i.e. mid-July to the end of August or thereabouts.
- The section of track tying in with the track in Albert Street will require the Moor Street Queensway/Albert Street junction to be closed and should:
 - Not be carried out at the same time as Work Stages 1A (Phases 1 and 2). Work Stage 1B Phase 2 and 1C Phase 1
 - Be constructed at about the same time as the adjoining track in Albert Street when the junction will also be closed.
- Park Street will be closed and traffic diversion routes away from the metro route will be in operation.
- New Canal Street will be closed except for access/construction traffic and traffic diversion routes away from the metro route will be in operation.
- Banbury Street will be closed and access to the premises off Banbury Street and New Canal Street north of the railway bridge will be available via the HS2 service road from the north and Fazeley Street/Andover Street to the south.
- Construction in New Canal Street/ Meriden Street at the junctions with Fazeley Street, Bordesley Street and Coventry Street should be phased so that at least one of these junctions is open during construction.
- Working hours permitted for the Construction in Work Stage 5 may be restricted to off-peak periods.
- Construction of the track across the outbound carriageway on High Street Deritend at the junction with Meriden Street will be required to be carried out in two phases over successive summers i.e. ideally mid-July to the end of August or thereabouts).

Programming is discussed further in Chapter 9.

4.5 Traffic Diversions

As discussed in Section 4.2 above, while maintaining two-way traffic flow over the majority of the route would be possible, subject to the use of temporary traffic signals, total closure or one-way operation would be a safer, more efficient and traffic friendly option for construction.

In any scenario, the restrictions to capacity during construction will dictate that a wider traffic management strategy needs to be in place to discourage vehicles from using the affected routes. The A4540 Middleway, Jennens Road/Moor Street Queensway and the B4100 High Street Deritend generally bound the construction area and would be expected to form the basis of an alternative route strategy. Construction within the High Street Deritend corridor will, however, require a traffic management strategy to encompass still wider measures aimed at discouraging traffic on the strategic highway network from using this route into the City Centre, particularly during periods of heavy traffic flows.

Local access traffic will also need to be catered for, particularly for the businesses in and around New Canal Street, Meriden Street and Adderley Street. Closure of the Fazeley Street, Bordesley Street and Coventry Street junctions on New Canal Street/ Meriden Street should be phased to ensure sufficient access is provided throughout the construction period. The roads parallel to New Canal Street/Meriden Street and Adderley Street will need to be properly utilized as alternative routes.

The overall strategy will be agreed between Centro and the local highway authority although it is anticipated that the following principles will be adopted.

Table 4.2: Traffic Diversions

Work Stage	Affected Road	Diversion
Work Stage 1A	Bull Street and Corporation Street	Alternative route for buses via Moor Street Queensway / Priory Queensway. Closure of the BCCE between Bull Street and Corporation Street during Phase 2 of the construction of the delta junction.
Work Stage 1B	Bull Street	Alternative route for buses via Moor Street Queensway / Priory Queensway (inbound track construction only).
Work Stage 1C	New Meeting Street	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1C	Kings Parade	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1D	Albert Street	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1D	Dale End	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 2	Moor Street Queensway	Restricted lane use, possible

Work Stage	Affected Road	Diversion
		contraflow.
Work Stage 3A	Park Street	If HS2 is on site, will already be closed and available alternative routes being used. If HS 2 is not on site alternative routes via Masshouse Lane / Moor Street Queensway (through traffic) and New Canal Street / Bordesley Street (service traffic).
Work Stage 3B	Curzon Street	Service access only.
Work Stage 3B	New Canal Street	Also likely to be already closed if HS2 is on site. Service access likely to be required in either scenario. If HS 2 is not on site alternative routes via Park Street or Masshouse Lane / Moor Street Queensway / Rea Street.
Work Stage 3B	Banbury Street	If HS2 is on site Banbury Street will already form part of the new HS2 service road network. Access will be available from Curzon Street to the north and Fazeley Street/Andover Street from the south. If HS2 is not on site, access will be available from Fazeley Street/Andover Street.
Work Stage 3C	New Bartholomew Street	If HS2 is on site, access via Bordesley Street / New Canal Street northbound. If HS2 is not on site access via Park Street.
Work Stage 4A	New Bartholomew Street	If HS2 is on site, access via Bordesley Street / New Canal Street northbound. If HS2 is not on site access via Park Street.
Work Stage 4A	Bordesley Street East and West of New Canal Street	Access via Fazeley Street and Coventry Street
Work Stage 4B	Coventry Street East and West of Meriden Street	Access via Bordesley Street and High Street Deritend.
Work Stage 5	High Street Deritend	Lane closures. Restricted working hours, Traffic on the wider strategic highway network discouraged from using this route.

4.6 Construction Traffic

4.6.1 General

Construction traffic associated with the tram will generally be of relatively low volumes along most of the route, but will be present at times and in places where such traffic is not normal. Construction traffic will be significantly higher, however, in the areas of the HS2 and Martineau Galleries Developments if these

projects are on site at the same time as the Metro extension. There are a limited number of residential properties in close proximity to the scheme and there will be a need to minimise the effects of construction on these properties, particularly out of normal working hours. The construction methodology will also have to be developed with great sensitivity to the needs of the surrounding road network. If not controlled properly it will add to congestion, especially in the vicinity of the site compounds at the start and finish of each day's work. The delivery of plant and materials to site compounds and areas of ongoing work should where feasible take place during off peak periods. The contractor should minimise the double handling of materials to reduce the impact on the local community of construction traffic between principle compounds and the work sites. The contractor should also be encouraged to use "just in time" deliveries to avoid having to find large storage compounds. The arrival/departure of vehicles used for transporting excavated, waste or other materials such as concrete should be carefully managed so that queues of vehicles do not form.

Construction personnel should be encouraged to use public transport to get to work. Parking in the vicinity of the site compounds and work sites may be viable, particularly in view of the number of car parks in close proximity to the works, but should still be discouraged. Existing parking restrictions along the route are generally comprehensive, but will need to be enhanced to ensure no parking is allowed either during the construction phase or the operation of the tram. It is also envisaged that further parking restrictions will need to be imposed by the Highway Authority in the streets off New Canal Street and Meriden Street to facilitate construction of the works. The various roads off these streets will need to be used for alternative access while construction of the tram is ongoing.

If noticeable congestion is caused due to construction personnel accessing the City Centre during the morning and evening peaks, consideration should be given to the provision of a park and ride system using car parks more remote from the areas of work.

Access routes to the individual work sites will have to be agreed by the Contractor with the local highway authorities, based on a pre-agreed framework. During the construction long and heavy loads (lengths of rail, and occasional extremely long prefabricated rail sections for direct placement on the site) can be expected and vehicles will require to use routes and to stop in places not normally permitted. Parking restrictions will have to be enforced to ensure that access is available when required.

The construction plant required for track laying operations on the Metro line will not generally be 'heavy' in civil engineering terms. Tracked/wheeled excavating plant will be needed at each excavation face, but sizes will necessarily be restricted by the boundaries of the work sites, proximity of the public, properties etc. and by the optimisation of efficiency in regard to the nature and volume of the excavations.

Concrete placing operations, formwork transference, rail laying and general materials handling will be achieved by smaller mobile cranes, fork lift trucks and dumpers etc.

4.6.2 Indicative Construction Traffic Volumes and Movements

4.6.2.1 General Assumptions

The volume of construction traffic that will be generated by the BEE and the locations where vehicle movements will be concentrated will, of course, be dependent on:

- The sequencing/phasing of construction and the number of resources deployed.
- The number and location of principle site compounds and work sites established.

The sequencing of construction is discussed further in 4.4 and Section 9, and an indicative phasing programme has been developed as part of this report and this is included in Appendix B. A number of potential compound sites have also been identified and these are discussed in Section 8.

The following is an assessment of the volume of construction traffic that will be generated by BEE and the areas where it will be concentrated. The assessment is based on the sequencing of construction shown on the indicative programme and the assumption that three principle compounds will be established for the construction of the works.

Finally, it is assumed that track rails and bulk materials such as the track sleepers etc. will be delivered as far as possible overnight and, in the case of track rails, directly to individual work sites to avoid double handling and unnecessary congestion.

4.6.2.2 Level of Resources Required to Achieve the Indicative Programme

The indicative programme is based on the assumption that track construction resources will likely be in high demand when the BEE is on site and that it would be of benefit to keep these resources, as far as possible, in continuous work. Bearing this in mind and in order to meet the current timetable for the scheme, the indicative programme requires track construction to be ongoing simultaneously in two distinct sections with two sets of track resources operating almost continuously in each section as follows:

- Section 1: From Corporation Street to just south of the junction of New Canal Street /Fazeley Street.
- Section 2: From just south of the junction of New Canal Street/Fazeley Street to the Terminus in High Street Digbeth.

The indicative programme also shows that construction activities for all of the construction disciplines will generally be continuous from the start of construction in early 2020 to early 2021 when activities will gradually reduce as each section nears completion. From experience on other tram schemes it is anticipated that the following average level of resources will be required to enable the indicative construction programme to be met:

- Contractor's design and construction management and support staff based permanently on site: 30 No. (20 No. based at the main compound and 5 No. based at each of the satellite compounds.)
- Construction Operatives at each of the Work Sites for each activity:
 - Demolition: 10 No – Specialist Sub-Contractor required.
 - Road Construction/Accommodation Works – 10 No.
 - Bridgeworks: 10 No. (Depending on severity of works required).
 - OLE Foundations 10 No.(Assuming screw pile foundations are used).
 - Earthworks/Drainage/Ducting: 10 No.
 - Track Construction (Manual): 10 No.
 - Track Finishes/Road Works: 10 No.
 - Platform Construction: 5 No plus specialist trades as required
 - OLE Pole Erection 5 No.
 - OLE Cabling: 5 No.

Further, the indicative programme also shows the degree of concurrent working that will be required in each of the sections in order for construction to be achieved within the current timescale. For example three sets of road works resources will be required at the start of construction in:

- Bull Street/Albert Street
- New Canal Street
- High Street Deritend

Multiple sets of resources will also be required for demolitions, structures works, tram ground works/drainage/ducting, track finishes/road works and OLE erection.

It will be appreciated, however, that each set of resources will be located in different sections along the length of the tram route and the effect of any associated construction traffic generated by their activities will, in general, be localised and problems relatively short lived. Exceptions will be to the works (demolitions, road works and track construction etc.) required in Bull Street, Moor Street and High Street D Deritend, where the wider highway network will be affected when these works are carried out. It is likely, however, that construction on these sections will be confined to off peak hours during the day or overnight in some circumstances.

4.6.2.3 Traffic Generated by Construction Activities at Work Sites

It is anticipated that the maximum daily construction traffic generated by each of the activities at the work sites will be of the following order (note these figures are applicable to each site individually but do not include the movement of items of plant such as piling rigs/dumpers/rollers/JCBs operating in the immediate vicinity of the work sites):

- Demolition: 25 lorry/plant movements.
- Road works/Accommodation Works: 25 lorry/plant movements.

- OLE foundations - 5 lorry/plant movement.
- Track excavation: 20 lorry/plant movements.
- Drainage: 5 lorry/plant movement.
- Ducting: 5 lorry/plant movements
- Preparation of track foundation: 10 lorry/plant movements
- Track slab construction: 15 concrete waggons/plant movements.
- Rail installation (excluding delivery of rails): 5 lorry/plant movements
- Track Finishes/Road works: 10 lorry/plant movements.
- Stop Construction: 5 lorry/plant movements.
- Erection of OLE: 5 lorry/plant movements.

Bearing the above information and the indicative programme developed as part of this report (see Appendix B) Table 4.3 below contains an estimate of:

- The volumes of construction traffic one way) that will need to access each of the Work Areas from the wider highway network during construction.
- The number of worker journeys (one way) that will occur

Table 4.3: Indicative Traffic Impacts

Location		Description				2020				2021	2022
Total HGV Movement Generated		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	
Work Stage 1	Corporation Street to Moor Street Queensway	705	730	119	0	160	338	150	25		
Work Stage 2	Moor Street Queensway	0	70	76	0	0	0	55	5		
Work Stage 3	Moor Street Queensway to New Canal Street	61	139	631	179	133	85	57	35		
Work Stage 4	New Canal Street to High Street Digbeth	621	440	165	137	155	134	124	140		
Work Stage 5	High Street Digbeth	135	289	252	20	314	123	110	85		
Total No. of Additional HGV Journeys		1522	1668	1243	336	762	680	496	290		
Approximate No. of Worker Journeys		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	
Supervision	Site Compounds	750	1950	1950	1650	1950	1950	1950	1650	110	
Work Stage 1	Corporation Street to Moor Street Queensway	475	1452	615	0	472	1423	1100	125		
Work Stage 2	Moor Street Queensway	0	200	385	0	0	0	385	25		
Work Stage 3	Moor Street Queensway to New Canal Street	443	1268	1760	2055	1909	1120	460	175		
Work Stage 4	New Canal Street to High Street Digbeth	667	1664	751	1110	696	550	625	75		
Work Stage 5	High Street Digbeth	450	1140	750	100	405	1040	775	500		
Total No. of Additional Worker Journeys		2785	7674	6211	4915	5432	6083	5295	2550	110	

4.7 Provision of Information

In order for the Traffic Management Strategy to be successful it will be vital that the general public is kept fully informed and aware of the traffic arrangements. Appropriate extensive publicity will be required for each Work Stage, and all aspects of the media should be used to ensure that as many road users as possible know in advance the arrangements that will be in place and when changes to the system will occur. The publicity should involve working through the media including social media, the provision of extensive leafleting and the use of Centro's website. Centro will develop a Communications Strategy which will form the basis of the Contractor's communications plan.

Regular discussions will need to take place with the Local Authority, the Emergency Services, frontagers, public transport operators, taxi/private hire organisations, the disabled and other affected road users.

It is anticipated that a Public Relations team will be set up from personnel working for the parties to the Contract. The team would deal with:

- General enquires from the public.
- The specific needs of building owners and tenants whose property fronts the route with regard to agreeing access arrangements (taking into account particular requirements of the owner/tenants); and ensuring they are fully aware of the intended work; agreeing a programme for the work; and ensuring that predicted and unforeseen variations to the programme are readily communicated.
- Enquiries from media.
- Planned traffic management proposals to ensure that adequate notice is given to all relevant parties (including the public, emergency services and local authorities).

The team should also be proactive in promoting the scheme by providing regular progress reports to affected owners/tenants and to the general public via the media.

5 Pedestrians, Cyclists and Public Transport

5.1 Pedestrians and Cyclists

The construction works will require temporary closures and/or diversion of pedestrian and cycle routes. In developing a strategy for when closures or diversions should be undertaken the contractor should pursue the following hierarchy:

- Maintain cycle and pedestrian routes on or close to the existing alignment.
- Install any permanent alternative cycle route in advance of the main construction works.
- If diversions are required, then the following principles should be followed:
 - Keep to a single diversion to be maintained throughout entire construction period as far as practicable with minor changes as required. Changes should be kept to a minimum..
 - Agree diversions with the Traffic Manager and other key stakeholders (e.g. cycling groups).
 - Provide advance warning and notification.

New Canal Street / Fazeley Street / Liverpool Street / Adderley Street is a signed cycle route and temporary diversions will therefore need to be given particular attention.

Management of pedestrians will be a key issue in the construction of the works. The western end of the scheme in particular is in close proximity to busy pedestrian crossing points and bus stop locations. There are also major pedestrian flows along the footways of Bull Street, High Street and Moor Street Queensway and High Street Deritend. Management of pedestrians in these areas will need to be given careful consideration.

Table 5.1: Major Pedestrian Crossing Points

Street	Crossing Point
Bull Street	Junction with Corporation Street
High Street	Adjacent to junction with Bull Street
Moor Street Queensway	Adjacent to junction with Albert Street
High Street Deritend	Pedestrian crossings at traffic signal junctions

5.2 Public Transport

Public transport buses currently use the following roads which will be directly affected by the construction of the tramway:

- Corporation Street.
- Bull Street.
- High Street / Dale End.
- Albert Street.
- Moor Street Queensway.
- Digbeth and High Street Deritend and the junctions along this section.

Other routes may be also impacted by diverted traffic which is likely to affect the punctuality of services along these routes. Bus stops are located along Fazeley Street but are not currently in use.

During construction of the inbound track between High Street / Dale End and Corporation Street and the construction of the Corporation Street / Bull Street junction it is unlikely that buses will be able to be retained on their current route and diversion of all services is likely to be required.

Similarly, during construction work in Albert Street buses using the Dale End / Albert Street route will need to be diverted.

It should be possible to retain the existing bus routes on Moor Street Queensway although some temporary lane reallocation will be necessary.

Re-routing and associated temporary relocation of bus stops will need to be agreed with the bus companies in advance and information provided to bus passengers.

6 Utilities Diversions

6.1 Overall Strategy

A major principle of the Construction Strategy is that there should remain no reason to disrupt the operation of the Metro for planned access to services. As noted in Section 4.1, this requires the removal of all services from the areas which directly affect the structural foundations of the Metro. Services which do not affect the foundations but lay below the line of the tracks may be able to remain in place subject to a risk based approach based on the cost of diversion and likely disruption to the Metro once in operation. A safe working distance either side of the developed kinematic envelope (DKE) should be kept clear of plant and apparatus to give the utility companies sufficient room to carry out repairs and maintenance without disrupting the running of the system. A corridor should also be left free of services for the construction of other Metro infrastructure such as ducting, tram stop equipment and any OLE support foundations.

Where existing utilities run under or adjacent to the route then these will be diverted or sleeved. Services crossing the proposed tram alignment will be lowered and/or protected from potential damage from vibration and/or increased load. The relevant service authorities will be consulted about the level and type of protection required. Access chambers, currently within the area of the proposed track slab will be relocated to afford access adjacent to the slab.

The existing sewers should generally be sufficiently deep not to be affected by the construction of the tram. There may be problems however where the proposed DKE runs over or adjacent to sewer manholes. Where this occurs, the manholes will need to be modified for side entry to allow access to the sewer without interfering with the running of the tram. In extreme cases, where a side entry manhole is either impractical or unacceptable, diversion of the sewer may be necessary. In addition a CCTV survey should be undertaken of the sewers which impinge upon the DKE. This should be carried out as early as possible to allow any necessary remedial work to be agreed and undertaken before the tramway construction commences.

For the services that cross the tram alignment, new maintenance and emergency procedures will have to be agreed with the utility companies. Provision should also be made for additional under track crossings for future services as and when these are required. The Contractor will be required to keep full records of all services diversions and the position of any additional duct crossings for future use.

However, it may not be possible to relocate all apparatus especially on street running sections due to the restricted space available. Where services are lying along or close to the line of the LRT they will need to be individually considered with a view to being moved, protected, or left in-situ. Considerations in making the choice will include:

- Depth of the existing service (many sewers would remain in place);
- The state of the service's preservation, material, and fragility (old cast iron water mains may not flex under the new loading regime of construction and operation without leaking);
- Minimising of stray current;
- Maintenance access;
- The need for service connections in the future; and

- The effects of failure of the service on tram operation.

Communication company cabinets, post boxes, telephone boxes, fire hydrants and CCTV cameras may also need to be relocated to accommodate the tram alignment. Discussions with Royal Mail, Communication companies, the Fire Brigade and other operators will be required to determine the amount of apparatus affected. Where such apparatus needs to be moved it should be relocated to positions agreed with the relevant owner/authority and in a manner that will ensure minimum interference with tram services.

6.2 Implementation

Implementation of the utility diversions will generally be carried out by the utility companies under the provisions of the NRSWA Act prior to the start of the main contract works. Contractually it is preferable for the protection/diversion of Statutory Undertakers' apparatus to be completed separately prior to the start of the main contract. This may not be possible however bearing in mind the lead in times required for some diversions and the time scale required for construction.

Advance diversion of utilities will minimise the construction time for Metro itself but will result in initial excavation of roads and footways for service diversions, perhaps on several occasions as each utility carries out its work, and re-opening of excavations for later construction of Metro. To the general public this may be perceived as 'twice' the disruption. In reality it will ensure continuous construction of Metro over a site that has already been prepared during 'Advance Works Contracts' with the utilities.

6.3 Utilities Report

Centro will liaise with the Utilities Companies to identify those services that will need to be diverted and/or protected for the construction of the BEE. A Utilities Diversion Management Strategy will be prepared in due course which identifies the extent of the works to be carried out, the lead in times required by the Utilities Companies and the periods required for the works to be executed. This strategy should be co-ordinated with other major developments such as Martineau Galleries and the HS2 Curzon Street station to ensure that new utilities for other projects or diversions are not planned to be built within the Metro corridor.

7 Structures

The following is a list of existing structures along the route which will, or may be affected by the tramway construction.

Table 7.1: Affected Structures

Reference	Structure	Affected	Description
S1	Ramp on Bull Street / Corporation Street Junction	Yes	Filling of ramp structure.
S2	New Canal Street Rail underbridge	Possible	Lowering of carriageway for OLE clearance. Possible effect on foundations. EMC considerations due to the interface between ac electrified railway and dc electrified tramway.
S3	Meriden Street Rail underbridge	Possible	Lowering of carriageway for OLE clearance. Possible effect on foundations. EMC considerations due to the interface between ac electrified railway and dc electrified tramway.
S4	River Rea over bridge	Yes	Revised levels due to tram alignment. Structural modifications likely to be required.

The current strategy and programme assumes these structures can be modified / extended to accommodate the tramway. If major reconstruction of any of these structures is necessary, it could have a significant effect on programme and traffic management strategy.

8 Construction Compounds and Work Sites

8.1 Principal Site Compounds and Facilities

Prior to the start of construction, the Contractor will, subject to local authority planning approval, need to enter into agreements for land and / or facilities to be used for principal site compounds. Ideally these compounds should be positioned for easy access to the main areas of work and to minimise the number of traffic movements for delivery of goods and materials.

Bearing in mind the extent of the works to be carried out, the following principal site facilities / compounds are likely to be required for the HS2 extension:

- Administrative offices for the construction team and supervisory staff.
- A principal construction compound to accommodate workshops, batching facilities and for the storage of the larger items of plant and materials.
- Further compounds at Work Sites and adjacent to the sites of the major structures to facilitate access, economic use of resources and storage of materials.
- Community liaison office or mobile consultation unit.

8.2 Opportunities for Principal Site Compounds

Discussions will take place with the City Council on the availability of appropriate facilities and general open spaces for principal site compounds. Opportunities are likely to be limited close to the city centre, though the proposed property demolition on Dale End may provide some opportunity for limited facilities.

Greater opportunities for principal compounds should exist in the more industrial areas around Fazeley Street, but there may be a greater demand for compound space if the HS2 works are being constructed concurrently with the Metro.

Preliminary studies have identified a number of possible sites adjacent to the proposed route and these are shown on Drawing No. MMD-300207-HS16-DRA-0000-0002 in Appendix A and discussed further below.

8.2.1 Site 1: Existing Balfour Beatty compound in Lionel Street currently being used for the construction of the BCCE.

Site 1 is a roughly triangular area of land on the south east corner of the junction of Lionel Street/B4100 (Old Snow Hill/Constitutional Hill). The area measures approximately 60m by 30m at its frontage and was previously a Birmingham City Council Car Park. It is currently being used as a compound for the construction of BCCE. Access is from Lionel Street which is one way from Livery Street towards the B4100 (Old Snow Hill/Constitution Hill). Construction traffic will, therefore, need to:

- Approach the site using Great Charles Street Queensway and Livery Street.

- Access the tram route either via Snow Hill Queensway and Bull Street or St. Chads Queensway, James Watt Queensway and Moor Street Queensway.

The above may not be acceptable to the local highway authority. The site is also limited in size and relatively remote from the works.

8.2.2 Site 2: Existing BCCE Compound on the Northwest Corner of Albert Street/Moor Street Queensway.

Whilst owned by BCC, site 2 forms part of the potential Martineau Galleries Development Area and is currently being used as a satellite compound for the storage of materials for the construction of BCCE. It is located immediately adjacent to the BEE tram route on the north corner of the junction of Albert Street and Moor Street Queensway. It is ideally located for use as a compound, in particular for the storage of materials for Work Stages 1 and 2. Deliveries to the site can be made either off-peak or overnight using Moor Street Queensway, while construction traffic running to and from the adjacent work areas should be able to do so in the main by utilizing the tram corridor. It is understood that planning permission for the Martineau Galleries Development has recently lapsed, so it is anticipated that the area should be available for construction.

8.2.3 Site 3: Area Adjacent to Work Stage 3 and Within the HS2 Site.

It is understood that Centro will ask HS2 to provide an area within the HS2 site for use as a compound by the BEE construction team. It is anticipated, however, that due to the scale of construction of the HS2 project, that any areas available within the HS2 site will likely be:

- Of limited size.
- Subject to severe access restrictions.

Even if a larger area is available within the HS2 site for use as a main BEE compound, the increased volumes of traffic that will result on the approach and egress routes to/from the HS2 site, especially during the early morning and evening peaks, may not be acceptable to the local Highway Authority. Volumes of construction traffic operating within the HS2 site would also be increased which even if managed effectively could also lead to problems.

Notwithstanding this, however, it would be an advantage if the tram corridor for construction within the HS2 site could be made as wide as possible in order to:

- Permit access for storage and construction purposes within a separate, safe and clearly defined corridor controlled in the main by BEE staff.
- Allow for the provision of welfare facilities for tram construction personnel working immediately within Work Stage 3 of the tram route.

Further comments with regard to the possible use of an area or areas within the HS2 Site will be made once more information is available.

8.2.4 Site 4: Area on the South East Corner of the Junction of New Canal Street/Fazeley Street

Site 4 is a rectangular area located on the south east corner of the junction of New Canal Street/Fazeley Street immediately adjacent to the tram corridor. The area is currently used as a Car Park with access off New Canal Street and measures approximately 100m by 35m. Access from the strategic highway network is available via Fazeley Street and the various roads running parallel to New Canal Street. If the site is available it is recommended that main access should be from Fazeley Street as access from New Canal Street will be severely restricted by the adjacent tram works. The existing access on New Canal Street can be used by construction plant travelling to/from the local works areas.

8.2.5 Site 5: Area Adjacent to Work Stage 4 on the West side of Oxford Street Immediately North of the Railway.

Site 5 is a roughly rectangular area located immediately to the north of the railway viaduct on Oxford Street. It is close to the tram corridor, measures approximately 60m by 20m and is currently used as an industrial unit with access from Oxford Street. Access to the strategic highway network is available either directly via Oxford Street (beneath the railway viaduct) or the local highway network. Easy access to the tram corridor is available both to the north and south of the site.

Although limited in size, the site is conveniently located close to the tram corridor and in particular the railway under bridge on Meriden Street. It has good access both to the strategic highway network and the tram corridor and would be suitable for use either for materials storage/satellite offices/welfare facilities or to service the works to the under bridge on Meriden Street.

This site is owned by Hartwells, who also own the South and City College site on the corner of High Street Deritend / Meriden Street and have indicated the area may be available.

8.2.6 Site 6: Area on the north east corner of Meriden Street/High Street Deritend Junction currently the site of The Birmingham South of City College Building.

Site 6 is the block of land located on the north west corner of the junction of High Street Deritend and Meriden Street and is bounded by Oxford Street and Coventry Street to the west and north respectively. It is immediately adjacent to the tram corridor and the strategic highway network and measures approximately 125m by 100m. The area is currently the site of:

- The South and City College – Birmingham Fusion building and parkin/service areas.
- A Car Park
- Various industrial units.

This land is owned by Hartwells and is due to be redeveloped.

Access is available from both High Street Deritend and Oxford Street

In terms of construction of the tram, the site is ideally located and of sufficient size to function as the main site compound for BEE. However, it is located on and will, in the main, be accessed from High Street Deritend. It is also immediately opposite the Birmingham Coach Station on High Street Deritend. Depending on the volumes of construction traffic that will be generated, therefore, use of this site as the main BEE compound may not be acceptable to the local highway authority.

Finally, demolitions will need to be carried out before the whole of the site area can be made available. Viability of the site for use as the main BEE compound will depend, therefore, on the programme of the proposed redevelopment and how quickly the whole of the site area can be freed for use if redevelopment has not gone ahead prior to construction of the Metro.

8.2.7 Site 7: Area on the North East Corner of the Junction of Rea Street/Bradford Street.

Site 7 is a rectangular area of land located to the south of High Street Deritend on the northwest corner of the junction of Bradford Street/Rea Street with access from Rea Street. It is close to the southern end of the tram corridor and the strategic highway network and measures approximately 50m by 30m. The site is bounded to the west by the River Rea and has recently been re-fenced to separate it from the area of land on the other side of the river which is currently used as a Car Park. Although the site has easy access to/from the strategic highway network via High Street Deritend and Bradford Street, in terms of access for construction it is located on the wrong side of High Street Deritend and the tram corridor. The site is also directly opposite the Birmingham Coach Station on the corner of High Street Deritend/Rea Street and the local highway authority may not, therefore, agree to its use by BEE.

8.2.8 Site 8: Area Adjacent to Work Stage 5 on the North Side of Lower Trinity Street Immediately to the East of the Derelict Railway Viaduct.

Site 8 is an irregular shaped area of land on the north side of Lower Trinity Street immediately to the east of the derelict railway viaduct. It measures approximately an average 35m by 50m and has access either from Lower Trinity Street or Bromley Street/Hack Street. The site can be accessed from the strategic highway network via Heath Mill Lane and either Lower Trinity Street or Bromley Street. Access to the tram corridor can be gained either by this route or Heath Mill Lane and Fazeley Street. The site is limited in size but is relatively close to the southern end of the tram route with reasonable access to the strategic highway networks and the tram route. If other areas closer to the tram route are not available, it would be useful as a satellite compound suitable for materials storage/satellite offices/welfare facilities.

8.2.9 Site 9: Area on the South West Corner of the Junction of Adderley Street/New Bond Street

Site 9 is a roughly rectangular area of land on the south west corner of the junction of Adderley Street/New Bond Street. It measures approximately 130m by an average 40m wide and lies between the Canal to the east and New Bond Street to the west with access from Adderley Street to the north. It is currently used to house containers associated with a self-storage business. The site can be accessed from the strategic highway network via High Street Deritend/Adderley Street to the west and Watery Lane Middleway/Adderley Street to the west and lies approximately 0.5km to the west of the southern end of the tram route. Access to the tram route can be gained either via Adderley Street/High Street Deritend or Adderley Street/Liverpool Street/Fazeley Street. Although not immediately adjacent to the tram route, the site is reasonably close with good access both to the strategic highway network and the tram corridor. Although it is narrow in width it would be suitable for use as the main site compound in conjunction with some of the smaller sites closer to the tram corridor.

8.3 Preferred Sites for Use as Principal Compounds

It is considered that Site Area 1 is too remote from the tram route and is unlikely to be used if closer more suitable sites are available. It is also unlikely that permission will be obtained from the local highway authority for the use of Site Areas 6 and 7 because use of these areas will result in additional congestion on High Street Deritend and cause unnecessary disruption to the operation of the adjacent Coach Station.

Bearing this in mind and given the remaining site areas that have currently been identified, it is considered that the following Site Areas should be used as Principal Site Compounds for the construction of the BEE:

- Site Area 2: Suitable for use as a satellite/storage compound. It is conveniently positioned for the construction of Work Stages 1 and 2 to the extent that general construction traffic should be contained within the local highway network. The site also has good access to the wider highway network via Moor Street Queensway.
- Site Area 4: Suitable for use as a satellite/storage compound. It is conveniently positioned for the construction of Work Stages 3, 4 and 5 again to the extent that general construction traffic should be contained within the local highway network (except when crossing High Street Digbeth to access the tram route within the centre reserve). The site also has good access to the wider highway network via Fazeley Street.
- Site Area 9: Suitable for use as the Principal Site Compound for the location of the contractor's main site offices and management facilities. It also likely to provide some storage capacity and is conveniently positioned adjacent to both the wider highway network and the tram route. Use of the area should have no immediate effect on either High Street Deritend or the Coach Station. It also has good access to/from the satellite compounds via the local highway network (Site Area 4) and the wider highway network (Site Area 2).

8.4 Work Sites

The nature of the route means that there are unlikely to be many vacant areas of land available for use as work sites adjacent to the areas of ongoing works. Work Sites will consequently have to be located within the areas where work is being carried out, and will have to be adapted on a continuous basis to suit the progress of the works. Offices, mess huts etc. are likely to have to be provided at the Contractor's main and/or principle compound since there is unlikely to be sufficient space available within work sites.

The key principles which should be adopted in the development of the Work Site strategy are:

- A work site should be limited to approximately 100m in length. This is seen as the optimum balance between the Contractor's desire to maximise work lengths and the requirement to minimise the disruption to pedestrian movements and access to retail and industrial units. It also complies with fire service requirement to allow them to reach an incident midway along a work site.
- In general the work should be phased to minimise the area required for the work, generally no more than half the width of the street, while maximising the space for access traffic and pedestrians.
- Secure fencing should be provided around each site with appropriate noise and dust mitigation measures.
- Any unsecured equipment and loose materials should be removed at the end of each day's work.

8.5 Access to Work Sites and Site Compounds

The majority of the works will be carried out on street or in close proximity to the highway network so local access to these areas should not be a problem. As discussed in Section 8.2 above, the Contractor will have to agree pre-defined routes which can be used by construction traffic between the principle site compounds and the work sites, together with routes to be used by construction traffic accessing the principle compounds or work sites directly from the wider highway network. It is likely that the use of the agreed routes will be limited either to off peak hours during the day or in special circumstances overnight i.e. for the delivery of materials such as the rails, OLE poles etc.

9 Construction Programme

9.1 Construction Timetable and Key Dates

The current timetable for the construction of the HS2 extension to Midland Metro is as follows:

Table 9.1: Key Dates

Event	Target Date
Advance Service Diversions	Early 2019
Construction Start	Early 2020
First Service	Early 2022

An indicative preliminary construction programme is included in Appendix B.

9.2 Programme Constraints

9.2.1 General Issues

The principal constraints to the HS2 tramway programme are likely to be the interfaces with adjacent developments, notably the HS2 rail works and the Martineau Galleries development. Other redevelopment within the Eastside area generally may also have an influence.

On a more local level, a number of buildings need to be demolished for the works which is likely to involve the relocation of a number of businesses.

The Contractor's construction programme will need to take account of and minimise the effect of other road works and major events at venues within the city centre though given the location disruption by events is unlikely to be significant.

Birmingham City Council Traffic Management Team maintains a database of events programmed to occur in the city centre each year. A programme of events for the construction period is not currently available but will need to be considered by the Contractor.

The programme does not reflect the impact of individual events on the construction programme. However, it would be expeditious if events which affect the route could be either relocated or managed in such a way as to allow construction work to continue. Centro will discuss options for relocation of events with the City Council in advance of construction. During the construction period, this will be a matter for the Contractor.

9.2.2 Seasonal Issues

Ideally, construction activity should be maximised in the summer months to take advantage of better weather and lighter traffic flows. This may not be possible, however, due to the restrictions on the programme imposed by access requirements and traffic management issues.

Birmingham City Centre and surrounding main routes are subject to restricted working from early November to mid-January each year by the City Council. Details of the area affected in 2015 can be found in Appendix A. The exact area and dates can change each year and it is advised that the contractor attend the Traffic Manager's Quarterly Coordination Meeting for the City Centre, arranged by Birmingham City Council. The restriction applies to all but emergency works to carriageways and footways. Centro will seek agreement with the city council to allow continuous working for the construction of the HS2 Metro during these periods, though given the length of the extension it should be possible to programme the works such that works take place outside the restricted area during these periods.

Traffic in the city centre and on the approach routes is reduced during the major holiday period, July to September. It would be beneficial therefore if construction works which impact upon major traffic flows could be undertaken during these periods. This principally relates to the crossing of Moor Street Queensway and High Street Deritend, but should be considered in the programming of other junction works.

9.3 Basis and Development of Programme

The proposed construction programme has in the first instance been based on the sequence of working given in Section 4.3 while taking account of the comments made in 9.2.1 and 9.2.2 above. It has also been assumed that sufficient resources will be available to enable the degree of concurrent working required to be maximised and the construction period kept as short as is practicable. Further, the need to keep the specialist resources associated with construction of the tram track itself in continuous work during the course of construction has, as far as possible, been given priority. It has been assumed that resources associated with other activities such as earthworks, drainage, ducting, and pavement finishes will be more readily available.

The proposed construction programme has therefore been developed with the above in mind, and consideration has been given wherever possible to other sections of the works that could be carried out at the same time where advantageous to the works and where the constraints allow.

9.4 Rates of Construction

The rates achievable for construction of the works within each of the Work Stages will depend on a number of factors, most notably the following:

- Availability of plant, labour and materials as already discussed above.
- Restrictions on access and space available for construction.
- Track type and construction details.
- Ground conditions
- Construction method or methods used i.e. whether use of a paving train is feasible or manual construction is required.

Based on current information it has been assumed for the purposes of this report that:

- Ground conditions will be relatively good and ground treatment will not be required.
- Standard concrete slab track will apply throughout the route.
- Due to the comparatively short length of the proposed extension, the topography/characteristics of the route and the restrictions likely to be imposed by the local highway authority, the use of a paving train is unlikely to be viable and manual track construction methods will be used throughout the route.

Experience of other LRT schemes (most notably NET Phase 2) has shown that if resourced properly, standard concrete slab track can be constructed using manual techniques within a city centre location at the following average rates (note that the rates quoted are for construction of the track slab and fixing/welding/encapsulating of the rails only):

- Concrete On-Street Double Track – 75m/month.
- Concrete On-Street Single Track – 150m/month

A minimum period of 10 days is required, however, where construction in shorter lengths is necessary.

Similarly, experience has shown that:

- Stops normally take between 8 and 12 weeks to complete depending on their size and the quality of finishes.
- OLE can be erected at a rate of 230m/month.

The rates of construction actually achieved will, of course, vary according to the resources available and the individual circumstance that apply in any particular location. Generally, however, for the purpose of this report the above rates have been used as a basis for assessing construction durations for the HS2 extension.

9.5 Restrictions to Working Times

The majority of the construction takes place in areas of little or no residential property and working times could be flexible. It is unlikely, however, that the Contractor will wish to work outside the hours of 7.00am to 7.00pm on a regular basis for both safety and economic reasons.

Where work is taking place on or immediately adjacent to major traffic routes i.e. Moor Street Queensway and High Street Deritend, or where works indirectly affect major traffic routes, more onerous restrictions may be imposed.

Similarly, in areas close to city centre where high rise residential accommodation is located along the route (e.g. Hotel La Tour and the Hive apartments around Masshouse / Park Street), the City Council is likely to impose more stringent restrictions.

Consultation with businesses by the Contractor is essential in these areas as buildings such as hotels may use their facilities for hosting conferences during normal working hours.

Working hour restrictions will be agreed with the City Council prior to commencement of construction.

10 Construction Methodology

10.1 General

Demolition involves a small number of individual properties scattered along the route of the scheme.

Site clearance will also not be extensive over the majority of the route, and will generally consist of the removal to storage or disposal of street furniture, fencing, lamp columns, signs, trees, advertising hoarding and the like.

As stated in 1.1, this report assumes that the closures and diversions associated with the HS2 rail project are in place prior to the commencement of the Metro works in the area, but will also comment on the implications of these diversions and closures not having taken place at the time of construction for each of the Work Stages.

10.2 General Sequence of Track Construction

As discussed in Section 3.1, the length of track that can be constructed in a continuous length will be defined by the requirement to maintain access and compliance with restrictions imposed by the Emergency Services and the highway authority. Experience on other LRT schemes has shown that within urban areas the lengths of continuous track construction rarely exceeds 100m and this is likely to be the case for construction of the HS2 Metro extension, particularly if one-way traffic operation under signals is involved. There may be areas that, with the agreement of BCC, the length of continuous track construction could be extended. It will generally be necessary for track to be constructed in single track widths and for work areas to shift around junctions, vehicular accesses and loading / unloading areas to comply with traffic management requirements.

Bearing the above in mind, the general sequence of track construction following diversion of the services within each work area is expected to be as follows:

1. Install traffic management.
2. Demolition if required.
3. Site clearance.
4. Removal of any paving etc. (to be retained where appropriate for re-use).
5. General excavation.
6. Installation of OLE bases, drainage and ducting.
7. Laying granular capping material if required.
8. Laying sub base/blinding.
9. Fixing reinforcement.
10. Laying first stage concrete.
11. Installing rails, tram location loops, completing stray current protection and earthing/bonding connections.
12. Completing drainage/ducting above first stage concrete.
13. Laying second / third stage concrete around rails and installation of any rail sealants.
14. Constructing Stops where required.

15. Installing main cabling.
16. Completing highway/accommodation works and final surfacing where possible.
17. Installing OLE supports (where required).
18. Completing final surfacing.
19. Installing wiring and complete cabling.
20. Energisation.
21. Systems commissioning including vehicle gauging.
22. Shadow timetable operation.

10.3 Work Stage 1

10.3.1 Key Elements

Work Stage 1 extends from the tie in to the BCCE on Corporation Street to the intersection with Moor Street Queensway and comprises the following:

- Widening of Bull Street and Corporation Street carriageways to accommodate the tram and off-line bus stops.
- Filling in of the subway on the outbound side and construction of a retaining wall.
- Construction of a signalised delta junction with the operational BCCE route (suspension of BCCE services will be required during tie-in works).
- Demolition of Nos. 1-5 Dale End.
- Highway works in New Meeting Street and Albert Street.
- New twin track throughout the section.

10.3.2 Traffic Management

Construction of the delta junction at Bull Street/Corporation and the tie in works to the city centre Metro tracks will necessitate:

- Closures of Bull Street and Corporation Street at the junction; and
- Temporary termination of the tram service between Bull Street and Corporation Street.

Construction of the inbound track on Bull Street will require temporary relocation of the Bull Street bus services onto Moor Street Queensway.

During construction across Albert Street opportunities for access / egress from Moor Street Queensway will be limited. High vehicles, however, cannot access via Dale End due to the low bridge so access will need to be maintained direct from Moor Street Queensway or via Carrs Lane and High Street (subject to amendment of the existing bus only order). Vehicles other than service vehicles will need to be temporarily banned from the area.

10.3.3 Maintenance of Vehicular and Pedestrian Access

As noted above, vehicular access to Albert Street will need to be restricted to access for service traffic. It would be preferable during the construction period to remove the on-street parking from Kings Parade to minimise conflicts with construction traffic.

Pedestrians will need to be diverted around the works, particularly in Corporation Street, Bull Street and High Street. It should be feasible to retain pedestrian movement through New Meeting Street, Kings Parade and Albert Street, though through pedestrians should be re-routed via Carrs Lane to minimise conflicts during construction.

It is not known at this stage whether or not pedestrian and vehicular traffic in the area to the west of Moor Street Queensway will be significantly affected by the construction of HS2 to the extent that construction of the tram will be adversely affected. In the absence of any further information and for the purposes of this report it has been assumed that the construction programme for the tram in this section will not be affected by HS2. The report and programme will, of course, need to be updated should any further relevant information be made available.

10.3.4 Work Stage 1 Sequence of Construction

Bearing the above in mind, the suggested sequence of construction in Work Stage 1 (with HS2 on site) is as follows (refer to drawing MMD-300207-HS16-DRA-0000-0003 for detailed phasing of Works Stages 1 and 2):

- Divert Services (this work is assumed to be complete prior to the Contractor taking over the site).
- Demolition of 1 – 5 Dale End.
- Construct temporary access through the demolitions area for access to Kings Parade/New Meeting Street and temporary widening in High Street/Dale End.
- Carry out site clearance and widen the carriageway in Bull Street and Albert Street.
- Set up traffic management and construct single width track work sequentially in Bull Street (Work Stage 1B Phase 1) These sections of track to be completed prior to the works in Work Stage 2 commencing.
- Fill in the subway on the outbound side of Bull Street/Corporation Street junction and construct the retaining wall between the subway and the adjoining frontages at the same time as the outbound track is constructed in Bull Street.
- Construct track and accommodation works in New Meeting Street (Work Stage 1D Phase 1. Note these works are 'offline' and will not clash with the works in Moor Street Queensway).
- Following completion of Phase 1 of the Moor Street Queensway crossing, close the High Street Dale End carriageway and construct the track across the carriageway (Work Stage 1C Phase 1).
- No further works to be carried out in Work Stage 1 until the end of the BCC Christmas Blockade.

- Following the end of the BCC Christmas Blockade, close the Bull Street/Corporation Street junction and construct the delta junction at Bull Street/Corporation Street (Work Stage 1A Phases 1 and 2) and complete the track in Bull Street (Work Stage 1B Phase 2).
- Construct track and accommodation works (twin track construction) through the demolition area 1-5 Dale End (Work Stage 1C Phase 2. Note these works are offline and will not clash with the works in Moor Street Queensway).
- With access re-established via Carrs Lane/ High Street/ Bull Street/Dale End close the Moor Street Queensway/Albert Street junction and construct track in Albert Street (Work Stage 1D Phase 2) in conjunction with the track immediately adjacent in Moor Street Queensway.
- Complete highway/accommodation works through the section.
- Erect OLE.

It is considered that the above sequencing of construction would not be affected or need to be amended if HS2 was not on site at the time of construction.

10.4 Work Stage 2

10.4.1 Key Elements

Work Stage 2 extends across Moor Street Queensway and comprises the following:

- New twin track throughout the section.
- Installation of a signalised junction.

10.4.2 Traffic Management

Moor Street Queensway is a major bus route and heavily used traffic route around the south eastern side of the city centre. Temporary relocation of bus stops removed by the scheme will need to be considered. Total closure for construction is unlikely to be feasible and it is assumed that BCC will require a minimum of two lanes of traffic to be maintained in each direction at all times. In order to achieve this, the outbound carriageway will need to be widened at the junction with Albert Street to provide an additional running lane and the centre reserve will need to be filled in. Construction is likely to be carried out in three sections under lane closures with contraflow systems in place and the traffic management facilities required will be extensive. Consideration will need to be given to bus stops that may be affected and whether stops can be relocated or routes temporarily diverted. Finally, in order to minimise congestion it would be advisable to construct as much of the works as is possible during the summer months with advisory signing recommending use of the eastern section of the ring road for through traffic.

10.4.3 Maintenance of Vehicular and Pedestrian Access

Access onto Albert Street needs to be retained for high vehicles or alternative access/ egress provided as identified in Work Stage 1. Light/low vehicles should be encouraged to avoid the junction and access/ egress via Dale End.

Pedestrian movements are significant due to the proximity of bus stops to the junction with Albert Street and the pedestrian route between High Street / Dale End and the Eastside park area. Local diversion of the pedestrian route is likely to be necessary during construction with possible temporary relocation of bus stops away from the junction.

10.4.4 Work Stage 2 Sequence of Construction

Bearing the above in mind It is likely that construction across Moor Street Queensway will be carried out in two phases during the summer holiday periods (July to September) 2020/2021 as follows (refer to drawing MMD-300207-HS16-DRA-0000-0003 for detailed phasing of Works Stages 1 and 2):

Phase 1: Summer 2020

- Carry out temporary road widening in the area of Albert Street (in conjunction with the road works in Albert Street) and fill in the centre reserve on Moor Street Queensway..
- Install contraflow and close the centre section of the carriageway. Close Albert Street except for access
- Construct the central section of track either side of the centre reserve. The length of track constructed should be maximized to include the lengths required for welding track at the joints.
- Complete track and surface finishes (temporary and permanent) to enable the carriageways to be re-opened. Open Albert Street Junction.

Phase 2: Summer 2021

- Install contraflow and close the two outer sections of the inbound/outbound carriageways. Close Albert Street junction.
- Construct the two outer sections of track on each carriageway.
- Complete track and surface finishes to enable both carriageways to be fully re-opened.

Completion Works (Off-Peak Under Lane Closures)

- Install new traffic signals (all excavation/ducting and pole foundation works (as far as possible) should be completed during construction of the track in each section).
- Complete Streetscape works.
- Erect OLE.

The timetables for construction within each of the windows identified will be extremely challenging and it is likely that the construction of significant elements of the completion works will continue beyond each of the holiday periods. These works will need to be carried out during off peak hours or, if necessary, overnight to limit disruption to peak traffic flows.

Finally, if design constraints allow, consideration should be given to the use of precast concrete track slab foundations and any other measures that could increase the speed of construction across this Work Stage.

10.5 Work Stage 3

10.5.1 Key Elements

Work Stage 3 is the section of tramway between Moor Street Queensway and the junction of New Canal Street and Fazeley Street and is largely off-highway. It comprises:

- New twin track offline from Moor Street Queensway to New Canal Street.
- New twin track on-street in New Canal Street including the Fazeley Street junction.
- Possible structural alterations to the foundations to the West Coast Main Line underbridge.
- Tram Stop to the east of Moor Street Queensway
- Tram Stop in New Canal Street to interface with HS2.

10.5.2 Traffic Management

If HS2 is on site, it is assumed that:

- Park Street will have been closed and traffic diverted away from the tram route.
- New Canal Street north of Fazeley Street will be closed for construction access only and diversion routes for pedestrians and vehicles will already be in place.

In these circumstances, construction of the tram will need to interface with that for HS2. It is assumed that access to Banbury Street and the properties to the north of the railway will not be required. New Canal Street will need to be closed to allow construction beneath the West Coast Main Line underbridge and the junction works with Fazeley Street. Fazeley Street will also need to be closed at its junction with New Canal Street to facilitate the junction works. As stated in Section 4, Bartholomew Street is currently one way in the direction of Bordesley Street. With the Fazeley Street junction closed and access from Park Street unavailable, the one way system will need to be reversed during construction of this short section of track

If HS2 is not on site, Park Street will need to be closed for construction of the transverse road crossing. The closure should be limited to approx. 4 weeks for construction of the short length of track which interfaces with the highway. Through traffic would be diverted traffic via Moor Street Queensway. Local traffic could access the area via Curzon Street and /or New Canal Street. Following completion of the track across Park Street, New Canal Street can be reduced to one way between Curzon Street and Fazeley Street and the junction of New Canal Street and Fazeley Street closed.

Access to Banbury Street and the properties to the north of the railway would also be required and New Canal Street would continue to be a major access route for the local area. The traffic management

associated with New Canal Street would, therefore, need to be phased with that of Park Street. Alternative routes would be via Park Street and Bordesley Street (subject to availability) or Masshouse Lane / Moor Street Queensway / Rea Street.

Finally, New Bartholomew Street could be accessed via Bordesley Street, Park Street and Fazeley Street and the current one-way system in New Bartholomew Street would be unaffected.

The current programme reflects the situation where HS2 is on site, but will need to be re-phased if HS2 is not on site so that construction of the short length of track across Park Street does not:

- Clash with construction in Work Stage 2.
- Clash with construction in New Canal Street.

10.5.3 Maintenance of Vehicular and Pedestrian Access

If HS2 is on site, construction of the track through this section would need to interface with the construction of HS2. No details are available yet for any pedestrian/vehicular restrictions that may apply, nor for any restrictions that may be imposed on construction of the tram by the phasing of the construction of HS2. For the purposes of this report, therefore, it has been assumed that construction of the tram will not be adversely affected by the construction of HS2. This report and the programme will, of course, need to be updated once the necessary details are available.

If HS2 is not on site, pedestrian routes could be maintained throughout construction with the exception of the short length of track across Park Street where a short diversion would be required during construction. Vehicular traffic accessing the car parks and premises immediately to the south of the closure would do so via New Canal Street and Fazeley Street.

10.5.4 Work Stage 3 Sequence of Construction

The suggested sequence of construction for Work Stage 3 is as follows:

- Divert Services (this work is assumed to be complete prior to the Contractor taking over the site).
- Carry out site clearance.
- Install traffic management and close the section of New Canal Street through the railway under bridge.
- Construct twin track across the HS2 service road and carry out lowering of carriageway and any accommodation works required to the Railway under bridge.
- Construct twin track through the railway under bridge.
- Construct twin track through the main HS2 Station site.
- Construct twin track between Moor Street Queensway and HS2 main site.
- Construct Tram Stops and accommodation works within the HS2 site.
- Close New Canal Street/ Fazeley Street junction outbound side and construct the outbound track across the junction.

- Close New Canal Street/Fazeley Street junction inbound side, reverse the one way system in New Bartholomew Street and construct inbound track across the junction.
- Complete highway works / paving works to remainder of section.

As stated in 10.5.2 above, if HS2 is not on site the construction of the short length of track across Park Street will need to be programmed so that:

- Construction does not take place at the same time as construction in Work Stage 2.
- Park Street is not closed at the same time that New Canal Street is reduced to single lane running nor the junction with Fazeley Street closed.

Construction in this section should not otherwise be affected.

10.6 Work Stage 4

10.6.1 Key Elements

Work Stage 4 is New Canal Street and Meriden Street from the junction with Fazeley Street to just north of the junction with High Street Deritend Digbeth. It comprises:

- New twin track throughout the section.
- Possible lowering of the carriageway and structural alterations to the foundations of the Railway underbridge in Meriden Street.
- Partial or full demolition of The Birmingham South of City College Building at the junction of Meriden Street and High Street Deritend (Digbeth).

10.6.2 Traffic Management

As stated in Section 4 and 10.5.2 above, if HS2 is on site New Canal Street north of Fazeley Street is likely to be closed for construction access only and diversion routes for pedestrians and vehicles will already be in place. Only construction traffic will need to enter New Canal Street from the Curzon Street end and, as a consequence, traffic flows from the north should be significantly lower than at present. If this is the case, then New Canal Street will need to be made one way in a direction that best suits local traffic patterns and the requirements of the HS2 Site. The one way system currently operating in New Bartholomew Street may need to be reversed depending on the direction of the temporary one way system that is implemented. One of the junctions with Bordesley Street and Coventry Street will need to remain open until construction across Fazeley Street has been completed to provide adequate access to the east and west of New Canal Street/ Meriden Street. Similarly, while either the Bordesley Street or Coventry Street junctions are closed for construction, the other two junctions should remain open.

If HS2 is not on site, traffic flows from the north are likely to be significantly higher. The traffic management regime required for construction in this section of the route is likely, however, to remain the same.

10.6.3 Maintenance of Vehicular and Pedestrian Access

If HS2 is on site, access will be available from the south via the various parallel and side roads serving the area. As stated in 10.6.2, it is recommended that at least one junction on New Canal Street/Meriden Street is kept open for construction at any one time to facilitate vehicular access.

If HS2 is not on site, the situation would remain very much the same but the volume of traffic that would need to be accommodated from the north is likely to be greater.

10.6.4 Work Stage 4 Sequence of Construction

The suggested sequence of construction for Work Stage 4 is as follows:

- Close New Canal Street outbound lane between Fazeley Street and Bordesley Street (Bordesley Street junction open). Widen/realign Fazeley Street on the outbound side and construct outbound track and highway/surface finishes.
- Close Meriden Street/ High Street Deritend junction and demolish the Birmingham South of City College Building.
- Close Meriden Street inbound lane from north of Coventry Street to the High Street Deritend closure. Construct inbound track and highway/surface finishes
- Open Fazeley Street outbound lane and close inbound. Construct inbound track and highway/surface finishes.
- Open Meriden Street inbound lane between High Street Deritend to north of Coventry Street) Close outbound and construct outbound track and highway/surface finishes.
- Open Fazeley Street junctions and close Meriden Street through the railway under bridge. Carry out any works required to the under bridge.
- Open Coventry Street junction and close Bordesley Street junction outbound lane. Construct track, tram stop and highway/surface finishes on the outbound side.
- Open outbound lane on Bordesley Street junction and close inbound. Construct track, tram stop and highway/surface finishes on inbound side.

If HS2 is not on site the general sequence of construction above should not be affected.

10.7 Work Stage 5

10.7.1 Key Elements

Work Stage 5 is the extent of High Street Deritend from the junction with Meriden Street eastwards to the junction with Heath Mill Lane:

- Highway widening/realignment to accommodate the tram.
- New twin track throughout the section.

- Structural works to the River Rea over bridge.
- Tram Stop platform close to the junction with Milk Street.

10.7.2 Traffic Management

As stated in 4.4, High Street Deritend is a major artery and bus route in to the City Centre and any work on this carriageway is likely to cause significant disruption to traffic both locally and on the wider highway network. It is assumed that no work will be permitted within the High Street Deritend corridor during the BCC blockade and that the sections of track crossing the outbound carriageway at Meriden Street will be constructed over the summer months (mid-July to September where possible).

Any traffic management strategy for construction of this section of the route should aim to:

- Encourage traffic on the wider highway network to use alternative routes in to the city centre.
- Provide as much carriageway space as can be made available during construction for remaining traffic using the route.

Extensive alterations to the existing highway will accompany the introduction of the tram on this section which (after crossing the outbound carriageway) will run in the widened centre reserve. Much of the construction of the required highway alterations will need to be put in place to enable the widened centre reserve to be available for construction of the tram.

There are a number of traffic signal junctions on this section of the route which facilitate vehicles from the surrounding side roads to cross the centre reserve on High Street Deritend; notably at the junctions with Meriden Street, Rea Street, and Heath Mill Lane. It is recommended that where feasible and alternative routes are available then as many of these crossing points should be closed to facilitate construction. It is anticipated, however, that this will not be possible and that:

- Temporary traffic lights will have to be provided at these crossings; and
- Construction phased in order that the crossing points can be maintained during construction.

No details are currently available for any structural works required for the River Rea over bridge. It has been assumed at this stage that any works required will not significantly affect traffic in this section beyond that which will be caused by the changes to the highway and construction of the tram infrastructure. The Report should be updated once more information is available on the structural works required.

10.7.3 Maintenance of Vehicular and Pedestrian Access

As the tram is located mainly within the centre reserve in this section, once the necessary highway works have been completed to facilitate construction of the track, then there should be little problem in maintaining vehicular access to the premises either side of the dual carriageway. Any disruption that does occur will be during the construction of the highway works and should be relatively short lived. Fortunately, the numbers of premises that currently have direct vehicular access from High Street Deritend are few

within this section of the route and are present only on the outbound carriageway. Access to and from the Coach Station on the south side of the carriageway will, of course, be a priority and will need to be maintained for both vehicles and pedestrians.

The changes to the highway within the section incorporate narrowing of the footways in a number of locations and the movement of pedestrians along the carriageway will be disrupted while these works are being carried out. In addition, the existing pedestrian crossing facilities at the various traffic signals along the section will have to be replaced by temporary facilities during construction of both the highway changes and the tram infrastructure. These temporary facilities will also need to be relocated from time to time to accommodate the ongoing construction.

10.7.4 Work Stage 5 Sequence of Construction

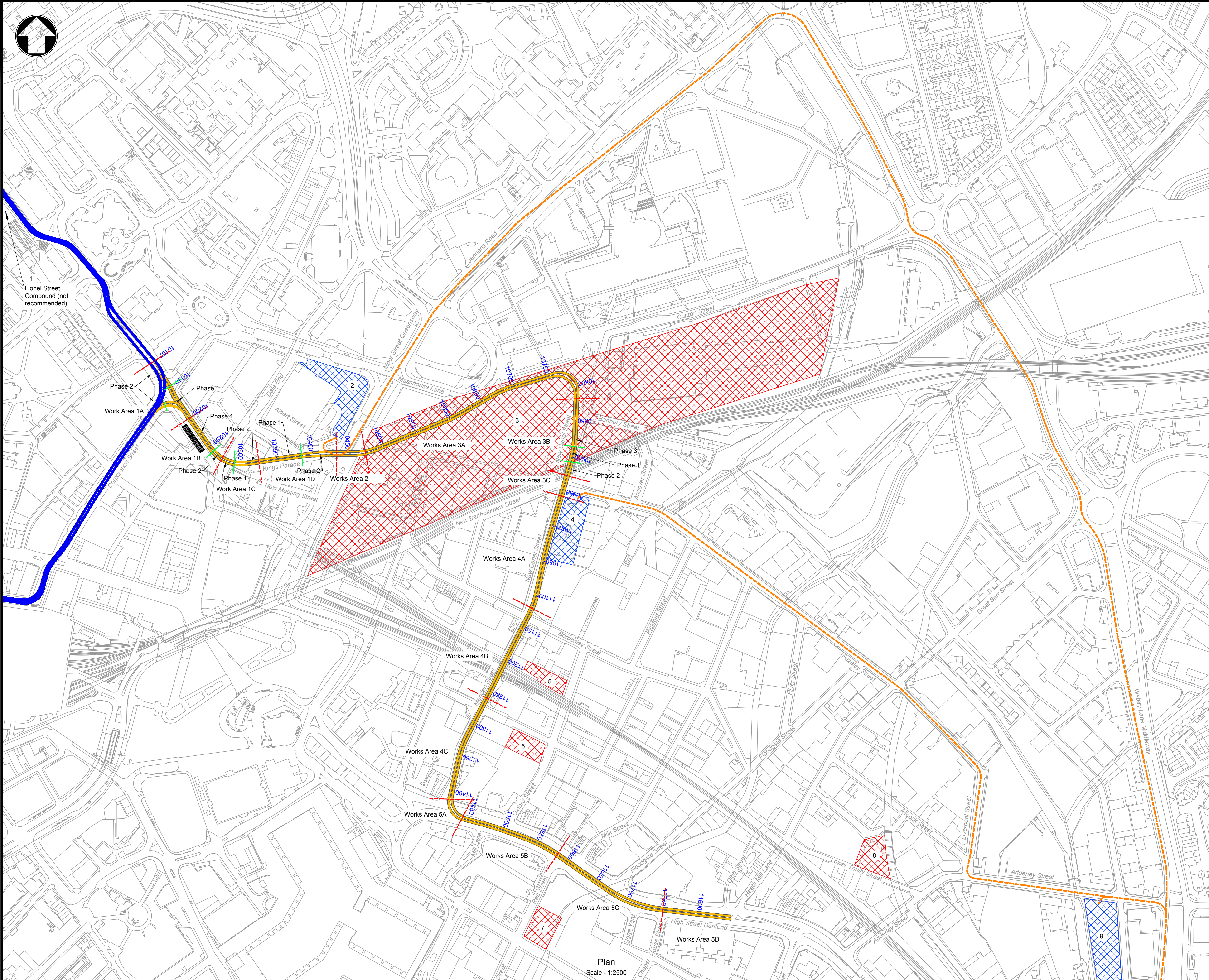
The construction in Work Stage 5 will be particularly problematic due to the levels of through traffic that will have to be dealt with. The phasing of construction will need, therefore, to be such that as much space as possible is available for vehicles using the route. As stated in Section 4 and 10.7.2 above, no details are available at this stage for the works that will be required to the River Rea over bridge. It has been assumed for the purposes of this Report that these works will be limited to and can be accommodated within an area that does not extend significantly beyond the tram corridor above the watercourse. If more extensive works subsequently prove to be required then the Report will need to be updated.

Bearing this in mind, the general sequence for Work Stage 5 is expected to be as follows (Note the demolitions and highway works required at the junction with Meriden Street are dealt with in Work Stage 4):

- Divert Services (this work is assumed to be complete prior to the Contractor taking over the site).
- Carry out highway accommodation works to enable the carriageways and centre reserve to be widened to facilitate construction of the tram. This will include the provision of temporary traffic lights at the junctions where traffic crosses the centre reserve.
- Carry out any works required to the River Ray over bridge.
- Construct the track crossing the carriageway from Meriden Street (construction to take place in two phases over the summer months (mid-July to September where possible)).
- Construct the track in the centre reservation, phasing the works in a manner that enables the temporary traffic signal junctions within the section to remain operational
- Construct the Tram Stop adjacent to Milk Street.
- Erect OLE.
- Complete highway and tram accommodation works.

If HS2 is not on site, it is not expected that the traffic management/ access requirements or the sequence of construction in this Work Stage will be affected.

Appendix A. Construction Sequencing Drawings



Notes

1. All dimensions are in metres unless otherwise stated.
2. Do not scale any items or information from this drawing.
3. To be read in conjunction with High Street Deritend Construction Strategy Report and Programme.

Key to symbols

- High Street Deritend Route
- Birmingham City Centre Extension (BCCE)
- Work Areas Boundary
- Traffic Routes
- Work Stage Phasing Sequence Marker
- Potential Compound Site
- Recommended Compound Site

Reference drawings

P2	19/11/2015	JK	Route Ammended.	CMS	GJL
P1	17/11/2014	AG	Preliminary Issue	CMS	GJL
Rev	Date	Drawn	Description	Ch'k'd	App'd

1st/2nd Floors
35 Newhall Street
Birmingham
B3 3PU
United Kingdom
T +44 (0) 121 234 1500
F +44 (0)121 200 3295
W www.mottmac.com

transforming public transport

Client

Centro
Centro House
16 Summer Lane
Birmingham
B19 3SD

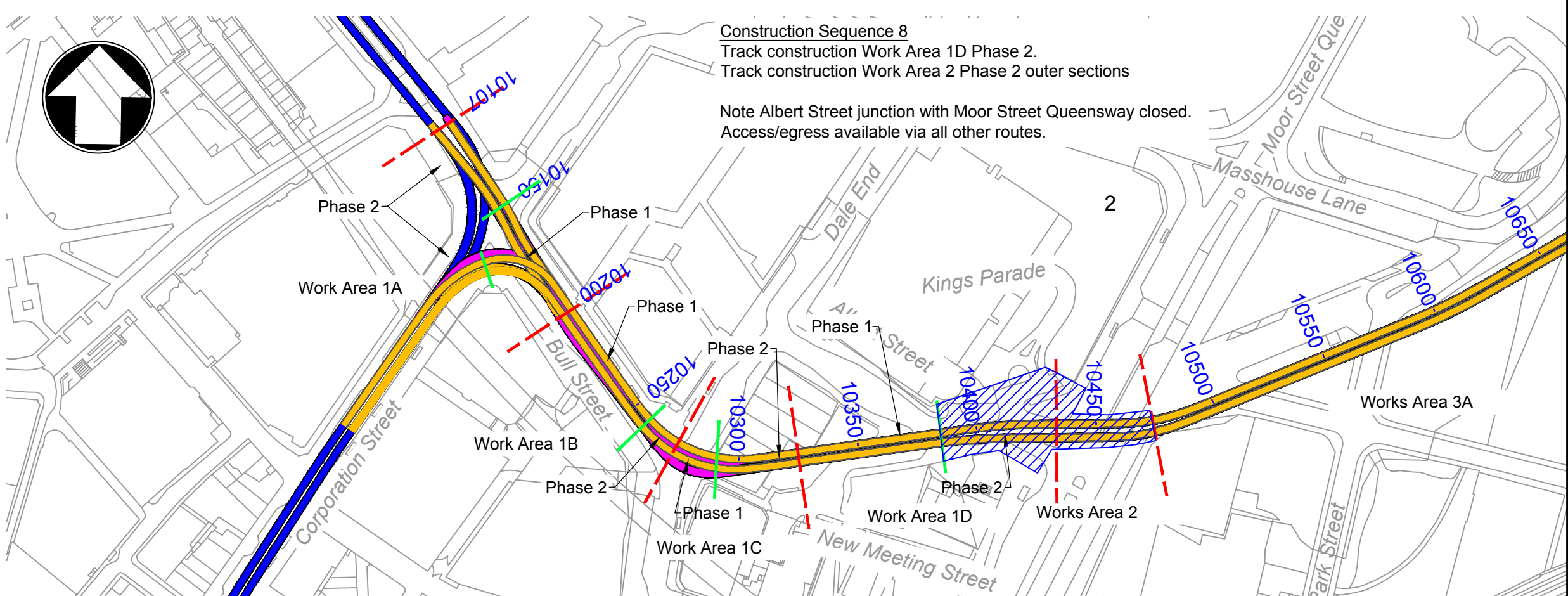
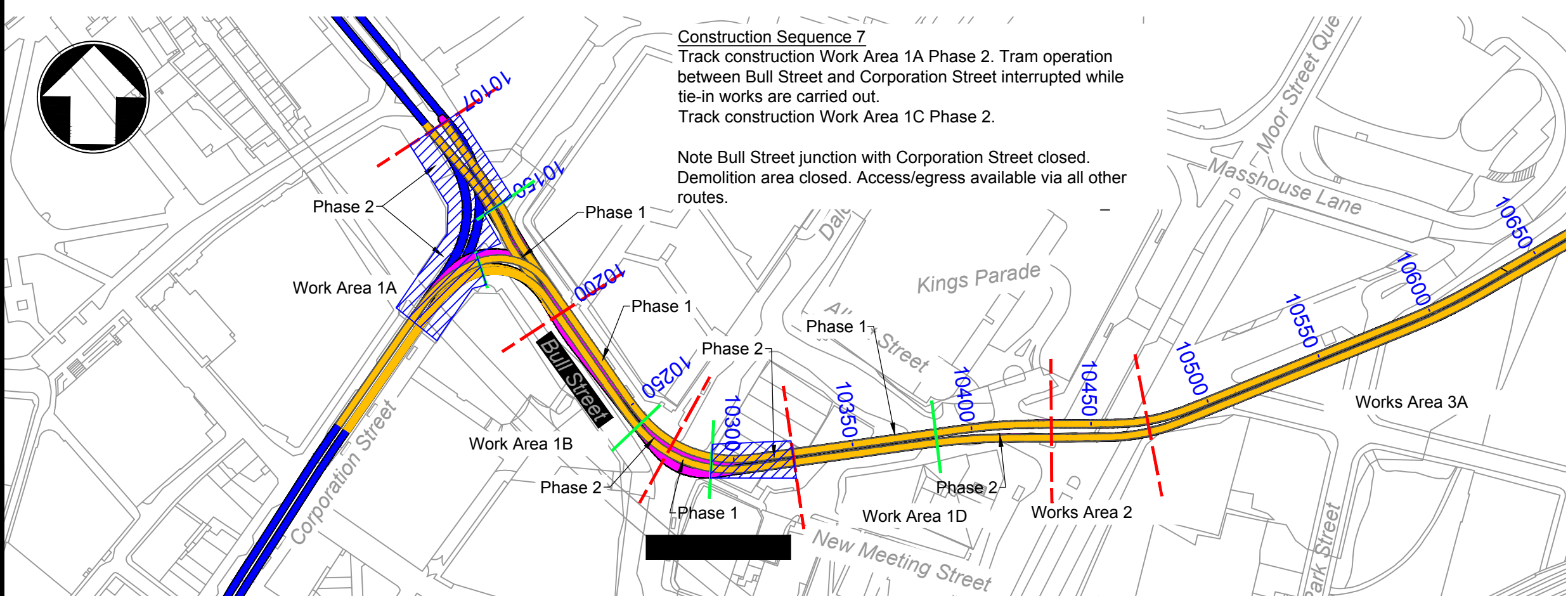
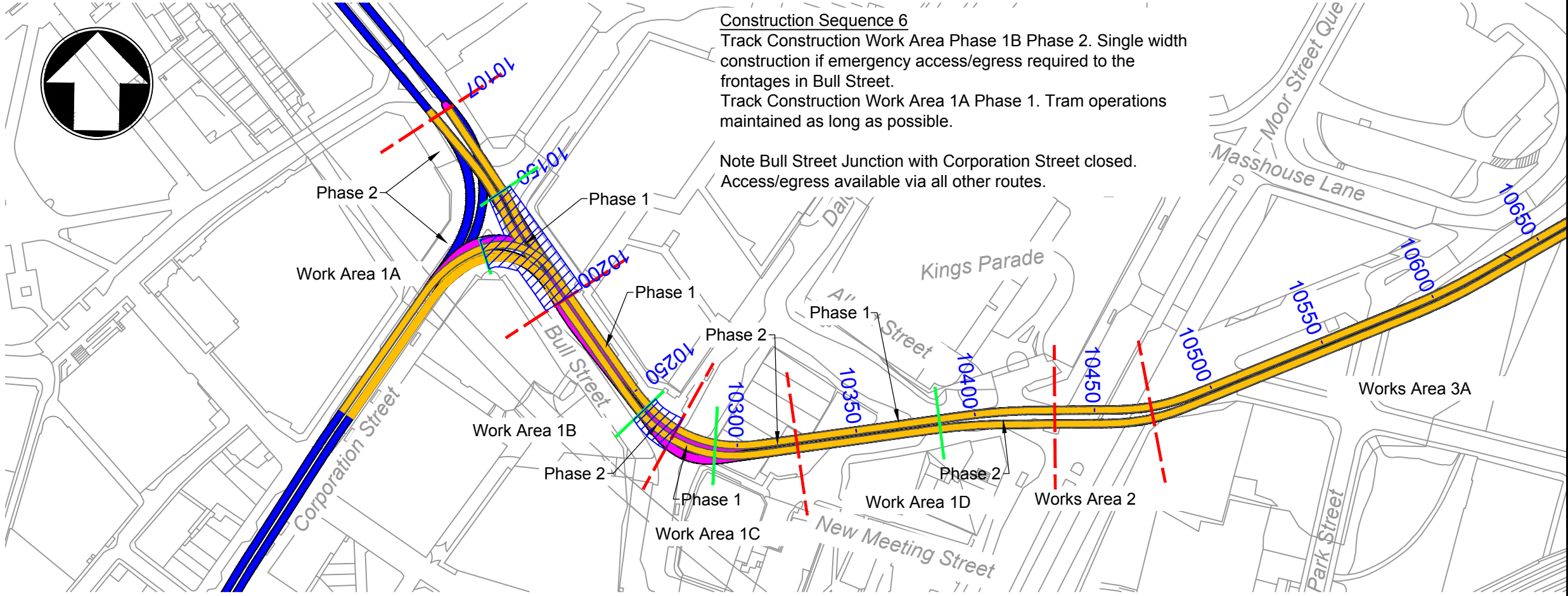
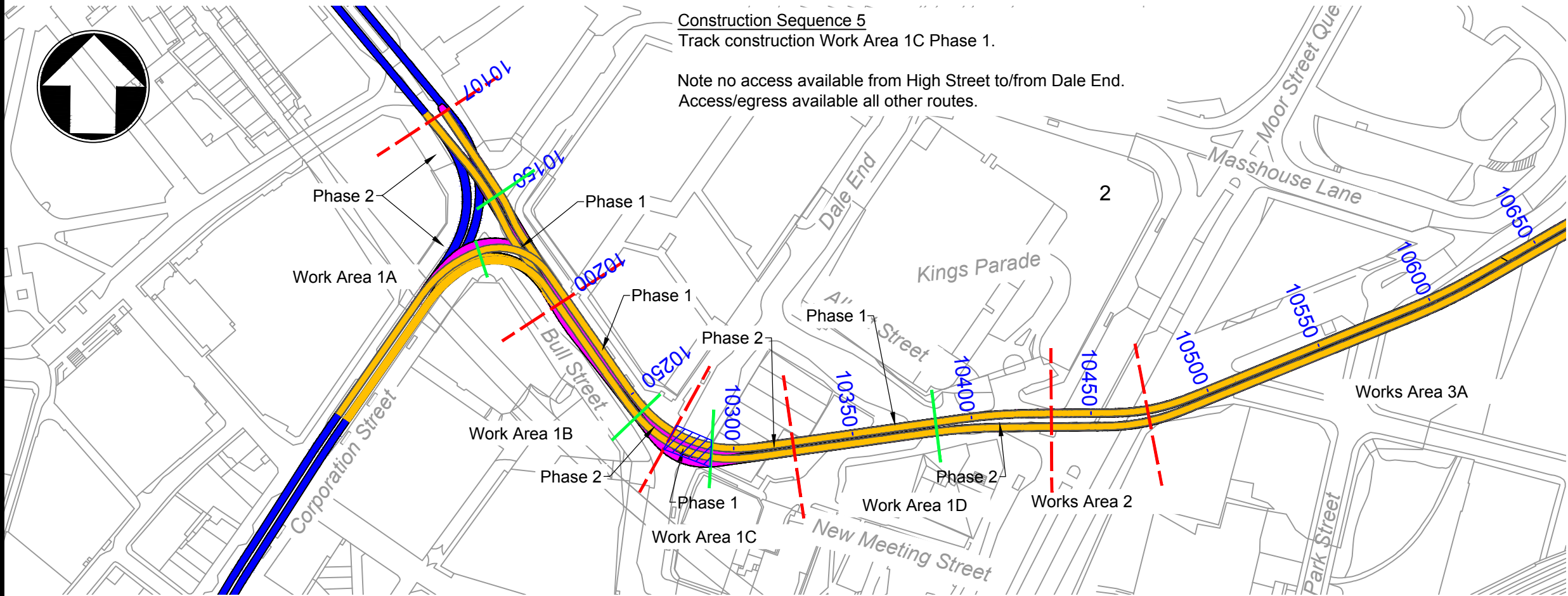
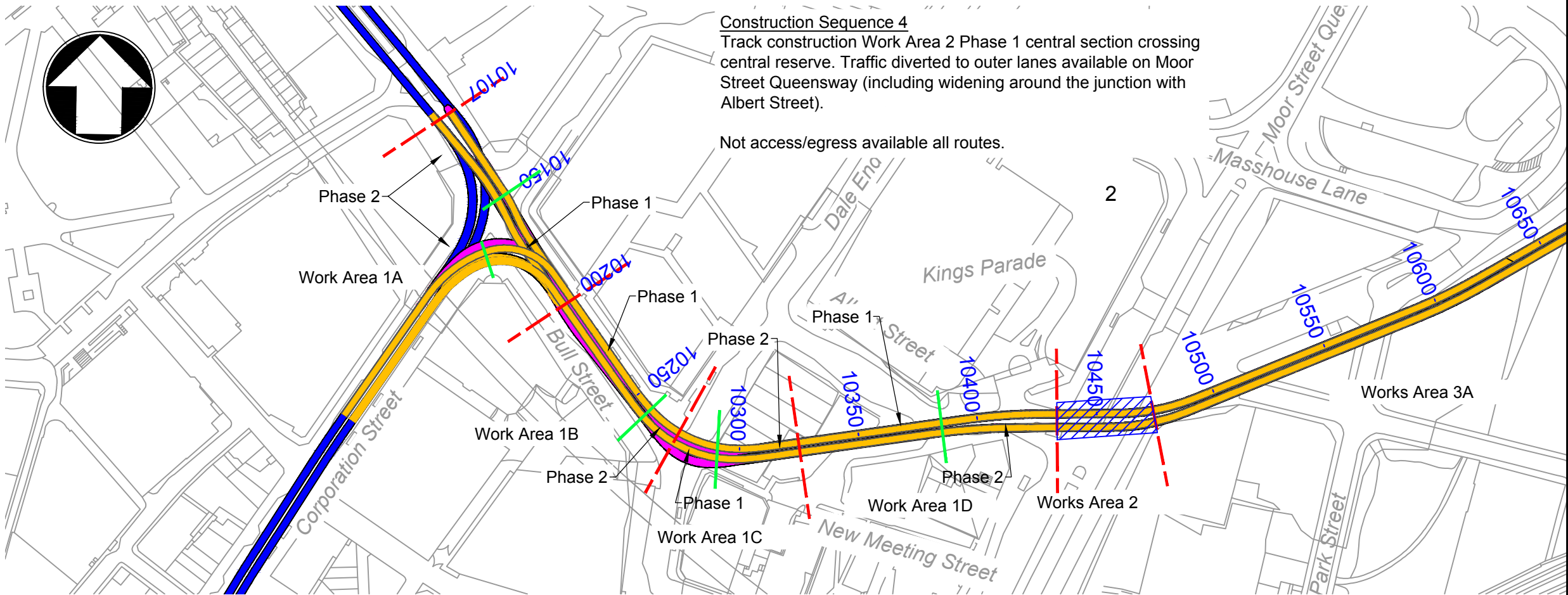
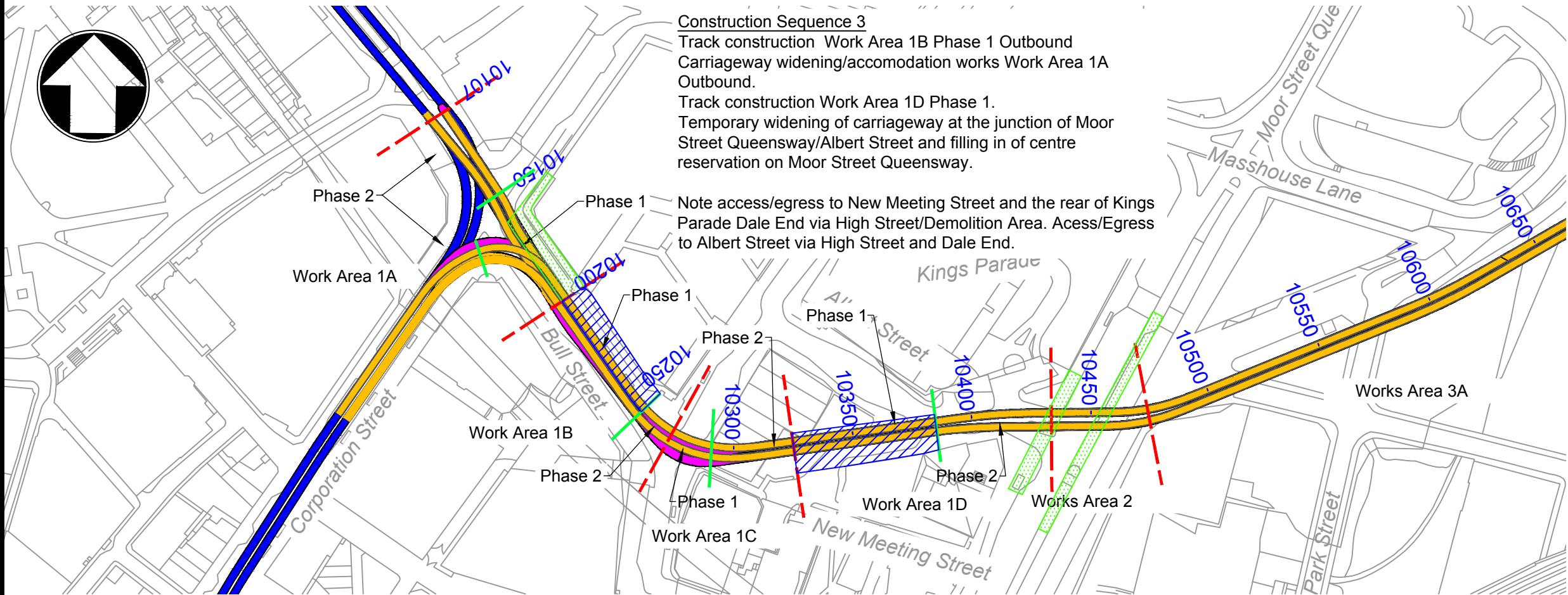
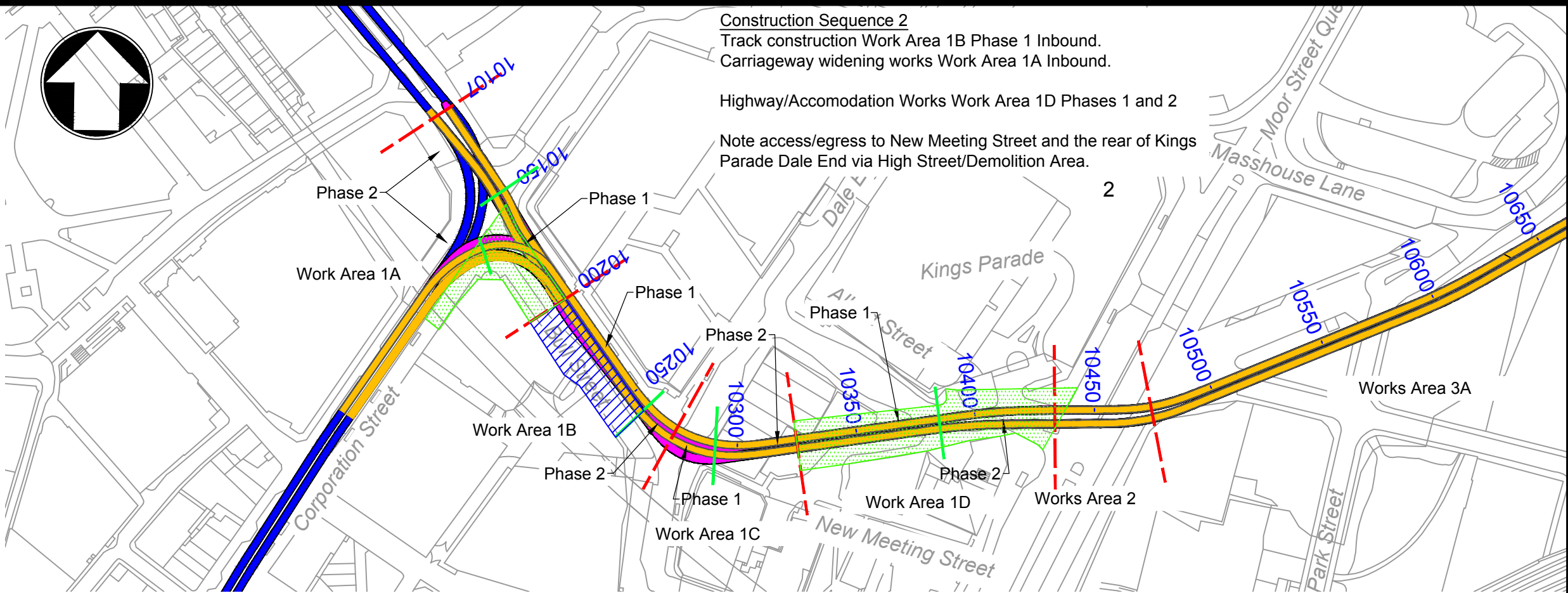
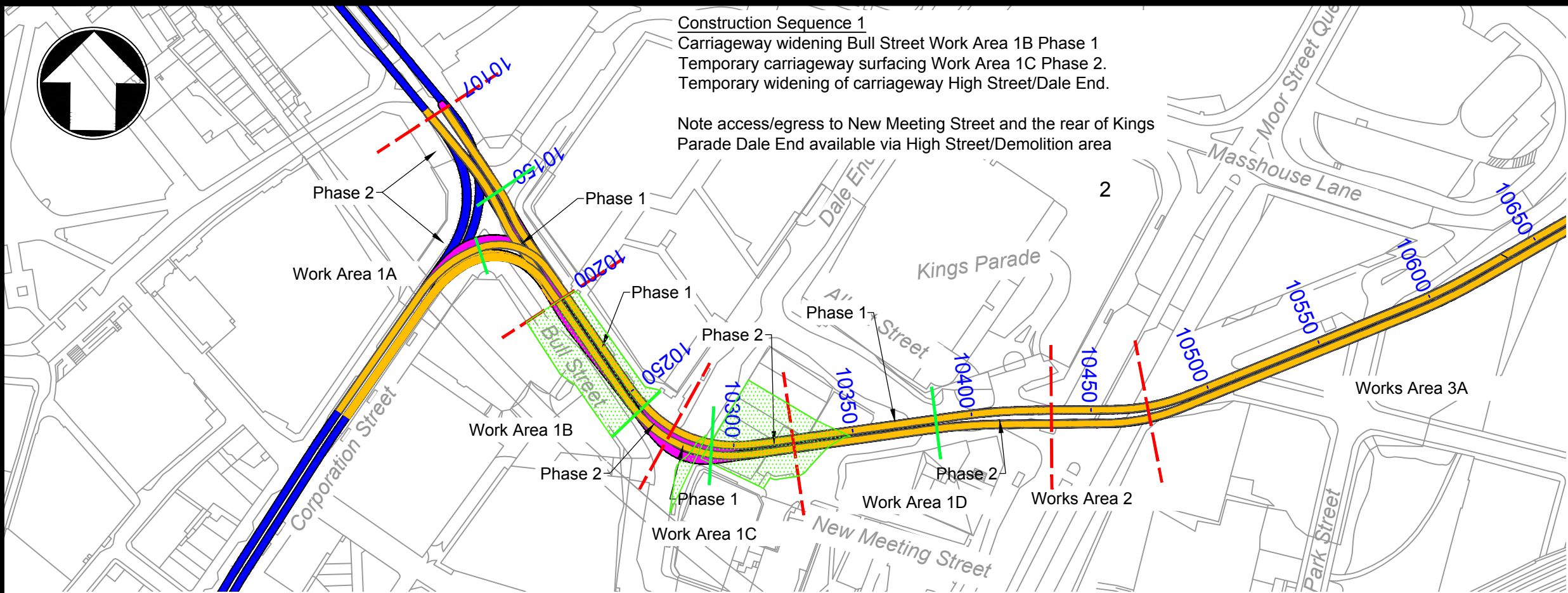
Title

Midland Metro Phase 2
Birmingham Eastside Extension
Construction Strategy Work Areas
High Street Deritend

Designed	J. Ship	JJS	Eng check	C. Seanson	CMS
Drawn	A.Griffiths	AG	Coordination	C. Seanson	CMS
Dwg check	M Donovan	MWD	Approved	G. Last	GJL
Scale at A1	Status	Rev			
1:2500	PRE	P2			

Drawing Number

MMD-300207-HS16-DRA-0000-0002



Notes

1. All dimensions are in metres unless otherwise stated.

2. Do not scale any items or information from this drawing.

3. To be read in conjunction with High Street Deritend Construction Strategy Report and Programme.

Key to symbols

Track construction works

Accommodation/Temporary works

Reference drawings

P1	20.11.15	JK	Preliminary Issue	CS	GJL
Rev	Date	Drawn	Description	Ch'k'd	App'd

Mott MacDonald

1st/2nd Floors
35 Newhall Street
Birmingham
B3 3PU
United Kingdom
T +44 (0) 121 234 1500
F +44 (0)121 200 3295
W www.mottmac.com

centro

transforming public transport

Client

Centro
Centro House
16 Summer Lane
Birmingham
B19 3SD

Title

Midland Metro Phase 2
Birmingham East Extension
Construction Strategy Work Areas
Work Areas 1 and 2 Phasing

Designed	J. Ship	Eng check	C. Seanson
Drawn	J. Kirby	Coordination	C. Seanson
Dwg check	A.Griffiths	Approved	G. Last

Scale at A1	Status	Rev
1:2000	PRE	P1

Drawing Number

MMD-300207-HS16-DRA-0000-0003

This document is issued for the party which commissioned it and for specific purposes connected with the captioned project only. It should not be relied upon by any other party or used for any other purpose. We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

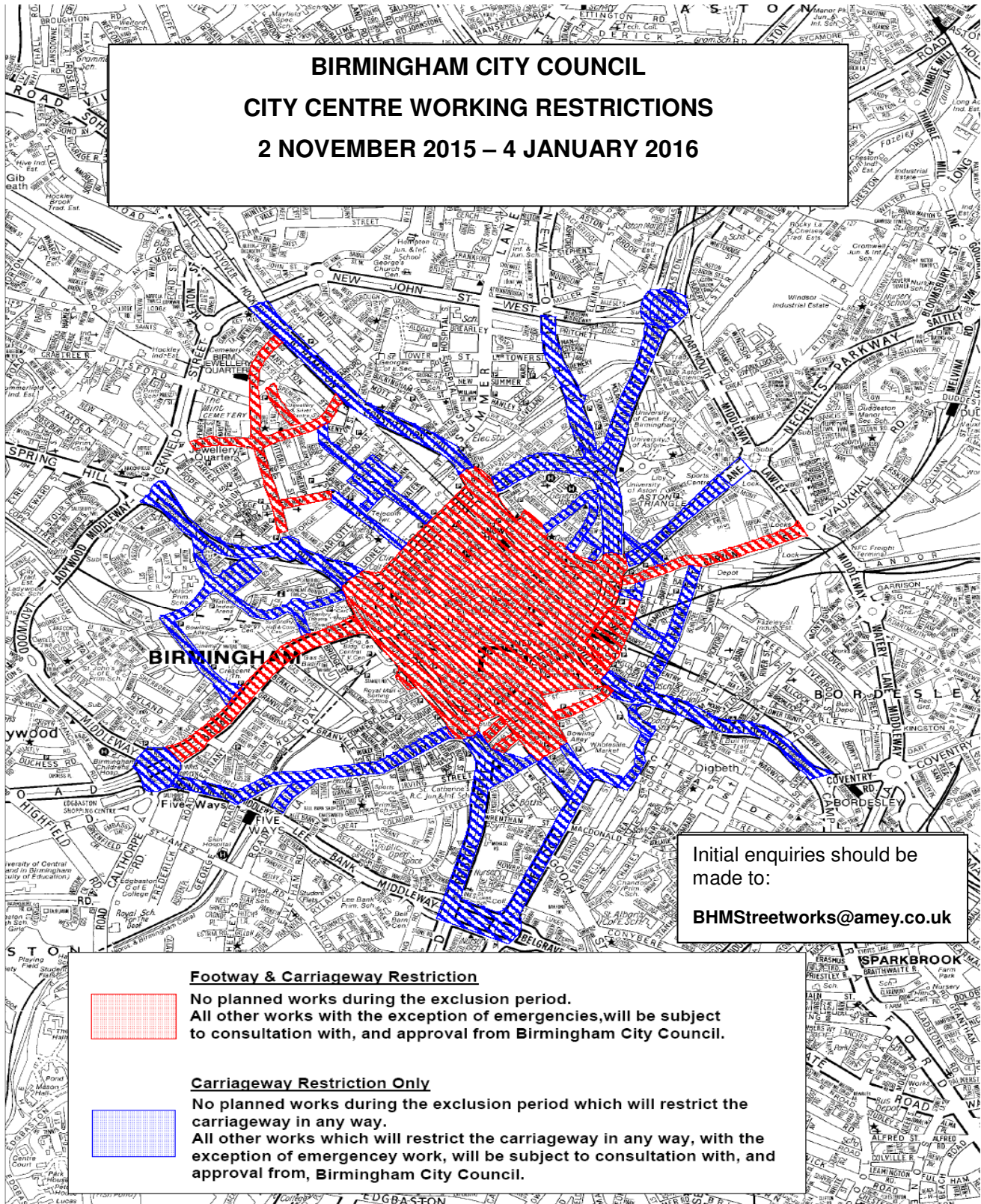
Reproduced from the Ordnance Survey base map with permission of the Controller of Her Majesty's Stationery Office. Crown Copyright Licence No. 01100019543. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or Civil Proceedings

0 10m 20m
1:200

BIRMINGHAM CITY COUNCIL
CHRISTMAS & NEW YEAR WORKING RESTRICTIONS

Start of the First Week in November through to First week in January

Due to the increase in vehicular and pedestrian movements during and the adverse affect highway restrictions will have on trading during the Christmas period the City Council have imposed restrictions in the City Centre. The plan shown below identifies the roads which are restricted. The start date and end date of restrictions will vary from year to year.



Appendix B. Preliminary Construction Programme

ID	Task Name	Duration	Start	Finish	Last Progress	Predecessors	Successors	Resource Name	1 Jan 2021	1 Jun 2021	1 Oct 2021	1 Dec 2021	1 Jan 2022
1	East Side Extension Construction Strategy Programme(HS2 On Site)	483 days	Mon 01/03/20	Fri 21/01/22	Fri 15/04/22								
2	BCO Blockade 2020/2021	36 days	Mon 16/11/20	Fri 20/01/21	Fri 20/01/21	78,245.38	64,821.5	248					
3	BCO Blockade 2021/2022	40 days	Mon 15/11/21	Fri 21/01/22	Fri 21/01/22	107,86,70,50,31,2055	261						
4	Complete Mobilisation	5 days	Mon 01/03/20	Mon 02/03/20	Mon 02/03/20		5,7						
5	Works Area 1 - Corporation Street to Moor Street Quayside (Ch1020m to Ch10425m (318m))	414 days	Mon 02/03/20	Fri 18/11/21	Fri 15/04/22								
6	Accommodation Works	101 days	Mon 02/03/20	Fri 24/07/20	Fri 24/07/20								
7	Site Preparation and TM	5 days	Mon 02/03/20	Fri 06/03/20	Fri 06/03/20		8						
8	Full Street Accommodation Works (Carriageway Works Required for Work Stage 1B)	27 days	Mon 02/03/20	Fri 05/04/20	Fri 05/04/20	35,129,882	17	Road Works 1					
9	Demolition Nos. 1-5 Date End Temporary Carriageway Widening H2	20 days	Mon 02/03/20	Fri 05/04/20	Fri 05/04/20	855	10	Demolition 1					
10	Temporary Surfacing Works Demolition Area Nos. 1-5 Date End Temporary Carriageway Widening H2	5 days	Mon 02/03/20	Tue 14/04/20	Fri 14/04/20	9	11	Road Works 1					
11	New Meeting Street Street Street Accommodation Works	27 days	Mon 02/03/20	Fri 05/04/20	Fri 05/04/20	10	12	Road Works 1					
12	Carriageway Widening Bull Street/Corporation Street Junction Inbound Side	14 days	Fri 14/05/20	Thu 04/06/20	Thu 04/06/20	35,38FF J	13	Road Works 1					
13	Full Sideway Ramp/Carriageway Widening Bull Street/Corporation Street Junction Outbound Side	20 days	Mon 02/03/20	Fri 05/07/20	Fri 05/07/20	42,12	14,90	Road Works 1					
14	Complete Relining Vial Outbound Side	15 days	Mon 02/03/20	Fri 24/07/20	Fri 24/07/20	13,112,0FF	17	Structure 1					
15	Work stage 1A Ch10107m to Ch 10200m (39m)	107 days	Thu 14/03/21	Fri 01/01/21	Fri 15/04/22								
16	Phase 1 - Bull Street Turn-Offs	48 days	Thu 14/03/21	Thu 27/05/21	Thu 14/03/21								
17	Close Bull Street and Corporation Street Junction (BOCE Tram Operation)	1 day	Thu 14/03/21	Thu 14/03/21	Thu 14/03/21	14	18,48						
18	OLE Foundations	5 days	Tue 09/03/21	Mon 15/03/21	Mon 15/03/21	17	19						
19	Excavation, Draining, Ducting and Prepare Formation	10 days	Tue 09/03/21	Mon 22/03/21	Mon 22/03/21	18	20						
20	Track site and Rails	35 days	Tue 09/03/21	Thu 05/05/21	Thu 05/05/21	19,52	21,25FF,26	Track 1					
21	Track and Surface Finishes	15 days	Fri 01/05/21	Thu 27/05/21	Thu 15/07/21	20	29						
22	Temporarily Terminate Tram Service Between Bull Street and Corporation Street	68 days	Mon 08/03/21	Fri 04/06/21	Fri 04/06/21								
23	OLE Foundations	5 days	Tue 30/03/21	Wed 07/04/21	Wed 21/04/21	25	25						
24	Excavation, Draining, Ducting and Prepare Formation	10 days	Thu 22/04/21	Thu 05/05/21	Thu 05/05/21	26,29FF	26						
25	Track site and Rails	35 days	Fri 07/05/21	Fri 11/06/21	Fri 11/06/21	25,20	27,27	Track 1					
26	Track and Surface Finishes	15 days	Mon 14/06/21	Fri 02/07/21	Thu 15/07/21	26	28,29						
27	Remove Tram Service Between Bull Street and Corporation Street	5 days	Fri 02/07/21	Fri 02/07/21	Fri 02/07/21	27	29						
28	Open Bull Street and Corporation Street on West and South Sides of Junction	5 days	Fri 02/07/21	Fri 02/07/21	Fri 16/07/21	27,21	99,30,31						
29	Completion of Highway/Streetworks Works Work Stage 1A	30 days	Mon 08/07/21	Fri 30/07/21	Fri 17/09/21	29	31						
30	OLE Work Stage 1A	10 days	Mon 22/07/21	Fri 27/07/21	Fri 27/07/21	30	53,3	OLE1					
31	Work stage 1B Ch10200m to Ch 10275m (75m)	373 days	Wed 15/04/20	Fri 15/01/21	Fri 15/01/21								
32	Phase 1 Ch10200m to Ch10250m	71 days	Wed 15/04/20	Fri 24/07/20	Fri 24/07/20								
33	Inbound Track Ch10250m to Ch10250m (50m)	37 days	Wed 15/04/20	Fri 24/07/20	Fri 24/07/20								
34	Site Preparation and TM	5 days	Wed 15/04/20	Wed 15/04/20	Wed 15/04/20	8	36,12						
35	OLE Foundations	5 days	Wed 15/04/20	Tue 21/04/20	Tue 21/04/20	35	37						
36	Excavation, Draining, Ducting and Prepare Formation	10 days	Wed 15/04/20	Wed 06/05/20	Wed 06/05/20	36	38						
37	Track site and Rails	35 days	Wed 15/04/20	Wed 20/05/20	Wed 20/05/20	37	39,139	Track 1					
38	Track and Surface Finishes	10 days	Thu 07/05/20	Thu 04/06/20	Thu 04/06/20	38	12FF,40						
39	Switch Traffic From Outbound to Inbound	5 days	Thu 24/05/20	Thu 04/06/20	Thu 04/06/20	39	41						
40	Outbound Track Ch10250m to Ch10260m (50m)	36 days	Fri 05/06/20	Fri 24/07/20	Fri 24/07/20								
41	Site Preparation and TM	1 day	Fri 05/06/20	Fri 05/06/20	Fri 05/06/20	40	43,13						
42	OLE Foundations	5 days	Tue 09/06/20	Mon 15/06/20	Mon 15/06/20	42	44						
43	Excavation, Draining, Ducting and Prepare Formation	10 days	Tue 09/06/20	Mon 22/06/20	Mon 22/06/20	43	45						
44	Track site and Rails	35 days	Tue 09/06/20	Mon 29/06/20	Mon 29/06/20	43	45						
45	Track and Surface Finishes	10 days	Tue 23/06/20	Mon 13/07/20	Mon 13/07/20	43,77	46,14	Track 1					
46	Remove TM From Bull Street	5 days	Tue 16/07/20	Fri 24/07/20	Fri 24/07/20	45	47						
47	Phase 2 Ch10260m to Ch10275m (15m) Bull Street Closed	37 days	Fri 14/03/21	Wed 14/04/21	Fri 03/09/21	47	51,49FF						
48	Site Preparation and TM	5 days	Fri 14/03/21	Mon 01/03/21	Mon 01/03/21	49	51						
49	OLE Foundations	5 days	Tue 23/03/21	Mon 15/03/21	Mon 15/03/21	50	52						
50	Excavation, Draining, Ducting and Prepare Formation	10 days	Tue 23/03/21	Mon 22/03/21	Mon 22/03/21	51,119	53,20	Track 1					
51	Track site and Rails	35 days	Tue 23/03/21	Wed 14/04/21	Fri 03/09/21	52	54						
52	Track and Surface Finishes	10 days	Thu 15/04/21	Thu 15/05/21	Fri 01/09/21	53	55						
53	Completion of Highway/Streetworks Works Work Stage 1B	30 days	Mon 08/07/21	Fri 30/07/21	Fri 17/09/21	53	74,3	OLE1					
54	OLE Work Stage 1B	10 days	Mon 22/07/21	Fri 27/07/21	Fri 27/07/21	54	74,3	OLE1					
55	Work stage 1C Ch10275m to Ch10280m (50m)	282 days	Fri 01/09/20	Fri 22/01/21	Fri 15/04/22								
56	Phase 1 Ch10275m to Ch10275m (15m)	37 days	Tue 01/09/20	Wed 21/09/20	Fri 15/04/22	46							
57	Site Preparation and TM/Close Junction (Access Via Albert Street)	5 days	Tue 01/09/20	Wed 02/09/20	Wed 02/09/20	78,97	59						
58	OLE Foundations	5 days	Thu 03/09/20	Wed 09/09/20	Wed 09/09/20	58	60						
59	Excavation, Draining, Ducting and Prepare Formation	10 days	Thu 03/09/20	Wed 23/09/20	Wed 23/09/20	59	61						
60	Track site and Rails	35 days	Thu 03/09/20	Wed 07/10/20	Wed 07/10/20	60,68	62,31	Track 1					
61	Track and Surface Finishes	10 days	Thu 03/09/20	Wed 07/10/20	Wed 07/10/20	61	62						
62	Phase 2 Demolition Area Ch10280m to Ch10285m (55m)	113 days	Mon 11/03/21	Wed 21/03/21	Fri 15/04/22	61							
63	Site Preparation and TM	5 days	Mon 11/03/21	Tue 16/03/21	Tue 16/03/21	246	65						
64	OLE Foundations	5 days	Wed 16/03/21	Thu 25/03/21	Thu 25/03/21	64	66						
65	Excavation, Draining, Ducting and Prepare Formation	10 days	Fri 12/03/21	Fri 11/06/21	Fri 11/06/21	65	67						
66	Track site and Rails	35 days	Mon 15/06/21	Fri 02/07/21	Fri 02/07/21	66,68	68,69	Track 1					
67	Track and Surface Finishes	10 days	Mon 06/07/21	Fri 16/07/21	Fri 16/07/21	67	100,69						
68	Completion of Highway/Streetworks Works	30 days	Mon 16/07/21	Fri 13/08/21	Fri 13/08/21	68	70						
69	OLE Work Stage 1C	5 days	Mon 16/07/21	Fri 22/07/21	Fri 22/07/21	68,65	88,3	OLE1					
70	Work stage 1D Ch10285m to Ch 10435m (110m)	348 days	Thu 14/05/20	Fri 05/11/21	Fri 15/04/22								
71	Track Construction	37 days	Thu 14/05/20	Fri 05/11/21	Fri 15/04/22								
72	Phase 1 Ch10350m to Ch10350m (50m) New Meeting Street	17 days	Thu 14/05/20	Mon 17/06/20	Fri 15/04/22								
73	Site Preparation and TM (Access Via High Street/Demolition Area)	2 days	Thu 14/05/20	Fri 15/05/20	Fri 15/05/20	71	75						
74	OLE Foundations	5 days	Mon 14/05/20	Fri 22/05/20	Fri 22/05/20	74	76						
75	Excavation, Draining, Ducting and Prepare Formation	10 days	Tue 26/05/20	Mon 06/06/20	Mon 06/06/20	75	77						
76	Track site and Rails	35 days	Tue 26/05/20	Mon 29/06/20	Mon 29/06/20	76,139	78,45	Track 1					
77	Track and Surface Finishes	10 days	Tue 26/05/20	Mon 29/06/20	Mon 29/06/20	77	79,55						
78	Completion of Highway/Streetworks Works	30 days	Tue 21/07/20	Mon 17/08/20	Fri 15/04/22	78							
79	Phase 2 Ch10350m to Ch10355m (50m) Albert Street	51 days	Fri 14/07/21	Mon 27/08/21	Fri 04/10/21								
80	Close Main Street/Albert Street Junction	1 day	Fri 14/07/21	Fri 14/07/21	Fri 14/07/21	80	8255,10						
81	Site Preparation and TM	2 days	Fri 14/07/21	Mon 19/07/21	Tue 26/07/21	2,8155	83						
82	OLE Foundations	5 days	Tue 30/07/21	Mon 26/07/21	Thu 05/08/21	82	84						
83	Excavation, Draining, Ducting and Prepare Formation	10 days	Mon 06/08/21	Mon 06/08/21	Fri 11/08/21	83	85						
84	Track site and Rails	35 days	Mon 06/08/21	Mon 06/08/21	Fri 11/08/21	84,103	86	Track 1					
85	Track and Surface Finishes	10 days	Tue 09/08/21	Mon 27/08/21	Fri 01/09/21	85	87						
86	Completion of Highway/Streetworks Works Work Stage 1D	30 days	Tue 24/08/21	Mon 19/09/21	Fri 15/04/22	86	88						
87	OLE Work Stage 1D	10 days	Mon 25/09/21	Fri 05/11/21	Fri 05/11/21	87,70	3,107	OLE1					
88	Works Area 2 - Moor Street Quayside Ch10425m to Ch10475m (35m)	337 days	Mon 06/07/20	Fri 12/11/21	Fri 12/11/21								
89	Temporary Road Widening Around Bull Street Junction and Filling in of the Centre Reserve on Moor Street Quayside Inland TM	15 days	Mon 06/07/20	Fri 24/07/20	Fri 24/07/20	13	93	Road Works 1					
90	Track Construction	30 days	Mon 27/07/20	Fri 12/11/21	Fri 12/11/21								
91	Phase 1 - Centre Reserve Area	35 days	Mon 27/07/20	Fri 08/08/20	Mon 14/11/20								
92	Site Preparation and TM	5 days	Mon 27/07/20	Mon 27/07/20	Mon 27/07/20	92,47	94						
93	OLE Foundations	5 days	Mon 27/07/20	Fri 13/07/20	Fri 13/07/20	93	95,85						
94	Excavation, Draining, Ducting and Prepare Formation	5 days	Mon 27/07/20	Fri 13/07/20	Fri 13/07/20	94,65	96						
95	Track site and Rails	35 days	Mon 02/08/20	Fri 14/08/20	Fri 14/08/20	95,144	97,61	Track 1					
96	Track and Surface Finishes	10 days	Mon 17/08/20	Fri 26/08/20	Fri 26/08/20	96	110FF,58,58						
97	Re-establish 3 Lanes in Each Direction on Moor Street Quayside	5 days	Fri 08/09/20	Fri 08/09/20	Mon 14/11/20	97	2						
98	Phase 2 Outer Sections Either Side of Centre Reserve Area	31 days	Mon 14/07/21	Tue 31/08/21	Fri 03/09/21	29							
99	Site Preparation and TM	5 days	Mon 14/07/21	Fri 23/07/21	Fri 23/07/21	68,81	101						
100	OLE Foundations	5 days	Mon 28/07/21	Fri 23/07/21	Fri 23/07/21	100	102,85						
101	Excavation, Draining, Ducting and Prepare Formation	5 days	Mon 28/07/21	Fri 30/07/21	Fri 30/07/21	101,55	103						