Midland Metro Phase 1
Centenary Square Square
Extension
Construction Strategy
MMD-300207-CS28-DOC-0000-0001 Rev A
March 2014
Centro
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Centenary Square Extension

Construction Strategy
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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 the next stage of this route, the Centenary Square Extension (CSQE).

The CSQE will run for approximately 0.8 km from Stephenson Street, along Pinfold Street, Paradise Street, around Paradise Circus onto Broad Street, terminating alongside Centenary Square. The proposed route is shown on Drawing No. MMD-300207-CS28-DRA-0000-0001 included in Appendix A of this Report, and will include two stops, one in Paradise Street and one at the terminus adjacent to Centenary Square. 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 is currently being expanded to provide the additional stabling and servicing facilities required for the proposed extensions.

1.2 Purpose of Report

An application was made in March 2003 under the Transport and Works Act for powers to construct and operate a Tramway between the existing Snow Hill Stop and Five Ways roundabout. Whilst this application included the length of the BCCE and CSQE, changes that have been required along the CSQE section around Paradise Circus to facilitate developments in the area have led to a further application having to be made for this section. The application was made in December 2013. Subject to a successful application, Centro propose to enter into contract for the construction of the proposed CSQE in 2016.

This report considers the construction methodology for the implementation phase of the CSQE and describes a realistic construction method and likely sequence of work. It also identifies access points and available 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 agreements with the Local Highway Authority, any deviations from the strategy are likely to require the approval of the Highway Authority.

The document is intended to inform 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 1.3 below.
1.3 Sources of Information

This report is based on and should be read in conjunction with the following documents:
- BCCE Code of Construction Practice Part 1 September 2009
- Centenary Square Extension Transport and Works Order 2013.

1.4 Proposed Route

The route of the CSQE continues from the proposed BCCE headshunt on Stephenson Street onto Pinfold Street. The alignment then turns left through the pedestrian area (Victoria Square) at the top of Pinfold Street and passes in front of the Town Hall building where a stop will be located. From here the alignment continues onto the southern section of Paradise Circus which will be reconfigured as part of the Paradise Circus Development. The alignment continues around Paradise Circus and onto Broad Street where it continues along Broad Street to a terminus stop located approximately 150m along Broad Street adjacent to Centenary Square.
2 General Principles

2.1 Code of Construction Practice

A Code of Construction Practice (CoCP) Part 1 has been 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 will be in addition to statutory regulations and the requirements of the Works Information. The Contractor will be required to expand this document into a Code of Construction Practice Part 2. The Contractor, his agents and employees will be required to comply in full with the terms of the Code of Construction Practice and to incorporate its requirements in any contract or sub-contract relating to any aspect of the scheme.

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 corrosion. All practical 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.

2.3 Site Safety

The Contractor will 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 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.
- Provision of adequate footways for pedestrians and carriageways for vehicles around work areas, taking into account the requirements of special needs users.
- 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 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 not be allowed to commence until an agreed traffic management and safety plan has been agreed with the Employer and the Local Highway Authority and implemented for that section.

2.4 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 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.

Each of these issues is considered in more detail in the CoCP and the Environmental Statement.

There are a number of locations where work is to be carried across accesses and building entrances. For a number of these, 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 retail
premises and residential properties, agreements will be required as to when works can be undertaken. Having discussed this matter with the environmental department at BCC, they advise that the work for each entrance will have to be evaluated on a case by case basis. This would aim to balance BCC’s requirements 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.

2.5 Interface with Other Developments

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

2.5.1 Paradise Circus

The redevelopment of Paradise Circus is expected to commence in early 2015. The proposals include redevelopment of the central core together with modifications to the highway network to remove the section of gyratory along the eastern side of the development; the western side becoming two-way. The critical dates for CSQE will be the closure of the eastern side of the gyratory and the availability of the land currently occupied by the University of Birmingham.

Based on current information, the highway modifications to the north of Broad Street, together with the closure of the eastern arm of the gyratory, will be complete in advance of the commencement of CSQE construction.

2.5.2 Arena Central

The Arena Central development comprises the redevelopment of the area bounded by Broad Street / Bridge Street / Holiday Street and Suffolk Street Queensway. Firm dates for the redevelopment are not yet available. The main interaction between the Arena Central development and CSQE will be the works required to the retaining wall between Suffolk Street Queensway and Broad Street which are likely to require access from the Arena Central site and temporary closure of Easy Row pedestrian subway.

2.5.3 Highway Improvement Schemes

A number of highway improvement schemes are proposed within the period 2015 to 2017 which may impact on the construction of CSQE. In close proximity are the Navigation Street Link Road, Holloway Circus Improvement. A number of ring road improvements are planned which will not directly affect the construction of SCQE but may influence temporary traffic diversion routes.
2.6 Public Relations

Centro are already in discussion with frontagers and other parties likely to be affected by the construction works and / or advance utility diversions. 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. It is likely that a similar facility will be necessary for the construction of the CSQE.

2.7 Local Highway Authority Approvals

In order to obtain the necessary approvals for construction of the CSQE, the Contractor will need approvals from Birmingham City Council. Centro will agree with BCC a single principal point of contact for this process. This will enable BCC to give a consistent and coordinated response.

It is anticipated that the majority of planning conditions will have been discharged and approval to the design will be in place prior to commencement of construction.
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 whatever surface finishes are required. The track slab is likely to be of insitu 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 existing structures, a different form of construction may 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.

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 within city centres 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 occasionally 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 Pinfold Street, Paradise Street and Broad Street 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 and levels.

Bearing the above in mind, the following sections briefly describe the general 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.

The existing “Iron Man” and “Watt Boulton Murdoch” statues in Victoria Square and Broad Street respectively will need to be dismantled for relocation.

Details of other 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 extensive hard landscaping in the streets and areas along the route of the proposed tram alignment within the City Centre core. In order to mitigate costs and to maintain the standard of finishes within the City, wherever possible existing hard landscaping materials will be taken up and stored for reuse in the reinstatement of the areas affected.

3.4 Demolition

The demolition that is currently anticipated as part of the scheme is as follows:
- Demolition of part of a retaining wall along the northern edge of Broad Street
- Demolition of part of the Victoria Square wall
- Potential for modification to the BCC House of Sport building steps requiring demolition of the steps and canopy should the building not have been removed as part of the Arena Central development

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

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 are long and will 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 is being 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.
It is anticipated that the majority of diversions will take place in advance of the main construction, commencing in 2014. 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 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, however, 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 trackslab 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).
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 banned from the route (e.g. Pinfold Street) and in other areas the tramway shares the carriageway with vehicular traffic.

Construction of on-street tram track will follow completion of the service diversions, earthworks, drainage and ducting and, depending on the location, will be constructed either over their full width or, where space is limited, in two sections. Where possible the supports for the OLE will 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.

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

Photo 3.1: Slab Beneath Rails Lowered Locally to Enable the Installation of Ducts and Pipes
Sub-base material is laid and compacted prior to the positioning of the reinforcement mesh.

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.

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 being used on the current 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 and stray current protection is completed following installation of the rails.

- A second layer of concrete is poured around the rails to a level that allows for road surfacing to be laid.
New kerbs, parking bays and OLE base supports will be constructed following completion of the slab construction.

The majority of the system is proposed to have an exposed aggregate concrete finish which is introduced as a third concrete pour around the rails. The finish is achieved by retarding the set of final surface.

3.9 Segregated Construction

The tram is located in segregated sections as the alignment passes through Victoria Square and onto Paradise Circus as well as along the centre of Broad Street.

For these sections the tracks are again placed in concrete the same construction procedure as for on-street construction will apply.

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 (e.g. Pinfold Street / Stephenson Street). It is likely that construction can be achieved 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 (e.g. Suffolk Street slip roads and Broad Street / Paradise Circus), however, will be more difficult. 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.

Conflicting road and tram movements will be controlled by signals at the junction between Paradise Circus Queensway and Broad Street where tram alignment crosses the carriageway. The traffic signals to be installed as part of the Paradise Circus development may need to be reconfigured to accommodate the tram. Minor junctions and crossings will be priority controlled. It is anticipated that the traffic signals at Paradise Circus Queensway and Broad Street will be linked to the existing Urban Traffic Control (UTC). Work may be required to the existing control system to accommodate the additional signal controlled junctions.
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.

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 frontager 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.

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 trackform design and/or stray current collection systems in the track-bed.

Installation of OLE will follow completion of the track construction in two stages:
- Erection of the supports.
- Suspension of the contact wire from the OLE supports 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 to utilise building fixings within the City Core where agreement can be reached with building owners and tenants. Where agreements cannot be reached and elsewhere 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.

Although the supports for the contact wire can be erected during the construction of the track if necessary, 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.

Photo 3.2: Typical Overhead Line Equipment (OLE) Wolverhampton Midland Metro
3.13 Stops

Two Stops are proposed for the planned extension. The Stops are likely to be of similar construction thought finishes may vary to reflect the surrounding public realm. Platform construction will begin following completion of the trackwork in each location, with final installation of platform infrastructure and equipment being carried out at the end of the Contract 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 Metro will therefore have to comply with the requirements of the City Council’s Traffic Manager. Traffic management layouts will 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 will be made to maintain access during construction. It should be noted that not all the current on street loading provision will be provided on completion of the scheme (e.g. Pinfold Street). 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 City. By its very nature the area 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 and shoppers. 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 Birmingham 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 be agreed with the Local Highway Authority for the short-term closures or diversions required by works in the highway.
4.2 Construction Traffic

Construction traffic will be of relatively low volumes, but will be located in sensitive parts of the City at times and in places where such traffic is not normal. The city centre now houses large numbers of residential properties, particularly in the area to the south of Broad Street. The construction strategy will need to minimise the effects of construction on these properties, particularly out of normal working hours. The strategy will also need to be driven 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 if possible take place during off peak periods. The arrival/departure of vehicles used for transporting excavated, waste or other materials should be carefully managed so that queues of vehicles do not form.

Construction personnel will be encouraged to use public transport to get to work. Parking in the vicinity of the site compounds and work sites is unlikely to be viable. It is envisaged that parking restrictions will be imposed by the Highway Authority and construction personnel will be required to park private vehicles at public car parks within the City Centre. 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.

4.3 Traffic Management Principles

It is currently anticipated that construction works for the CSQE will not commence until the highway works associated with the Paradise Circus development to the north of Broad Street are complete. This will include the removal of the eastern arm of the existing gyratory.

In order to minimise conflicts during the construction of CSQE, it is anticipated that the following permanent closures / restrictions will be put in place before adjacent construction commences:

- Closure of Pinfold Street to all vehicular traffic.
• Closure of the junction of Hill Street and Paradise Street to all vehicular traffic except cyclists.
• Closure of Broad Street between Bridge Street and Paradise Circus to all traffic except buses, hackney cabs and cycles.

Other than as noted above, it is anticipated that two-way traffic flows will be maintained throughout the construction but with reduced numbers of available traffic lanes to allow adjacent construction to take place. It is, however, likely that both the northbound and southbound Suffolk Street Queensway slip roads will need to be closed for periods to allow trackform construction across the entry / exit areas. The highway authority are likely to require this work to be undertaken in the summer months when traffic flows are reduced.

4.4 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>
<thead>
<tr>
<th>Work Stage No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stephenson Street and Pinfold Street</td>
</tr>
<tr>
<td>2</td>
<td>Victoria Square and Paradise Street to the western end of the tramstops</td>
</tr>
<tr>
<td>3</td>
<td>Paradise Street / Paradise Circus intersection</td>
</tr>
<tr>
<td>4A</td>
<td>Northern side of Paradise Circus</td>
</tr>
<tr>
<td>4B</td>
<td>Western side of paradise Circus</td>
</tr>
<tr>
<td>4C</td>
<td>Southern side of Paradise Circus</td>
</tr>
<tr>
<td>5A</td>
<td>Broad Street northern side carriageway widening</td>
</tr>
<tr>
<td>5B</td>
<td>Broad Street southern section</td>
</tr>
<tr>
<td>5C</td>
<td>Broad Street northern side completion</td>
</tr>
</tbody>
</table>

The Work Stages are shown on Drawing No. MMD-300207-CS28-DRA-0000-0001 included in Appendix A of this Report.
The general approach to sequencing of the works has been to closely tie in the temporary and permanent traffic management arrangements in order to minimise the number of changes affecting road users and frontagers.

Workstages 1, 2, and 3 can take place at any time subject to the closure of Pinfold Street, the junction of Hill Street / Paradise Street and the eastern side of Paradise Circus Gyratory.

Phase 5A needs to be constructed in advance of Phase 5B to provide the additional width required for the continued use by Buses and hackney cabs.

Phases 4A, 4B and 4C cannot be constructed until the additional land for widening from the Paradise Circus redevelopment is available to allow local diversion of traffic and need to be constructed sequentially. Phase 5C cannot be completed until buses and hackney cabs can be routed outbound through areas 4B and 5B.

A compliant construction sequence would therefore be as follows:

<table>
<thead>
<tr>
<th>Concurrent Phasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
</tr>
<tr>
<td>Phase 2</td>
</tr>
<tr>
<td>Phase 3</td>
</tr>
<tr>
<td>Phase 2</td>
</tr>
<tr>
<td>Phase 5A</td>
</tr>
<tr>
<td>Phase 2</td>
</tr>
<tr>
<td>Phase 5B</td>
</tr>
<tr>
<td>Phase 4A</td>
</tr>
<tr>
<td>Phase 4B</td>
</tr>
<tr>
<td>Phase 4C</td>
</tr>
<tr>
<td>Phase 5C</td>
</tr>
</tbody>
</table>

Programming is discussed further in Chapter 9.

### 4.5 Traffic Diversions

Two-way traffic will generally be maintained on sections of the highway where two-way traffic is proposed in the final scenario. Restrictions to capacity during construction, however, do dictate that a wider traffic management strategy needs to be in place to discourage vehicles from using these routes. This will
principally be traffic using the Suffolk Street slip roads to access / egress the city. The wider strategy will be agreed between Centro and the local highway authority though it is anticipated that this will principally be by diverting traffic onto the eastern or western sections of the Ring Road, depending upon where other highway improvement works are taking place at the time.

The closure of Hill Street at its junction with Paradise Street will require traffic currently using this route to be diverted via Navigation Street / Hill Street and Suffolk Street Queensway. An alternative would be to route traffic via Navigation Street and the Navigation Street Link Road subject to its programme for construction.

Inbound traffic on Broad Street will be diverted via Bridge Street and Holiday Street. Traffic originating beyond Fiveways will be signed via the Ring Road.

During temporary closure of the Suffolk Street Queensway slip roads, traffic will again need to be directed towards the Ring Road or into the main A38 tunnels via St Chads or Lancaster Circus Roundabout. During this period, particular attention will need to be given to signing access to the New Street Station and Bull Ring car parks.

### 4.6 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, 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 enquiries 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); 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 Pedestrian and Cyclist Management

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.
- If diversions are required then the following items should be adhered to:
  - Keep to a single diversion
  - Agree diversions with BCC and other key stakeholders (e.g., cycling groups)
  - Provide advance warning and notification.

Management of pedestrians will be a key issue in the construction of the works. There are a number of particularly busy pedestrian crossing points and areas along the route of the CSQE and the most significant ones are indicated below. There are also major pedestrian flows along the footways of Broad Street. Broad Street is the principal entertainment area within the city and large numbers of revellers are present, particularly during the evenings and at weekends. Management of pedestrians in this area will need to be given extremely careful consideration.

Table 5.1: Major Pedestrian Crossing Points

<table>
<thead>
<tr>
<th>Street</th>
<th>Crossing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephenson Street</td>
<td>Between New Street Station and Lower Temple Street</td>
</tr>
<tr>
<td>Hill Street</td>
<td>Victoria Square and Hill Street</td>
</tr>
<tr>
<td>Broad Street</td>
<td>Centenary Square and southern side of Broad Street</td>
</tr>
</tbody>
</table>

For a period during construction it is anticipated that the Easy Row subway under Paradise Circus will need to be closed to pedestrians for safety reasons. Diversions will need to be provided along the public highway footways during this period.

The permanent cycling strategy bans cyclists from sections of the tramway route. It is anticipated that the cycling restrictions will be imposed before construction commences in the relevant sections. Works in other areas such as the Broad Street/Paradise Circus junction may require further temporary diversions for safety reasons.
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 4.1, this requires the removal of all services from the areas to be excavated for the construction of the LRT. 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 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 have been consulted about the level and type of protection required. Access chambers, currently within the area for the track slab will be relocated to afford access adjacent to the slab.

The existing sewers should be sufficiently deep enough 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. 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 company. 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 insitu. 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),
- Minimisation of stray current,
- Maintenance access,
- The need for service connections in the future,
- Effects of failure of the service.

BT boxes, telephone boxes, fire hydrants and CCTV cameras may also need to be relocated to accommodate the tram alignment. Discussions with Royal Mail, BT, 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 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 are currently liaising with the Utilities Companies to identify those services that will need to be diverted and/or protected for the construction of the CSQ extension. 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.
7 Structures

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

Table 7.1: Affected Structures

<table>
<thead>
<tr>
<th>Reference</th>
<th>Structure</th>
<th>Proposed / Existing</th>
<th>Affected</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Retaining wall</td>
<td>Proposed</td>
<td></td>
<td>Proposed Victoria Square retaining walls</td>
</tr>
<tr>
<td>S2</td>
<td>Foundation pad</td>
<td>Existing Yes</td>
<td></td>
<td>Iron Man Statue</td>
</tr>
<tr>
<td>S3</td>
<td>Retaining wall</td>
<td>Proposed</td>
<td></td>
<td>Proposed Victoria Square tram stop retaining wall</td>
</tr>
<tr>
<td>S4</td>
<td>Retaining wall</td>
<td>Existing Yes</td>
<td></td>
<td>Paradise Street Retaining Wall</td>
</tr>
<tr>
<td>S5</td>
<td>Infilled Subway</td>
<td>Existing Yes</td>
<td></td>
<td>Paradise Subway (infilled)</td>
</tr>
<tr>
<td>S6</td>
<td>Sign Gantry</td>
<td>Existing Yes</td>
<td></td>
<td>Suffolk Street Queensway Tunnel - Sign Gantry</td>
</tr>
<tr>
<td>S7</td>
<td>Bridge-Tunnel Portal</td>
<td>Existing Yes</td>
<td></td>
<td>Queensway Tunnel Portal and retaining walls (Paradise Circus)</td>
</tr>
<tr>
<td>S8</td>
<td>Retaining wall</td>
<td>Existing Yes</td>
<td></td>
<td>Broad Street/Suffolk Street Retaining Wall</td>
</tr>
<tr>
<td>S9</td>
<td>Bridge</td>
<td>Existing Yes</td>
<td></td>
<td>Easy Row Subway</td>
</tr>
<tr>
<td>S10</td>
<td>Tunnel</td>
<td>Existing No</td>
<td></td>
<td>BT Tunnel</td>
</tr>
<tr>
<td>S11</td>
<td>Chamber</td>
<td>Existing No</td>
<td></td>
<td>BT Chamber Broad Street</td>
</tr>
<tr>
<td>S12</td>
<td>Bridge - Box</td>
<td>Existing No</td>
<td></td>
<td>Broad Street Civic Subway/Pump Room</td>
</tr>
<tr>
<td>S13</td>
<td>Retaining wall</td>
<td>Existing Yes</td>
<td></td>
<td>Centenary Square/Broad Street Retaining Wall</td>
</tr>
<tr>
<td>S15</td>
<td>Tunnel</td>
<td>Existing No</td>
<td></td>
<td>New Street North Tunnel</td>
</tr>
<tr>
<td>S16</td>
<td>Wall</td>
<td>Existing Yes</td>
<td></td>
<td>Diana Wall</td>
</tr>
<tr>
<td>S17</td>
<td>Thrust Blocks</td>
<td>Existing No</td>
<td></td>
<td>Victoria Square Water Main Thrust Blocks</td>
</tr>
<tr>
<td>S18</td>
<td>Retaining wall</td>
<td>Existing Yes</td>
<td></td>
<td>Paradise Circus Retaining Wall</td>
</tr>
<tr>
<td>S19</td>
<td>Tunnel Shaft</td>
<td>Existing Yes</td>
<td></td>
<td>Paradise Circus Mains Tunnel Shaft</td>
</tr>
<tr>
<td>S20</td>
<td>Statue</td>
<td>Existing Yes</td>
<td></td>
<td>Watt Boulton Murdoch Statue</td>
</tr>
<tr>
<td>S21</td>
<td>Steps</td>
<td>Proposed</td>
<td></td>
<td>Civil Subway Steps</td>
</tr>
</tbody>
</table>

In addition to the above there are a number of properties along Pinfold Street and Paradise Street which may have basements which extend under the footway / carriageway.

The most significant structures from a construction viewpoint are:

- Easy Row Subway and retaining walls – the subway will need to be extended and retaining walls constructed on the eastern side of Paradise Circus to accommodate the tramway alignment.
- Queensway Tunnel Portal and retaining walls - the portal may need to be strengthened to accommodate the tramway alignment.
- Broad Street / Suffolk Street retaining wall – the existing wall will need to be strengthened to accommodate the tramway alignment.
The current strategy 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 of 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, but this will depend on availability.

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 CSQE:

- 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.

8.2 Opportunities for Principal Site Compounds

Discussions with the City Council on the use of appropriate facilities and general open spaces as principal site compounds are ongoing. It should be noted that the availability of suitable sites is likely to change between the present time and the start of construction. On this basis it is likely that it will be necessary for the Contractor to locate suitable sites.

8.3 Work Sites

The nature of a busy city centre site is that there is unlikely to be any vacant land available for use as compounds adjacent to work sites. Compounds 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 compound since there is unlikely to be sufficient space available within the highway.

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 across the street and the access to businesses and retail 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.
Equipment and loose materials should be removed at the end of each day’s work.

8.4 Access to Work Sites and Site Compounds

The majority of the works will be carried out on street and access to these areas should not be a problem. As discussed in 4.2, the Contractor will however have to agree pre-defined routes which can be used by construction traffic between the site compounds and the work sites, together with routes to be used by construction traffic accessing the work areas directly from outside the City Centre. It may also be necessary to limit the times during the day when these routes can be used.

Similarly, access to the site compounds and offices is also likely to be subject to control by the Highway Authority. This subject will be discussed more fully once the locations of the site compounds and offices have been determined.
9 Construction Programme

9.1 Construction Timetable and Key Dates

The current timetable for the construction of the Midland Metro Birmingham City Centre Tramway is as follows:

<table>
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<tr>
<td>Advance Service Diversions</td>
<td>Late 2014</td>
</tr>
<tr>
<td>Construction Start</td>
<td>Spring 2016</td>
</tr>
<tr>
<td>First Service</td>
<td>Spring 2018</td>
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A preliminary construction programme is included in Appendix B.

9.2 Programme Constraints

9.2.1 General Issues

The principal constraint to the CSQE programme is access to the site currently occupied by the University of Birmingham within the Paradise Circus Development to allow the construction of the area of tramway in Phase 4A. It is currently anticipated that access to this land will be made available in October 2017. Prior to this land becoming available, only Phases 1, 2, 3, 5A and 5B are available for construction. The proposed construction start date has been determined to allow continuity of construction for the tramway Contractor.

The Contractor’s construction programme will need to take account of and minimise the effect of road works on major events at venues within and in the vicinity of the City Centre such as the NIA/ICC and in Centenary and Victoria Squares.

9.2.2 Seasonal Issues

Construction activity should be maximised in the summer months to take advantage of better weather and lighter traffic flows.

Birmingham City Centre and surrounding main routes are subject to restricted working between early November and mid-January each year by the City Council. The restriction will apply 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 CSQE during these periods. However, the current construction programme has been developed on the basis that Christmas shutdown will be imposed on the construction work. Works within the main pedestrian areas such as Victoria Square and Broad Street are likely to be heavily restricted, but agreement may be possible to allow work to continue in other areas to minimise delay and achieve completion as early as possible.
Birmingham City Council Traffic Management Team maintain 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 be made available to the Contractor.

The programme does not reflect the impact of individual events on the construction programme. However, it would be expeditious if these events 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.

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 4.4 while taking account of the comments made in 9.2.1 and 9.2.2 above. Within this framework it is understood that both Centro and BCC are anxious that construction should be completed as quickly as possible.

In order to minimise the construction period sufficient resources will have to be provided to enable the degree of concurrent working to be maximised. The proposed construction programme has therefore been developed with this aim 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 and the constraints allow.

For the purposes of this Report it has been assumed at this stage that sufficient labour, plant and materials will be readily available for the programme not to be adversely affected.

9.4 Rates of Construction

The rates achievable for construction of the works within each of the Work Stages will depend on the following factors:

- Availability of plant, labour and materials as already discussed above.
- Restrictions on access and space available for construction.

9.4.1 Restrictions on Working Times.

On sections such as those within Work Areas 1, 2 and 3 where access is not a major problem and the restrictions on working times are not prohibitive, the rate of construction will depend primarily on the availability of resources. On other Work Areas such as 4 and 5 restrictions on access and limitations on working times will be the primary factors in determining the speed with which the works can be constructed.

To achieve optimum rates of progress on construction of the track, the Contractor will need to open as many areas for construction as the constraints and resources allow. If constraints are placed on the
number of areas that can be opened for construction at any one time by the promoter or other bodies, then progress will be affected.

Experience of other LRT schemes has shown that under normal circumstances track can be constructed at the following average rates:

- Concrete On-Street Double Track – 100m/month.
- Concrete On-Street Single Track – 180m/month

Similarly, experience has shown that the OLE can be constructed at a rate of 230m/month, while Stops normally take between 8 and 12 weeks to complete depending on their size and the quality of finishes.
10 Construction Methodology

10.1 General

As discussed in Section 3.4, the extensive demolition of structures and buildings will not be required for the construction of the Metro. The major demolition requirement is for the current University of Birmingham buildings within the Paradise Circus development which will be demolished by the developer.

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. The ‘Iron Man’ statue in Victoria Square will have to be taken up and stored for re-siting following the completion of the works.

There are extensive areas of block paving along the route especially in Victoria Square. This should be taken up and removed to store for reuse following completion of the track construction.

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 city centres the lengths of continuous track construction rarely exceeds 100m and this is likely to be the case for construction of the Metro. It will be necessary for track to be constructed in single widths in some areas and for work areas to shift around junctions, vehicular accesses and loading/unloading areas to comply with the 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. Site clearance.
2. Demolition if required.
3. Removal of block paving if required.
4. General excavation.
5. Installation of OLE bases, drainage, ducts and stray current protection beneath track formation.
6. Lay granular capping material if required.
7. Lay sub base/blinding.
8. Fix reinforcement.
9. Lay first stage concrete.
10. Install rails and complete stray current protection.
11. Complete drainage/ducting above first stage concrete.
12. Lay second stage concrete around rails.
13. Construct Stops where required.
15. Complete highway/accommodation works and final surfacing where possible.
16. Install OLE supports.
17. Complete final surfacing.
18. Install OLE wiring and complete cabling.
19. Energise and commission.

10.3 Works Area 1

10.3.1 Key Elements

Works Area 1 extends from the tie in to the BCCE on Stephenson Street to top of Pinfold Street and comprises the following:
- New twin track throughout the section
- Remodelling of 80 New Street (“Supercuts” building) to move the entrance onto New Street.

10.3.2 Traffic Management

The works will require the closure of Pinfold Street to traffic as the road is not wide enough to construct one track at a time and maintain sufficient room for vehicular access around the works.

10.3.3 Maintenance of Vehicular and Pedestrian Access

Pedestrian access will need to be maintained along Pinfold Street in order to access the various frontages along the road for servicing and deliveries/collections. There are also several fire exits on both sides of the street. Refuse and goods will have to be carted between properties and waiting vehicles in Ethel Street or New Street. It may be possible to construct the track over its full width within this section in one operation.

Access to the car park at the bottom of Pinfold Street will also need to be maintained.

10.3.4 Works Area 1 Sequence of Construction

The suggested sequence of construction in Works Area 1 is as follows:
1. Divert Services (this work is assumed to be complete prior to the Contractor taking over the site)
2. Undertake work to relocate entrance to No. 80 New Street (“Supercuts”) to New Street
3. Carry out site clearance and widen the carriageway in Pinfold Street
4. Set up traffic management and construct track
5. Complete highway/accommodation works

10.4 Works Area 2

10.4.1 Key Elements

Works Area 2 extends from the top of Pinfold Street through Victoria Square and onto Paradise Street. The Works Area comprises the following:
- New twin track throughout the section
- Remodelling of the Diana Wall and nearby steps in Victoria Square
- Relocation of the Iron Man statue
- Paving through part of Victoria Square
- Stop with two side platforms outside the Town Hall
- New Retaining wall between the stop and the south side of Paradise Street.

10.4.2 Traffic Management

Before works to the track can commence, Hill Street will need to be closed at its junction with Paradise Street. This will require the proposed changes to the junction with Hill Street and Navigation Street to be in place in advance. The may be the opportunity to begin work on the relocated Diana Wall and Victoria Square without closing Hill Street.

10.4.3 Maintenance of Vehicular and Pedestrian Access

Servicing on Hill Street will need to be considered and managed between the closure of Hill Street and the construction of the turning head at its northern end.

Pedestrian access through Victoria Square will need to be maintained as it is the only step-free route through this area. Arrangements will need to be modified as construction progresses to ensure a suitable route is always available. Pedestrian access to the Town Hall will also need to be considered during construction of the track and stops. Side doors are available as exits but the front exits may be required at specific times.

Servicing for the Town Hall will be from the new highway layout of Paradise Circus, through Works Area 3, then back out onto Paradise Circus.

10.4.4 Works Area 2 Sequence of Construction

The suggested sequence of construction in Works Area 2 is as follows:
1. Divert Services (this work is assumed to be complete prior to the Contractor taking over the site)
2. Undertake work to Diana Wall and steps in Victoria Square
3. Carry out site clearance and close Hill Street construct Turning head
4. Construct new retaining wall and turning head
5. Construct track
6. Complete highway works / paving works where possible
7. Construct Stops and complete highway / paving works.
10.5 Works Area 3

10.5.1 Key Elements

Works Area 3 is a relatively short section of track from the end of the town hall stop up to the works to the main gyratory of Paradise Circus. It comprises:

- New twin track throughout the section
- Controlled Pedestrian crossing.

10.5.2 Traffic Management

No major traffic management of road closures would be required for this section.

10.5.3 Maintenance of Vehicular and Pedestrian Access

Pedestrian routes should be maintained throughout construction but it is not expected this will be a major issue.

It is anticipated that service access for the Town Hall and Paradise Street will be from Paradise Circus. Work will need to be undertaken on one track at a time to maintain access. Service egress will be back onto Paradise Circus via Paradise Street.

10.5.4 Works Area 3 Sequence of Construction

The suggested sequence of construction in Works Area 3 is as follows:
1. Divert Services (this work is assumed to be complete prior to the Contractor taking over the site)
2. Carry out site clearance
3. Construct north track
4. Complete highway works / paving works to northern half of site
5. Construct south track
6. Complete highway works / paving works to southern half of site

10.6 Works Area 4

10.6.1 Key Elements

Works Area 4 is the area around Paradise Circus and into Broad Street. It comprises:

- New twin track throughout the section
- Carriageway widening around the inside of the existing gyratory and extension of the existing Easy Row subway underneath Paradise Circus
- Structural alterations to the existing wall along the south-western edge of Paradise Circus. The extent of this is still to be determined but may include raising the parapet level and supporting OLE poles from the rear of the wall.
- Strengthening of the Queensway tunnel portal beams and adjacent retaining walls.
- Carriageway regrading throughout the section

10.6.2 Traffic Management

Works Area 4 has been broken down into 3 separate stages, each with its own traffic management arrangement. These are shown on drawings MMD-300207-CS28-DRA-0000-0041 to 0043 in Appendix A.

The proposals for the Paradise Circus Redevelopment have traffic removed entirely from the eastern side of the existing gyratory, with two-way traffic around the western side. The drawings for Works Area 4 have been developed on the assumption that this traffic system will be in place by the time the work to this area will begin and that access to the land currently occupied by the University of Birmingham is available.

Between each of the stages shown on the drawings, there will be a requirement to regrade sections of the carriageway to enable the following stage to start. This is due to the carriageway levels throughout the area being raised above existing. It is likely that this regrading would need to be carried out over several nights, with further temporary traffic management measures in place whilst the regrading is being completed.

10.6.3 Maintenance of Vehicular and Pedestrian Access

Whilst there are no pedestrian routes through the main route of the works, pedestrian routes through Fletchers Walk will be affected during the subway extension works. Additionally, the route along the pedestrian ramp around the south-western side of Paradise Circus will be affected during the works to the parapet. Alternative routes will need to be agreed with the highway authority and signed accordingly.

Works taking place within the Paradise Circus development site may influence the exact location of the diversion route.

Routes for servicing traffic will need to be maintained to the Town Hall and premises on Paradise Street. Access to this area is maintained along either the northern or southern side of Paradise Street in each of the work stages. Traffic will exit back onto Paradise Street and then south along Suffolk Street Queensway.

10.6.4 Works Area 4 Sequence of Construction

It is anticipated that the sequence of phases in Works area 4 will be 4A – 4B – 4C. Whilst the sequencing of is shown on the works staging drawings, the general construction sequencing for each stage is expected to be as follows:
1. Divert Services (this work is assumed to be complete prior to the Contractor taking over the site)
2. Undertake offline widening to subway and carriageway widening (Stage 4A only)
3. Install traffic management
4. Structural works to Queensway tunnel portal (Stage 4C only)
5. Construct track
6. Complete highway works
7. Undertake regrading required for next stage

It should also be noted that the staging for Works Area 4C has been developed to be constructed alongside Works Area 5C. Stage 5A of Works Area 5, as described in the following section will need to be carried out before Stage 4A can commence.

10.7 Works Area 5

10.7.1 Key Elements

Works Area 5 is the area along Broad Street that makes up the terminus of the CSQE. It comprises:
- New twin track throughout the section
- Alterations to the existing retaining wall along the northern edge of Broad Street
- Completion of any outstanding structural alterations to the existing wall along the south-western edge of Paradise Circus.
- Widening of the carriageway
- Construction of two platforms.

10.7.2 Traffic Management

Works Area 5 has been broken down into 3 separate stages, each with its own traffic management arrangement. These are shown on drawings MMD-300207-CS28-DRA-0000-0051 to 0053 in Appendix A.

The permanent traffic management proposal for Broad Street bans general traffic and limits access to bus, hackney cab and cycle only. General traffic will be directed into Bridge Street. It is assumed that this system is in operation when construction of Works Area 5 begins.

Some short term closures of the junction of Broad Street with Paradise Circus may be necessary to allow carriageway level differences to be made up.

10.7.3 Maintenance of Vehicular and Pedestrian Access

There are currently two bus stops in Works area 5, one in each direction. Whilst the proposals shown in the staging drawings maintain at least one stop in each direction at all times, space for laybys will not be available during construction so buses may have to queue behind one another.

There are currently two pedestrian crossings in the Works Area. It is proposed that any works are effectively done one half at a time, allowing a wide temporary crossing point to be maintained at all times.
10.7.4 Works Area 5 Sequence of Construction

Whilst the sequencing of Works area 5 is shown on the works staging drawings, the general sequence for each stage is expected to be as follows:

1. Divert Services (this work is assumed to be complete prior to the Contractor taking over the site)
2. Undertake widening to the northern side of Broad Street, including works to retaining wall (Stage 5A only)
3. Install traffic management
4. Construct track
5. Complete highway works
6. Construct platform
Appendices

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# Appendix A. Construction Sequencing Drawings

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<tr>
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Appendix B. Preliminary Construction Programme

MMD-300207-CS28-PRG-0100-0001