

3.5.4 CONSTRUCTION VEHICLE GENERATION

3.5.4.1 Introduction

Construction traffic will be generated for the duration of the works on site, with levels of vehicles movements varying throughout the construction period depending on the construction activities on-going. The construction vehicle generation will be from a number of sources:

- Hauling of demolition and excavated material off site;
- Concrete deliveries;
- Deliveries of reinforcement & formwork and other building materials such as drainage goods etc. to site.

The levels of construction traffic will vary during the weeks and almost on a day to day basis, with peak volumes predicted to be during combinations of the following activities:

- Demolitions;
- Excavations;
- Typical concrete pours for foundation/sub-structure and rising elements;
- Large concrete pour for basement/foundation slabs at levels B2 and B1.

BAM will enforce the no-parking policy for construction workers on or around the site. BAM's Mobility Management Plan (included in Appendix G of this document) sets out alternative measures for the safe mobilisation of the construction workforce to and from the site.

All HGV traffic entering and exiting the works site will be recorded by the site security company. Details of the date, time and type of load will be recorded and maintained in a central register on the BAM system.

3.5.4.2 Initial Phase (Months 1-6)

During the first 6 months of the Main Works Contract Phase A, works will be largely machine based with numbers of construction workers numbering approximately 60 -70.

Initially there will be two piling rigs on site, with up to 10 no. truck movements required to remove spoil from the site each day and 15 no. truck movements to deliver the concrete for the piles each day. To meet programme requirements the number of piling rigs may be increased to 3nr.

Construction vehicle generation from the Main Dig will be steady, with up to 100 truck movements required daily to meet the construction programme in removing the 413,000m³ of excavated material off site over the course of 367 week days.

3.5.4.3 Main Construction Phase (Months 7 -15)

During the Main Construction Phase, the site may have up to 4 piling rigs in operation, resulting in up to 20 no. truck movements required to remove spoil from the site and 56 no. truck movements to deliver the concrete for the piles.

Construction vehicle generation from the Main Dig will remain steady at almost 150 truck movements per day.

Contract Month	Date	Basement Exc	Load per month	Load per day (5 day week)	Pile Arklings	Load per month	Load per day (5 day week)	Total Load Much Away / Day	Concrete to Piles		Concrete to Frame		Total Concrete Trucks / Day	Vehicle In per day	
									m3	m3	m3	m3			
M-2	Jun-17														
M-1	Jul-17	12,989	1,081	51	484	40	2	53	484	85	3		3	57	
M01	Aug-17	12,910	1,078	47	2,663	222	11	58	2,663	355	15		15	73	
M02	Sep-17	18,274	1,523	73	2,691	221	11	84	2,691	353	17		17	200	
M03	Oct-17	11,886	991	45	2,205	184	9	54	2,205	294	13		13	68	
M04	Nov-17	19,244	1,604	73	2,601	217	11	84	2,601	347	16		16	98	
M05	Dec-17	8,550	715	34	2,104	175	9	48	2,104	281	13		13	58	
M06	Jan-18	22,134	1,845	80	2,638	220	11	81	2,638	351	15		15	108	
M07	Feb-18	25,508	2,126	106	2,433	203	10	118	2,433	324	16		16	133	
M08	Mar-18	29,523	2,460	112	1,896	158	8	120	1,896	251	11	2,294	306	14	145
M09	Apr-18	31,137	2,595	134	1,485	124	6	130	1,483	198	9	2,710	361	17	158
M10	May-18	36,362	3,197	139	1,074	90	4	143	1,074	143	6	3,455	461	20	178
M11	Jun-18	35,798	2,983	142	1,264	105	5	147	1,264	169	8	7,859	1,048	50	205
M12	Jul-18	28,782	2,390	100	478	40	2	182	474	63	3	5,437	1,258	37	140
M13	Aug-18	24,759	2,063	90				80				8,206	1,054	48	157
M14	Sep-18	33,974	1,998	100				100				11,135	1,485	74	174
M15	Oct-18	12,452	1,038	45				45				8,140	1,083	47	82

Table above shows the Projected Vehicle Generation for the Main Contract Phase A (Months 1 - 15)

3.5.5 Davitt Road Staging Area

The Davitt Road construction compound / staging area will support the storage of materials to allow for the orderly delivery of materials to the St James's Hospital campus and to stage construction vehicles before proceeding to the St James's Hospital campus. This will ensure that any goods / materials delivered to site are those for immediate incorporation into the permanent works.

The operations that will generate traffic at the Davitt Road Construction Compound primarily comprise:

- The staging of concrete trucks, before proceeding towards the St James's Hospital campus;
- Deliveries of building materials for storage before transfer to St James's Hospital campus;
- Transfer of materials to the Main Construction site.

Vehicle generation at the Davitt Road site is likely to be up to 40 movements/day during the first 8 months of the project.

3.5.6 Measures to Minimise Impact of Construction Traffic Generated by the Works

1. BAM to ensure that only the construction access routes agreed with Dublin City Council are used;
2. BAM will minimize HGV movements insofar as is possible during the hours of 07:00 – 09:00 Monday to Friday. This minimisation of HGV's will be managed by BAM engaging with all suppliers and delivery drivers. Notifications will be issued with all enquiries to subcontractors and suppliers.
3. BAM will strictly enforce the policy of no construction staff parking within the SJH Campus;
4. BAM will not allow trucks wait/ queue on the surrounding road network or on the internal roadway within the hospital campus;
5. BAM will assign flag men to manage construction vehicle access onto the public roadways, both within the campus and at both Accesses A (Rialto) and B (Mount Brown);
6. BAM have prepared a Construction Stage Mobility Management Plan for agreement as part of the Construction Management Plan – this document is included within under Appendix G;
7. BAM have appointed a Contractor Mobility Manager to liaise with the St James's Hospital campus Mobility Management team;
8. BAM will carry out regular travel surveys among construction staff, and review the results;
9. BAM will provide direct pedestrian access to the construction site from both the Rialto Luas stop and the Rialto entrance from South Circular Road (TM drawings for same currently being prepared);
10. BAM will provide on-site bicycle parking for construction staff;

11. BAM will promote the 'Cycle to Work' and the 'TaxSaver' scheme among construction workers;
12. BAM will prepare a Wayfinding Strategy to assist members of the public once they arrive on campus who may not be familiar with the revised access road arrangements;
13. Dust suppression measures (e.g. damping down during dry periods), vehicle wheel washes, road sweeping and generally housekeeping will ensure that the surrounding environment is free of nuisance dust and dirt;
14. BAM will implement a road sweeping programme, monitoring same to ensure its effectiveness.
15. BAM will prefabricate M&E elements to reduce multiple deliveries and personnel numbers on site.

3.5.7 Mobility Management Plan

To ensure the successful mobilisation of construction workers to and from the site, BAM have prepared a Mobility Management Plan (included in Appendix G of this document). BAM have also appointed Yvonne Brophy as the Mobility Manager.

The following measures are to be implemented by BAM's Mobility Manager to deliver the strategies set out within this Plan:

- Liaise directly with the Mobility Manager for the St James's Hospital campus;
- Carry out travel surveys among contractors based on site;
- Actively promote the Mobility Management Plan measures among construction staff;
- Promote direct pedestrian access to the construction site from both the Rialto Luas stop and the Rialto entrance from South Circular Road;
- Ensure secure storage facilities are provided for construction staff to store tools and other work equipment;
- Ensure ample bicycle parking is provided for construction staff;
- Ensure sufficient changing facilities are provided for construction workers within the construction site
- Promote the 'Cycle to Work' scheme among construction staff
- Promote the 'TaxSaver' tickets among construction staff

3.5.7.1 Pedestrian Access During the Works, including a Wayfinding Strategy on Campus

BAM will provide high quality and consistent way-finding signage throughout the site in accordance with the "*Exemplary Site Set-Up Manual- Safeway*" document included at the Appendices of the Prelim Health and Safety Document. BAM will include for all signage which may be required to ensure that the public, staff and visitor, and the contractors, sub-contractors and suppliers can easily navigate the site. The signage will be subject to ongoing review to be changed and adapted throughout the Project as required.

3.5.7.2 Car Park Management During the Works

It is a noted restriction in relation to parking on the site. As part of the BAM Safety Induction (which is a requirement for all personnel who work on the site) all persons being inducted are advised of the parking restriction on site and that parking in the surrounding areas is to be avoided, and advise all that the Luas and bus networks should be used where possible as a means of transport to the site. Bicycle parking is available on site and is encouraged by BAM. BAM have arranged for park and ride facilities to be established in Saggart which will allow for personnel to park cars and use the Luas or bus routes to the site. This facility will be established during Phase A of the project.

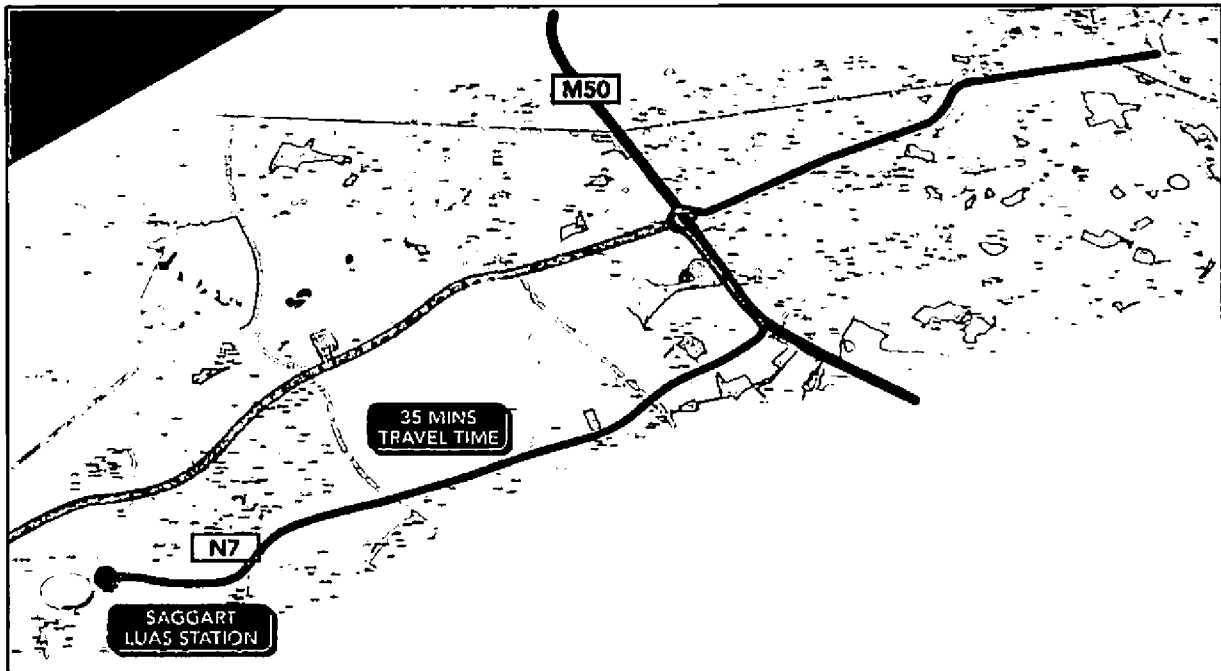


Image above shows location of Saggart LUAS station relative to Saint James's Hospital

3.5.7.3 Registration of Contractors' Vehicles and Drivers with SJH

All contractors' vehicles accessing the site shall be registered with SJH. BAM will liaise with the ER to provide a list of current vehicle number plate registrations, drivers and company names to be provided via ER to SJH security.

4.0 ENABLING WORKS

4.1 INTRODUCTION

The construction of the National Paediatric Hospital on the St. James's Hospital site will involve a series of demolition and enabling works to be undertaken in a carefully controlled sequence to achieve a clear site for the build. The purpose of the enabling works is to:

- Secure the site and organise the presence of the Main Contractor and the protection of live campus activities;
- Maintain blue light and emergency traffic access to and from the campus;
- Provide new utility connections to facilitate the clearance of the National Paediatric Hospital site;
- Safely divert all live services away from the National Paediatric Hospital construction footprint;
- Install new services infrastructure;
- Safely prepare and demolish the existing buildings to be removed, including removal of asbestos;
- Clear the site and prepare for large scale excavation;
- Excavate where possible and prepare the site for the Main Construction works generally.

The Enabling Works Contract was awarded to BAM Civil Limited who commenced works in August 2016 and has an anticipated completion date of August 2017.

4.2 DEMOLITION

4.2.1 Building Demolition

As part of the Enabling Works Contract, demolition is being carried out to buildings as per the decanting strategy, and as outlined in drawing NPH-C-OCSC-DR-XX-00-0001.

While demolition works near completion, and due to the overlap between both Contracts, demolition of the following buildings will be undertaken following commencement of the Main Contract Phase A:

- Hepatology Building
- Private Clinic
- Medical Gas Building
- Medical Information Centre
- National Centre for hereditary coagulation

The demolition of these buildings has been covered under specific method statements submitted under the Enabling Works Contract.

All existing services currently contained within the properties will be removed and/or diverted. The services currently anticipated are Water, Electricity, Gas and Sewage and Eircom. In addition, fire alarm panels and CCTV will be of particular importance as they are, in all likelihood, linked to a main panel located in the main hospital. BAM note that building services may be linked to each other in a "daisy chain" type effect and that these services will have to be broken and reconnected in a controlled fashion prior to demolition. This will be confirmed with the relevant service provider and the hospital technical services department in advance of any demolition works. All sewer drains will be sealed at the manhole immediately outside the building line.

Asbestos

A full and detailed asbestos survey report will be developed once each building is formally handed over to BAM. These surveys will be performed by a specialist surveyor. The resulting reports will be submitted for review to the ER for each building prior to the removal of asbestos commencing.

The slates on many of the buildings are Asbestos cement and will be dealt with using the guidelines

set out by the HSA publications for dealing with Hazardous substances and in line with the Safety, Health and Welfare at (Construction) Regulations 2006. Operatives, wearing harnesses fixed to a secure point via a lanyard, will gain access to the roof of the property using a boom hoist. They will strip the roof slate and remove them by hand from both properties. All elements of asbestos found through the survey will be removed by a specialist sub-contractor and disposed of to a suitable facility. On completion of the asbestos removal by the sub-contractor, the specialist consultant will re-survey the building and give sign off that the asbestos has been removed. Demolition will commence once the clearance certificate has been issued. Full transport and deposition records for the removed asbestos will be made available to the client on completion of the works.

A soft strip of the building will be carried out to remove all fixtures/fittings and M&E items. All site waste will be segregated prior to removal off site. Some large items, such as cabinets etc. may be left in place and will be segregated during the demolition stage by the demolition excavator. All sharps (if found) will be placed in sharps boxes for separate disposal.

The walls of the structure will be demolished using the selector grab to topple those inwards in a controlled manner. The first floor (where present) will be removed in a similar manner to the structure. When all structures have been demolished, the selector grab will be changed to a traditional bucket attachment and the rubble loaded into skips / tipping trailers for removal off site to a suitable facility. Dust mitigation in the form of sprinklers and dustbusters will be used during the heavy demolition works. Spoil will be removed from site as soon as possible after demolition, with a minimum of stockpiles of material left on site at any time, unless agreed otherwise with the ER.

4.2.2 Demolition – Other Works

While a large portion of the demolition and de-commissioning works form part of the Enabling Works Contract (EWC), localised areas of demolition are excluded from the EWC and shall be specifically carried out under the Main Contract. These include, but are not limited to:

- Demolition of diesel tank room in Energy Centre
- Demolition of existing retaining walls and flue stack adjacent to Energy Centre.
- Local demolition for connection of utility tunnel to Energy Centre and tie-in with existing tunnel.
- Local demolition of secant piles for utility tunnel and FM tunnel connection to the new hospital building.
- Buried tanks in Ambulance area.
- Underground weighbridge south of energy centre.

Method statements will be submitted for Client approval in advance of commencement of the above demolition works.

4.3 UTILITY DIVERSIONS

As part of the Main Contract Phase A, there is a requirement to carry out the following utility diversions:

- Temporary Watermain Diversion
- Utility Tunnel including diversion of its services
- Drimnagh Sewer
- O'Reilly Avenue connections to new foul sewer

- SJH Main drains (Storm and Foul)
- Fuel Oil diversionary works
- Medical gas alarm system
- Utility Tunnel ventilation systems

For each of the service diversions, removal, upgrading etc. BAM will carry out the following works:

- i. Liaise with and obtain consent from the relevant utility provider and SJH where appropriate.
- ii. Produce a specific Method statement for the required work, which will be submitted to the Employers Representative and the relevant utility provider for comment/approval.
- iii. A specific methodology and submission to Irish Water will be made with regard to the Drimnagh Sewer diversion for agreement prior to works commencing.
- iv. Address and incorporate comments
- v. Design, install, maintain and remove Traffic Management for each element of work (if required).
- vi. Design the service diversion in accordance with the utility provider's requirements.
- vii. Complete CCTV surveys pre/post as required (drainage)
- viii. Provide attendance to the relevant Utility provider
- ix. Compile as built information including specification sheets for the newly installed services
- x. Carry out relevant testing of installed services and commissioning
- xi. Provide all required handover documentation, including that required under BC(A)R and for all services diverted within the SJH campus that relate directly to the hospital.
- xii. Reinstate surface to original condition

Planning of Service Diversion Works

Prior to commencement on site, it is a policy of BAM to contact all relevant utility providers and to request a copy of all drawings which indicate the potential location of all services. It will be a priority to identify all major services within or in the proximity of the site and to put measures in place to ensure that these services are maintained at all times. A key component in assessing the precise location of underground live services is to undertake trial holes on any particular service to determine the exact location of same. This is carried out under the supervision of BAM by a specialised crew with archaeological monitoring as required. Once a service is located it will be surveyed to record the location prior to backfilling and marked with a coloured stake. A series of trial holes will be undertaken on a particular service in order to determine the precise route. In this way, the extent of services to be capped/truncated or diverted can be readily assessed prior to demolition works commencing.

ALL SERVICES UNCOVERED ARE TREATED AS LIVE UNTIL FINAL CONFIRMATION FROM THE CLIENT OR BY EXHAUSTING ALL AVENUES OF EXCAVATION CONFIRM OTHERWISE.

The planning and assessment of any potential diversionary work on any existing service supply forms an integral part of BAM's approach to the realization of a successful execution of the project. All relevant parties, including the specified utility provider and particularly the staff of the maintenance section of SJH will be consulted in order to assess all implications in terms of shut downs, time constraints and suitability of time (day or night) for carrying out diversions. The basic principle that

will be considered in developing any diversion strategy is to maintain continuity of service to SJH. Method Statements will be prepared for the following M&E / Utility Works:

- i. Electrical installations of small power, lighting and Cable Management Systems
- ii. Installation, testing & commissioning of Fire Alarm Systems
- iii. Installation testing and commissioning of BMS systems
- iv. Installation testing & commissioning of ICT systems
- v. Installation testing & commissioning of CCTV systems
- vi. Mechanical installation of pipework associated with Natural Gas
- vii. Mechanical installation of Medical Gas systems
- viii. Mechanical installation of domestic water systems
- ix. Mechanical installation of low temperature hot water and steam systems
- x. Strip out of mechanical systems
- xi. Strip out of Electrical ICT & Fire systems
- xii. Installation and modification of Medium Voltage system

On the basis of these consultation meetings, BAM will develop detailed methodology statements which will be based on parameters previously discussed/agreed at meetings. These method statements will be forwarded for review/comment and revised if required until all parties are satisfied the works can proceed on the basis of what is entailed in the method statement. A defined date and time for the works to commence and be completed will be agreed before works commence.

Due to the nature of this contract, BAM acknowledge that close co-operation with SJH nominated contractors will be necessary in order to allow an efficient decanting process of the existing buildings through each demolition phase. Any potential service disconnection works (externally) that are required by the SJH contractor will be undertaken in a timely manner in order to allow a particular building to be closed and prepared for demolition.

Prior to commencement of excavation/demolition works, the area to be excavated will be scanned thoroughly to identify any services, which may not have been picked up previously. A 'Permit to Dig' scheme will be operated in any areas to be excavated, whereby no excavation can take place until it has been signed off by the BAM Engineer in charge, and counter signed by the excavator driver and banksman.

4.4 UTILITY TUNNEL

These works will include:

1. The construction of a contiguous piled wall to the north of the site to facilitate the construction of the Utility Tunnel (part of temporary works). A temporary works design in accordance with Irish Eurocodes (including the Irish National Annex) has been submitted to the ER.
2. Construction of the Utility Tunnel including breakthrough works into CHP room of the SJH Energy Centre.
3. BAM carrying out necessary surveys to existing Utility Tunnel and Energy Centre as required to clarify the proposed extent and detailing of construction to final section of tunnel leading from the EC to future NCH basement B2 to take account of follow on Main Contract works.

4. In tandem with construction of the Utility Tunnel, BAM will construct the temporary works driveshaft chambers to facilitate follow on tunnelling for SJH main drains and Drimnagh Sewer installations.
5. Diversion of SJH MV from below hardstanding (between ESB Energy Centre and Utility Tunnel) to within Energy Centre to ARUP scope.
6. Temporary relocation of existing double doorset on southern façade of Energy Centre with adjacent fixed louver of same size, including relocation of all associated entry/access controls, provisions of new Fire Exit/Directional Signage etc. All to be reversed once new utility connection to the EC and associated works are completed.

Opes will be left in the roof of the utility tunnel to facilitate installation of M&E fittings as required. The redundant utility tunnel will be removed once the new Utility Tunnel is completed and all contained services within are "live". Where a void remains following the removal of the utility tunnel under building footprints and adjacent structures then this void shall be backfilled with C16/20 wet mix lean-mix concrete.

4.5 DRIMNAGH SEWER

The most significant civil service to be diverted on site is the Drimnagh Sewer. This is an existing public sewer line extending through the site of the new children's hospital and flowing in a south to north direction and alignment. The sewer comprises mainly twin (foul/combined and storm) 610mm diameter pipes, possibly understood to have been constructed c.1925 by tunnelling and enters the site at the southern boundary (adjacent to the existing St. James's Hospital Cardiac Unit) at a depth of approximately 8m below ground. At its deepest (In front of the existing St. James's Hospital Technical Services Building) the sewer is approximately 11m deep and at this point the storm line changes to a trapezoidal section and prior to connecting back into the sewer at Mount Brown changes profile to ovoid/flat semi-circular arch approximately 1m wide.

A combination of open cut and micro tunnelling techniques will be required to complete these diversion works.

A series of method statements covering all works associated with the Drimnagh Sewer will be submitted for the Client's approval in advance of the particular element of works commencing, including as a minimum the following elements:

- Open cut sewer installation
- Micro tunnelling installation
- Connections to existing Drimnagh Sewer
- Construction of shafts for Drimnagh Sewer

BAM note that there is a requirement to consult with third party bodies, namely, Irish Water and its appointed agent JB Barry & Partners and DCC and to gain agreement/approval for all related methodology and materials to be used prior to works commencing. The submissions will also include any temporary works required i.e. cofferdam/shaft construction. The following documents/information and obligations will be met by BAM:

- H&S plan.
- Any associated TM Plans – in particular the tie-in points to the existing network located on the Old Kilmainham Road.
- Proposals for the use of construction materials such as pipe bedding/pipes/concrete/remediation products/manhole covers and iron mongery etc.
- Advise Irish Water on any Technical, Quality, safety issues that may arise.

- Review all manhole designs including insitu concrete, precast concrete elements, permanent covers and internal fixtures ensuring safe access in line with industry standards and regulations.
- Review and advise on overpumping proposals/method statements
- Co-ordinating visits with the Site Supervisory Staff on a weekly basis, to monitor that the Works are being executed in accordance with Irish Water Agreement and Requirements and advising Irish Water on the result of site inspections. Reports to be issued no later than the following day after the site inspection to ensure any H&S issues can be escalated if required.
- Producing weekly reports and a concluding report. If the works are stalled/stopped at any stage the weekly visit shall be postponed.
- Review and comment on any design changes that emerge during the Contract.
- Witness pipe testing and water testing of manholes and no flow diversion will be allowed to take place until the consultant has signed off on these tests.
- Ensure defects are addressed before making the new pipe live.
- Review Flow Diversion Contingency Plans and advise Irish Water if the plans are adequate for Irish Water to allow flows to be diverted.
- On completion of the works Review comment on the defects list and make additions if necessary.
- Review and comment on the draft Safety File to be developed by the PSDP for the project.
- Certify in the capacity as third party checker in the form of a 'completion' document to Irish Water the satisfactory completion of the works and the satisfactory diversion of flows and handover of the Safety File in accordance with the required criteria.
- Prepare a Project Completion Report in line with IW proforma and attend final close out meeting with Irish Water*

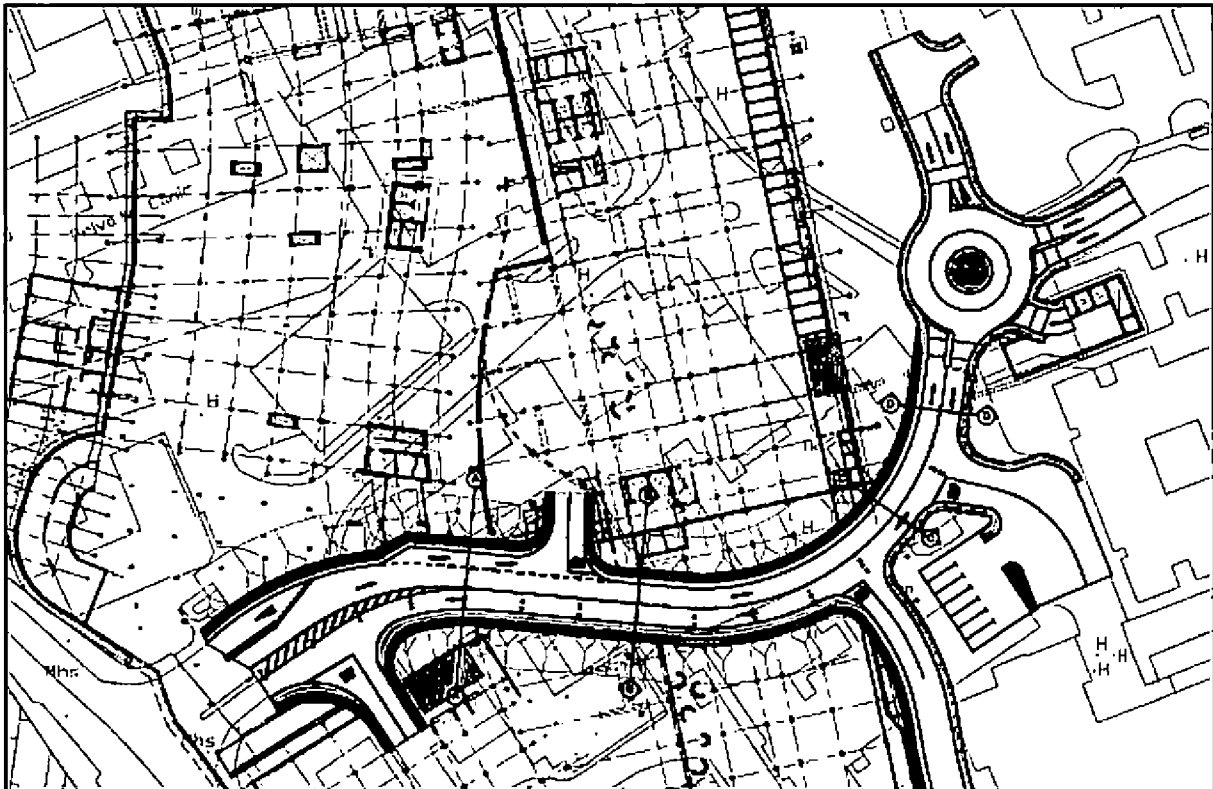
5.0 BASEMENT WORKS

5.1 INTRODUCTION

The Basement Works consist of all elements of the building structure up to and including the Level 00 slab. The basement footprint extends almost over the entire extent of the site, extending from the southern boundary accommodating Clinical/Out Patient Departments at lower ground level (single basement with car parking below at B01) to 2+ basement levels over the northern extent accommodating both car parking support services including FM Hub, Plant and Waste Marshalling Yard etc. The basement structure typically consists of a reinforced concrete cast insitu frame with concrete foundation slab, concrete walls and columns together with suspended concrete slabs at each floor level.

5.2 SITE SET-UP

The Basement construction works will be undertaken with the Central Access Road in place. As stated previously, the alignment of the Central Access Road is such that it runs parallel to a structural expansion joint providing an efficient and natural break point. It also avoids the new building's lift and stairwell shafts, allowing the structure to be constructed independently to each side, with infill works on the footprint of the access road to be undertaken immediately upon making live the permanent northern access road:



Extract from drawing "Access Road Layout", drg. ref. 16_132_00_2200-C01.
Refer to Appendix I for full set of Central Access Road temporary works design drawings.

5.3 SECANT PILE WALL & EXCAVATIONS

To facilitate the construction of the hospital in such a tight urban site location, the building footprint is contained within a secant piled wall. The detailed design of the secant pile wall is a Contractor Designed Element. On appointment of a specialist subcontractor and designer, the detailed design will be completed and issued to the ER for approval.

Temporary propping and/or anchoring of the piles will be required. BAM will submit to the Client and PSDP the necessary temporary works design. A method statement detailing the propping requirements will be submitted for Client review.

Up to 4 piling rigs will be mobilised to site, with piling to commence at the following locations as soon as possible:

1. Along the northern boundary of the site, including the augured pile foundations to flue stack;
2. Secant pile wall at the north western corner of the site adjacent to the Mount Brown Access heading southwards;
3. Secant pile wall at the south west corner heading both eastwards and northwards.
4. Installation of temporary contiguous piles to facilitate construction of the Utility Tunnel.

The overall plan extent of the secant pile wall is c.900 linear metres leading to a requirement for c.1000no. piles. The piles vary in length depending on their location on site and the lowest level of structure at that location, with piles typically varying from c.10m to c.20m in overall length. The quantity of piles to be bored each day will vary depending on the ground conditions. The rotary boring of piles will generate spoil which will be hauled off site and disposed of at an appropriate licence facility (refer to Section 3.3.8 for details on Removal of Material from Site). The casting of the piles will require concrete deliveries for the duration of this element of works (refer to Section 3.3.6 for Delivery of Materials to Site).

BAM note, that in some locations, piling will take place in close proximity to services in specific areas, particularly along the footpath of South Circular Road and Rialto Gate entrance. All services will be fully investigated and the alignment of same fully determined prior to piling operations commencing.

5.3.1 Secant Piling – Waterproofing Requirements

OCSC Specification for Waterproofing covers the design, detailing, supply and installation of a waterproofing system for the construction of below ground structural elements of the New Children's Hospital.

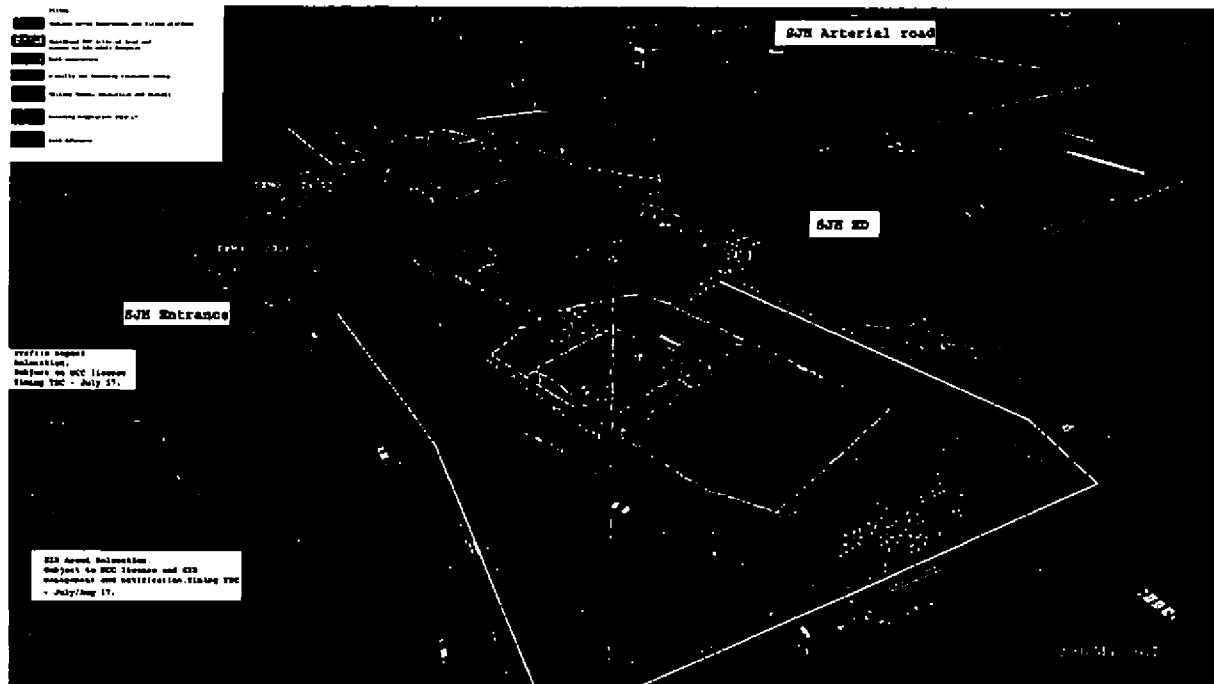
The below ground elements are to be protected to a minimum Grade 2 level in accordance with Table 2 of BS 8102:2009 with the FM Tunnel Link, and the habitable space of Lower Ground Floor, Basement B1 and B2 Levels to be protected to a Grade 3 Level (where indicated on drawings) in accordance with Table 2 of BS 8102:2009.

5.3.2 Testing Requirements of Piles

Load and integrity testing to be carried out on all types of permanent piles, i.e. secant, foundation and rock anchors as per requirements set out in *OCSC Piling and Embedded Retaining Wall Specification*. Testing of rock anchors is also described on drawings NPH-C-OCSC-DR-ZZ-00-1010-0150 to 0152.

5.3.3 Excavations

Excavations will be required throughout the site to facilitate the formation to basement levels, ramp access, construction of the utility tunnel, modifications to existing services including the Drimnagh Sewer and to facilitate construction of new services.



Areas of initial bulk excavation are shown above in orange

In total, an estimated 413,000m³ of made ground and clay material will be required to be excavated and removed off site.

Any areas requiring temporary retaining works will be determined by BAM and their temporary works / geotechnical designer (Byrne Looby). Secant piles will require propping where material in front of them is to be removed. BAM together with Byrne Looby will carry out slope stability checks on cut faces anticipated during construction in advance of excavation works commencing. Any temporary works design for supporting the secant piles, or the sides of excavations with slopes steeper than 1:1, or less if poor ground conditions exist, will be submitted by BAM to the Client for approval. Excavations shall not undermine the foundations of existing buildings.

All cut faces will be subject to weekly inspections during the works or after an event which may affect stability.

BAM will backfill any excavations undertaken below building footprints and adjacent structures that are wider or deeper than required with C16/20 wet mix lean-mix concrete (u.n.o.).

For example:

- Area within the secant piled wall of the new hospital
- FM tunnel
- Substation, Service yard and VIE Compound
- Utility Tunnel
- Any adjacent ground bearing structures

For all working spaces outside the building footprints, backfill will be in accordance with the OCSC *Specification for Civils Works*, NPH-C-OCSC-TD-SP-ZZ00-102 (u.n.o.).

BAM will submit a bulk excavation method statement for Client approval. In addition to the operational sequence of work and safety measures to be adopted, this method statement will include details of access/egress points, measures to prevent stacking of trucks, wheel wash implementation, dedicated areas where tarpaulin covers will be fixed before leaving the site, details of the excavation / stockpile register to be maintained by BAM.

The method statement will also include a watching brief and discovery procedure for contaminated material, detailing how potentially contaminated material to be excavated will be segregated and stockpiled in a contained manner and characterised by a competent professional through laboratory testing.

The excavations will be undertaken in a tiered fashion to facilitate the depths required, and in a sequential manner to ensure that the access and egress routes are unimpeded with the laden trucks making use of the both the Rialto Gate and the Mount Brown routes to ship materials off site. As noted previously, trucks will have a built on tarpaulin that will cover the excavated material as it is being hauled off site and will be required to pass through the wheel wash facilities provided. As the depth of excavations increase, temporary propping/supports as per BAM / Byrne Looby's temporary works design will be provided to support the secant pile wall.

The material to be excavated is predominantly boulder clay. However, given the depth of basement and the profile of the bedrock, it is anticipated that a very small volume of rock excavation will be required in the southern portion of the site. Such excavations will be through the upper weathered layers of the rock and as such has been technically evaluated as being suitable for "hard ripping" by a 32 tonne excavator or equivalent and should not require the use of hydraulic breaking.

As material is excavated, it will be loaded directly into trucks for transport off site, with no large scale or bulk stock piling of excavated material to be carried out on site (except for material that may be potentially contaminated which will be left insitu until a plan for same is agreed).

BAM shall ensure that all waste materials associated with the project (surplus and unsuitable/contaminated soil and wastes) are appropriately classified and documented with appropriate measures to be included in BAM's Construction and Demolition Waste Management Plan to be submitted as part of the Project Execution Plan. Soil sampling shall be carried out by a competent person following a documented sampling procedure or recognised standard. Waste soils (either U1 or U2 type materials) shall be managed by BAM in accordance with all relevant waste management and environmental legislation/regulations.

OCSC document "*Soil Classification, Site Investigation & Groundwater Monitoring Report*" (doc. ref. no. NPH-C-OCSC-9010-0001) details areas on the site where hazardous material has been identified, and further areas which have been identified as "potentially contaminated areas". A specialist contractor will be brought in to classify the material in this area by:

- (c) reviewing testing to date, and
- (d) carrying out further testing using an accredited laboratory.

As stated previously, WAC testing will be carried out on an ongoing basis throughout the bulk dig works to ensure excavated material being removed from site is sent to an appropriate location based on its composition.

All excavated material will be disposed of in an approved manner and to an approved licenced location. Copies of all collection, delivery and acceptance at approved licence location documentation will be kept on site.

Where old foundations, basements, filling, tanks, service pipes, drains, etc. not shown on the drawings are encountered, BAM shall not enter and shall obtain instructions from the NPHDB / Employer's Representative before proceeding.

BAM shall inform the Employer's Representative if the ground conditions differ from those noted in the geo-technical reports, or if hard and soft spots or highly variable material or desiccated soil at formation level is encountered.

5.4 BELOW GROUND SERVICES

The project will require a wide range of new below ground services to be installed, in addition to the services diversions discussed earlier in Section 4. All of the proposed services have been designed to meet the demands of the proposed development with connection points into the local authority and utility services providers agreed and incorporated within the design proposals. BAM have included the construction sequence of these services in their Level 3 Programme, and will liaise with each of the relevant authorities as required in advance of construction and to arrange tie-ins / connections etc.

Particular reference to live services that must remain in service during the excavation works. These services will be fully exposed and marked up on site plans and will be traced and marked out on the ground prior to excavation works taking place. All excavations will be subject to a "Permit To Dig" as per BAM H&S policy. Redundant services will be treated as live until proved otherwise.

5.5 BASEMENT STRUCTURE

The Basement Structure comprises of the following discrete levels:

- Level B3
- Level B2
- Level B1
- Level LG
- Level 00

Formation levels vary across the site as shown on the tender design drawing *NPH-C-OCSC-DR-XX-00-1010-0120* (formation levels for detailed design TBC). A minimum of 300mm of material will be left in place above formation level as weather protection until such time as measures are in place to approve the formation and subsequently cover it up as per the foundation details shown on the detailed design drawings. Formation approval will be carried out in phases, with areas signed off for approval by the Employer's Representative immediately prior to covering up.

5.5.1 Level B3

The level B3 is located in the northern portion of the site. It acts as an attenuation tank for storm water drainage for the site. Its structure consists of a foundation slab bearing onto the formation stratum of Boulder Clay. The slab will be constructed as follows:

- Completion of excavations to the formation level;
- Dewatering of excavations, if required, by the Main Contractor;
- Immediate placing of a concrete blinding layer to protect the foundation formation;
- Installation and placing of waterproof membrane & drainage;
- Placing of reinforcement;
- Casting and curing of concrete.

Once the slab has cured, works will commence on the rising elements from Level B3 to Level B2. These works will comprise:

- Installation and placing of waterproof membrane;
- Placing of reinforcement for vertical columns and walls;
- Erection of formwork to columns and walls;
- Casting of vertical elements.

5.5.2 Level B2

The Level B2 consists of plant space, loading bay and storage space. The structure is a mixture of a foundation slab bearing directly onto the formation stratum together with a suspended flat slab over the Level B3 area. The foundation slab will be constructed in a similar fashion to the Level B3 slab with:

- Backfilling of excavations around the perimeter of the B3 rising walls with leanmix blinding;
- Completion of excavations to the formation level for remaining footprint;
- Dewatering of excavations, if required, by the Main Contractor;
- Immediate placing of a concrete blinding layer to protect the foundation formation;
- Installation and placing of waterproof membrane & drainage;
- Placing of reinforcement;
- Casting and curing of concrete.

The works on the rising elements from Level B2 to B1 will be undertaken in the same fashion as that for the lower level.

5.5.3 Level B1

The Level B1 consists of plant space and car parking. The structure is a mixture of a foundation slab bearing directly onto the formation stratum together with a suspended flat slab over the Level B2 area. The construction works will follow the same form as those for Level B2 for the foundation slab whilst works for the suspended slabs will involve:

- Placing of propping and laying of formwork;
- Fixing of steel reinforcing bars for concrete;
- Casting of concrete slabs;
- Striking of formwork and temporary propping once concrete has adequately cured.

The works on the rising elements from Level B2 to B1 will be undertaken in the same fashion as that for the lower levels.

5.5.4 Level LG

The Lower Ground Floor Level (Level LG) comprises a mixture of car parking areas and areas of clinical accommodation. It consists of a concrete flat slab with a slab level of 16.8m OD. Again, structural works will be undertaken in a similar fashion to the lower levels.

5.5.5 Level 00

The L00 features the main pedestrian entrances into the new children's hospital building with access points located to the north, south, east and west elevations. It comprises accommodation with a variety of uses including Emergency Department, Diagnostics & Imaging as well as Out Patients Departments. The structure consists of cast in-situ concrete flat slab construction, with the thickness of slab varying to meet the end use requirements. The slab level internally is typically at a level of 21.0m OD with the levels externally stepped to suit the adjacent areas. To area the north of the main hospital superstructure consists of a suspended slab over the basement level carpark area. The permanent access road travels to the west, north and east of this area and consists of a mixture of suspended slab and beam structures over the basement footprint together with a traditional ground bearing outside of this area. The level of the road falls from c. 21.0mOD at the junction with South Circular Road to a level of 16.6m OD at the entrance to the car park along the northern perimeter of the basement.

5.6 WATERPROOFING

The below ground elements of structure include the following non exhaustive list:

- Basement B3 Level incorporating Attenuation Tank
- Basement B2 Level incorporating Facilities Management & Plant, Corridor, Link Tunnels
- Basement B1 Level incorporating car-parking
- Lower Ground Floor incorporating car parking & outpatients department
- Lower Ground Floor of Ronald McDonald House
- Utility Tunnel
- Facilities Management (FM) Tunnel Link to St. James' Hospital
- Suspended campus ring road (part of Landscape Architects spec.)
- Below ground vertical elements up to and including 300mm from Ground/DPC level or other similar horizontal waterproofing (to Architects specification).

All components comprising the waterproof system shall be designed, detailed, supplied and installed by a single Specialist Waterproofing Sub- Contractor (Supplier) and Sub-contractor/Installer and their Agents. All materials used in each of the waterproofing systems shall be manufactured by a single manufacturer.

5.6.1 WATERPROOFING SYSTEM REQUIREMENTS

All materials shall have a current British Board of Agreement Certificate or Equivalent. All materials shall have the necessary CE Marking and Certification with Declaration of Performance Certificates to be furnished with all submissions. All waterproofing and waterproofing jointing material shall have a certified Declaration of conformity/performance in compliance with the Construction Products Regulations.

BAM shall submit for approval drawings indicating the positions of joints and details of water bars to be used for all watertight construction.

BAM understand the preparation of surfaces and jointing of water bars and hydrophilic strips along with robust fixing to withstand the pouring process are key elements to achieving watertight joints. At slab and wall junctions, BAM will cast kickers at the same time as and integrally with the floor slab (unless otherwise noted on the drawings).

5.7 CONCRETE PLACEMENT

Concrete shall be transported from the place of mixing to the place of final deposit immediately upon discharge from the mixer agitator by methods that will prevent segregation or loss of constituents. When transported in truck mixers or agitators, concrete shall be placed (delivered) within 2 hours after the time of loading or within 1.0 hours after the time of loading when non-agitating equipment is used. These periods are subject to review depending on weather conditions and mix constituents. No additional water or admixtures are to be added to the concrete to assist placing.

BAM shall complete pre-pour inspection sheets prior to the Employer's Representative inspections before placement of any concrete. All concrete shall be placed continuously between predetermined square butt joints. Each unit of construction or each section of work shall be completed between predetermined and approved construction joints in one operation. Concrete shall be deposited in layers of not more than 600mm which shall follow one another within thirty minutes. Each layer shall be mechanically vibrated subject to other clauses in the concrete specification. Horizontal slabs shall be laid in one operation to the full thickness and beams in one operation to the full cross section.

During the works, BAM shall complete post-pour check sheets after concrete placement, and carry out post-pour surveys, in particular the concrete level survey of all floor plates within one week of concrete casting. Tolerance criteria to be in accordance with *OCSC Cast Insitu Concrete Specification*.

5.7.1 Crack Control & Constraint

BAM will submit concrete mixes under the MAR system for the Client's approval, ensuring the exposure classes and minimum cement contents are in compliance with those set out in *Table ST.05 of OCSC Specification for Structural Engineering*. The concrete mix designs submitted by BAM shall allow for crack control in accordance with the limits set out in *OCSC Movement and Tolerances Report*.

5.7.2 Concrete Finishes

All structural concrete finishes to be as per *OCSC Cast Insitu Concrete Specification* and the detail design drawings. All finishes to structural concrete shall be in accordance with Table F.4 to I.S. EN 13670.

BAM will prepare sample panels of R.C. elements to have a "special" finish concrete surface. Sample locations and finish to be agreed with the Architect/Employer's prior to full construction of element on site. Some typical "special" finish elements are as follows:

- exposed R.C. columns and walls in aesthetic sensitive areas;
- raking biome and 'Cone' structure columns;
- biome support beam;
- FM/Marshalling Yard entrance wall, etc.

All floor slabs except car-park ramp slabs and FM/waste marshalling area (TBC) to have power floated finish and treated with an epoxy dust sealer or alternatively power floated and treated with proprietary paint finish specified by the Architect. Car-park ramps are to have a tamped concrete finish. A sample panel will be constructed and reviewed by the ER/Engineer prior to construction of the ramp slabs.

5.7.3 Precamber

Some areas of reinforced concrete flat slabs require pre-camber to limit final downward deflection where floors do not receive a screed finish. The precamber shall be provided in the flat slab tables and striking times shall be extended and agreed with the Engineer/ER following a series of trials prior to the final construction. The contractor shall allow for the cost of the inclusion of any adjustments to table forms following the outcome of lower level pours. Pre-cambers are required at the following locations:

- Grid 50-57 transfer slabs on L03 and L04 above the Main Entrance;
- Level 02 and 03 above the South Entrance;
- L04 transfer slab;
- Slab bays supporting heavier loads in general;
- Localised bays.

5.8 FRAME

BAM will prepare a method statement detailing the methodology and construction sequence to be adopted during frame erection. This will be submitted to the Employer's Representative for approval in advance of works commencing.

5.8.1 Structural Steelwork

OCSC *Steelwork Specification* and general notes on drawing NPH-C-OCSC-DR-XX-00-2028-0000 set out all clauses covering the structural steelwork on the new hospital. All steel products and fabricated steel products must comply with the CE marking requirements of the relevant harmonised standard, e.g. I.S. EN 1993-1-1 and I.S. EN 1090. The building is classified as Execution Class EXC4.

However, localised or specific areas of structure may be reduced to EXC3 only if agreed between the main contractor and the Engineer due to industry readiness.

5.8.2 Steelwork Contractor

The Steelwork Contractor shall be subject to the Client's approval, and will provide a full time, senior, experienced and qualified representative to direct work on site.