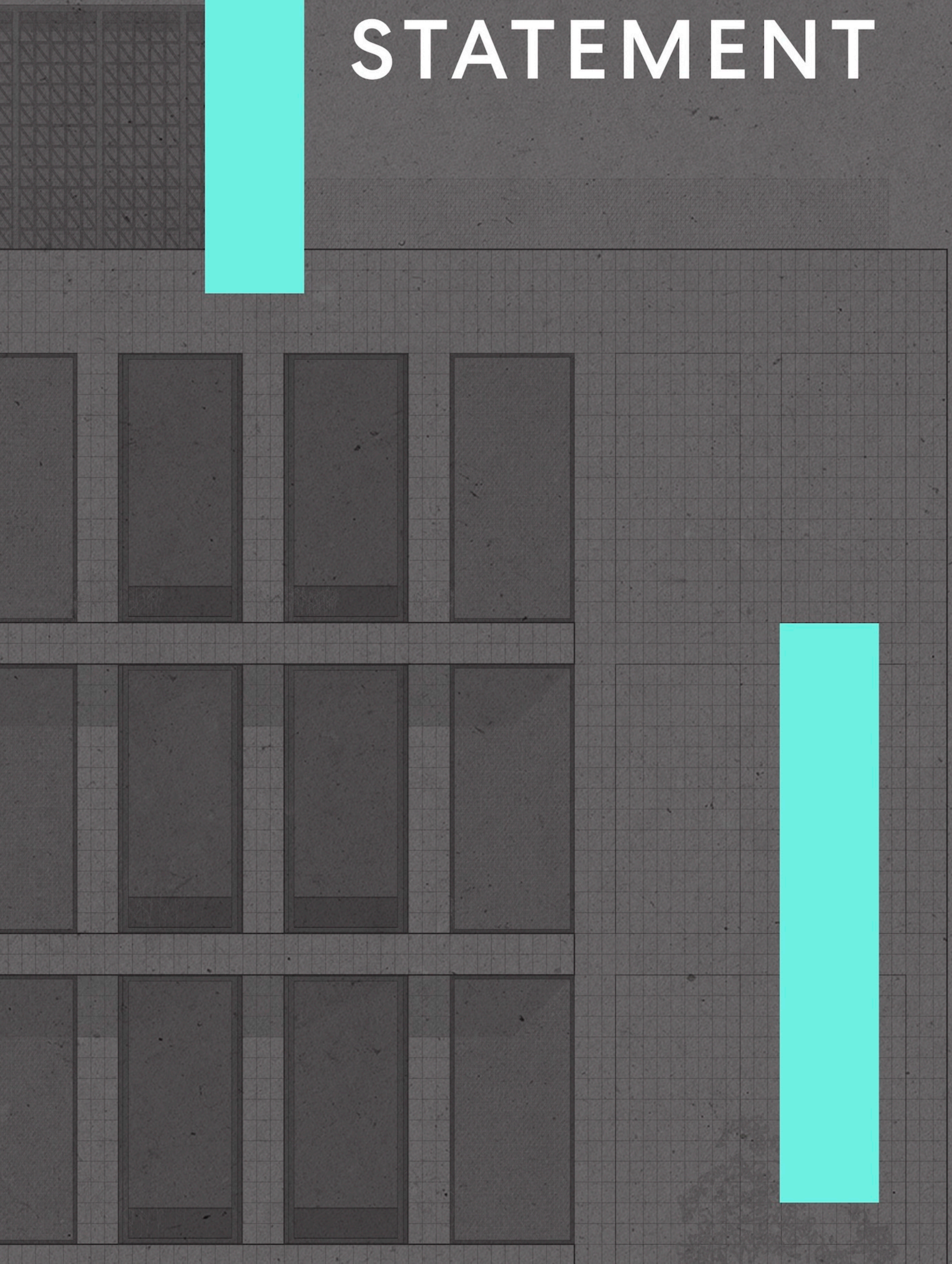
STRUCTURAL METHODOLOGY STATEMENT

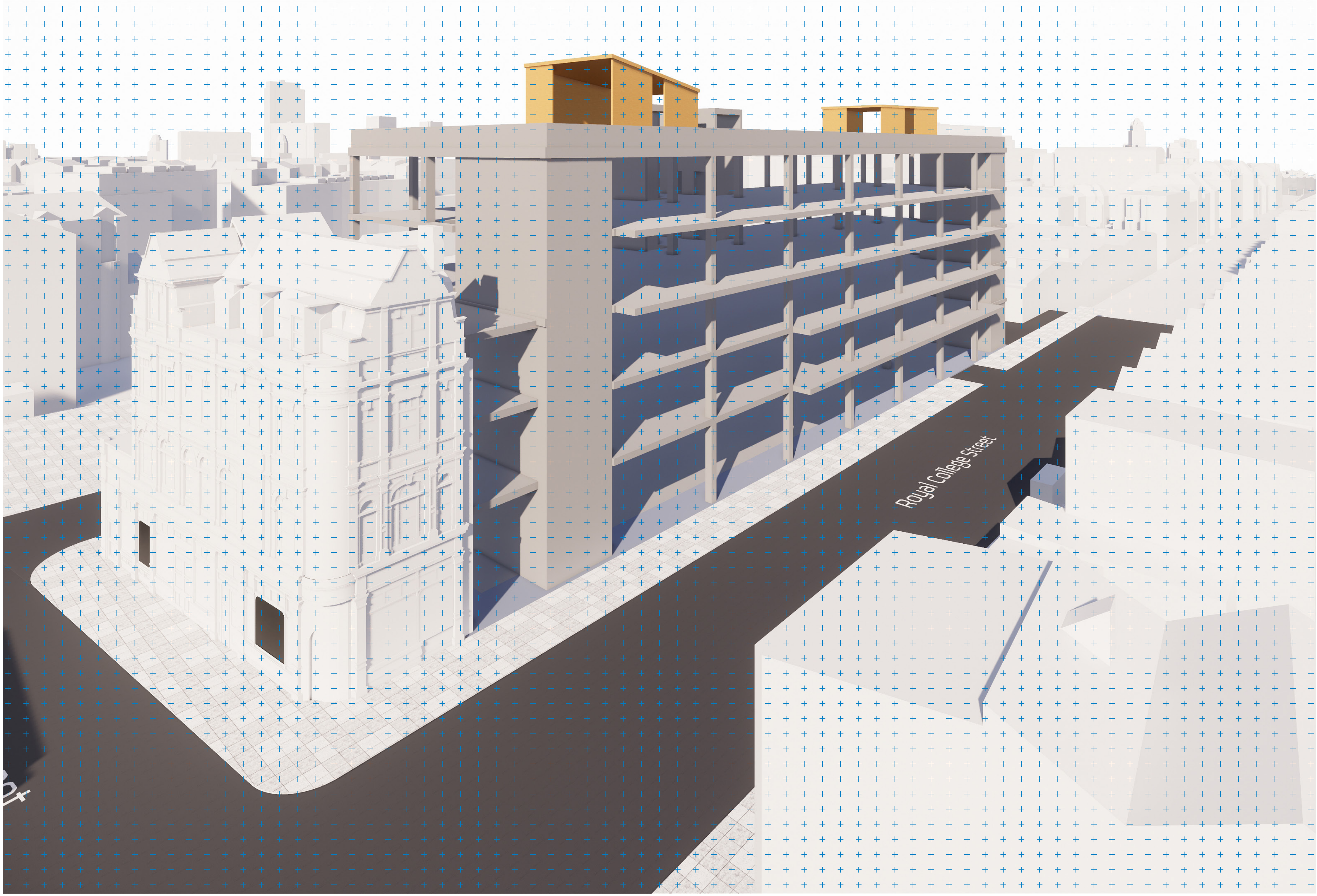
Former Car Repair Centre
70 – 86 Royal College Street
London
NW1 0TH



ROCCO VENTURES

NHS
Central and
North West London
NHS Foundation Trust

HEYNE
TILLETT
STEEL


Royal College Street

Contents

Appendices

Status: Planning
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Job no: 2222
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HEYNE TILLETT STEEL

Executive Summary

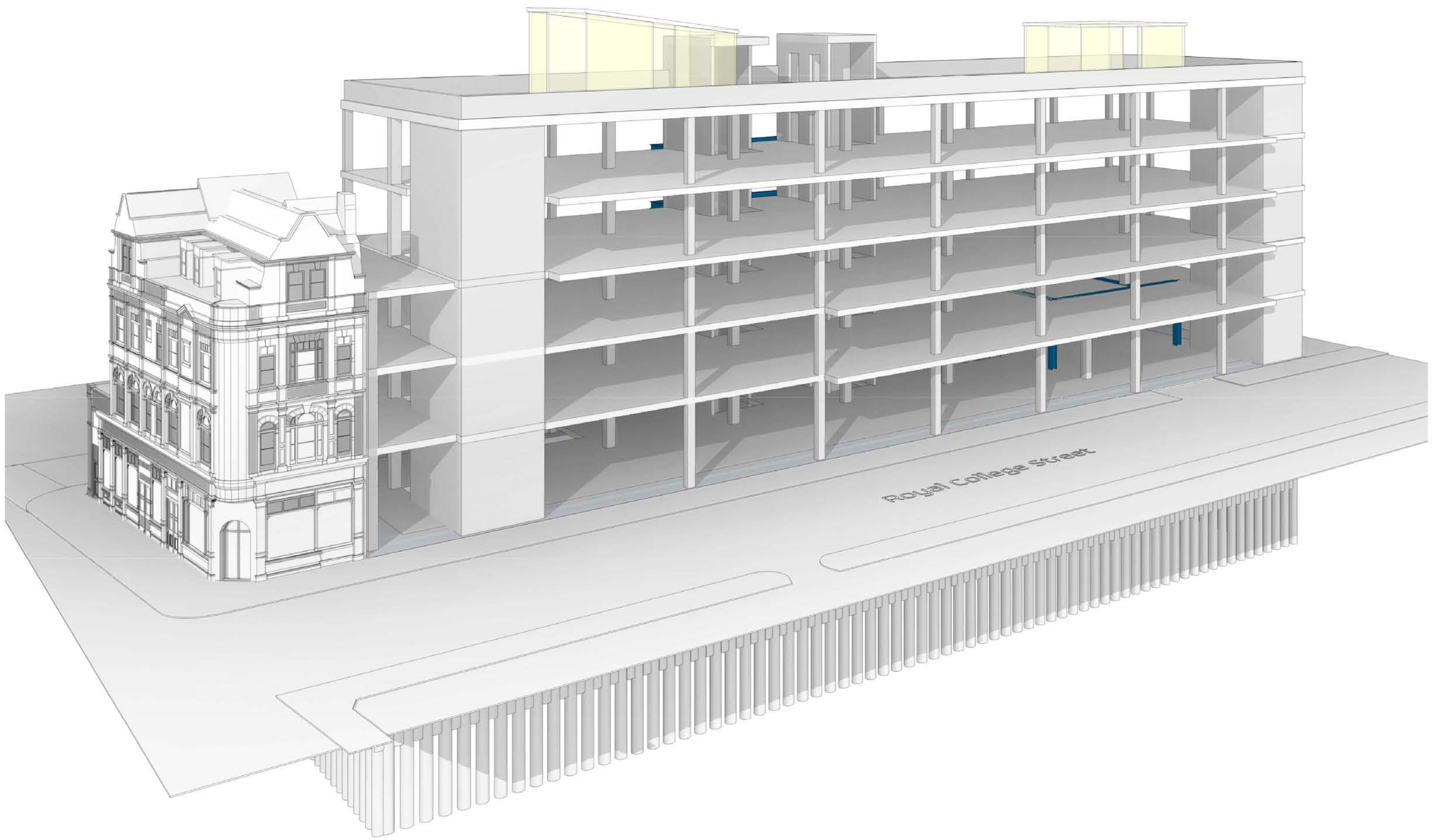
The site at 70-86 Royal College Street in Camden, currently consisting of a single storey garage and a large external paved area, has been proposed as the site for a new seven storey (including basement) healthcare building. This report outlines the structural and below ground drainage proposals for the scheme as well as geotechnical considerations such as contamination, ground movement and impact on assets and neighbouring properties.

The structure is proposed as reinforced concrete (RC) construction with flat slabs (beam free space) and columns on a 9 x 8m grid. The basement is proposed to be formed with a secant piled wall to the perimeter and a ground bearing raft slab, as such avoiding piling operations within the footprint of the building.

A steel transfer frame will be introduced above the ambulance bay to achieve a large column free space, and we are proposing thermally broken steel balcony structures and cross-laminated timber roof café spaces.

The ground movement assessment carried out as part of the BIA in appendix I illustrates that damage categories exhibited for each of the adjacent structures during the various phases of development are confined to Category 1 (Very Slight) damage with a majority of structures confined to Category 0 (Negligible). These results are within acceptable limits according to the Camden Planning Guidance document on Basements.

We propose to reuse the existing connection to the Thames Water sewer and to use a blue roof construction to control surface water run-off rates.



Cross Section Through Proposed Building

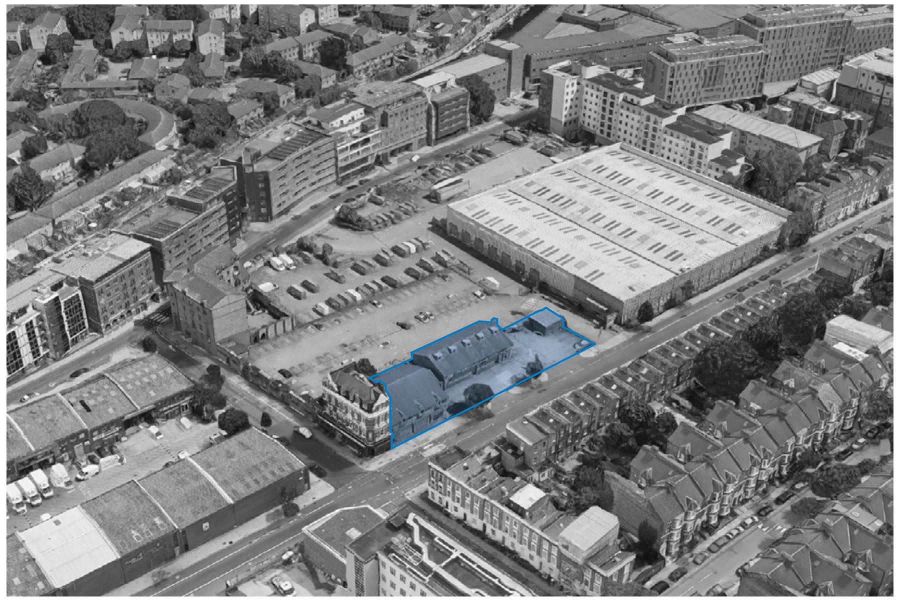
1 Introduction

Heyne Tillett Steel have been appointed by Rocco Ventures Ltd. to produce a Structural Methodology Statement (SMS) for the new-build healthcare development of 70-86 Royal College Street, Camden, London. This report describes the structural, geotechnical and drainage considerations associated with the proposed development.

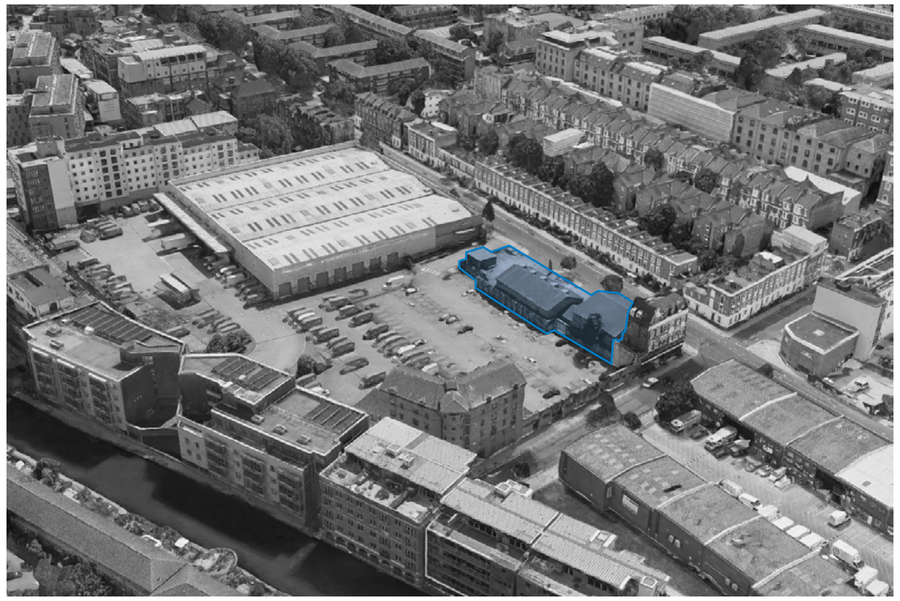
Intrusive geotechnical investigations as well as desk studies have been carried out for the development, and we have investigated archive sources such as the London Metropolitan Archives, Camden Building Control and the British Geological Survey to ensure that we have a good understanding of the existing site and buildings.

Table 1 – Typical Planning Requirements

A. A thorough desk study	· Section 2 – Site and Existing Buildings · RSK GIR Report (see Appendices)
B. An appraisal of the existing structure	· Section 2 – Site and Existing Buildings
C. A site investigation	· Section 2 – Site and Existing Buildings · RSK GIR Report (see Appendices) · RSK BIA Report (See Appendices)
D. Details of the engineering design	· Section 3 – Proposed works · HTS Proposed drawings (see Appendices) · HTS Drainage Strategy & Flood Risk Report (see Appendices)
E. An analysis of the Upper Aquifer.	· RSK BIA Report (see Appendices)
F. Details of flood risk, surface water flooding, critical drainage areas explaining how these are addressed in the design.	· HTS Drainage Strategy & Flood Risk Report (see Appendices)
G. An assessment of movements expected and how these will affect adjoining or adjacent properties.	· Section 6.3 – Ground movement assessment · RSK BIA Report (see Appendices)
H. Details of sequences of construction and temporary propping to demonstrate how the basement can be built to prevent movements exceeding those predicted.	· Section 5 – Construction sequence



Ariel view of Royal College Street from the East, Google Image of Site



Ariel view looking from South of the Canal and Georgiana Street, Google Image of Site

Ariel view of Royal College Street from North, Google Image of Site

2 Site and Existing Buildings

The site is situated on Royal College Street in Camden, just south of Camden Road train station, just west of Regents Canal. The site is rectangular in plan, roughly 70 x 20m with Royal College Street on the western long site boundary, the Golden Lion pub to the north abutting the site, an external parking area to the east and a Parcelforce building to the south separated from our site by the access road to the car park. Archive information suggests that the Golden Lion was refurbished in the 2000s to including internal modifications of the existing basement.

A Thames Water trunk sewer has been identified running past the site under Royal College Street, and as per the CCTV survey in Appendix L the site contains an existing connection to the sewer which we are aiming to retain and reuse.

The lost river fleet, now culverted, is indicated to run between the site and Regent's Canal. Running near the site it is unlikely to have any adverse impact on the development due to the culvert construction and the height of the clay strata. There is however a risk of stringent limits on ground movements which need to be investigated further. No ground investigations to date have identified alluvium deposits, the Thames Water asset map does not show the river, and historic maps show it away from the site.

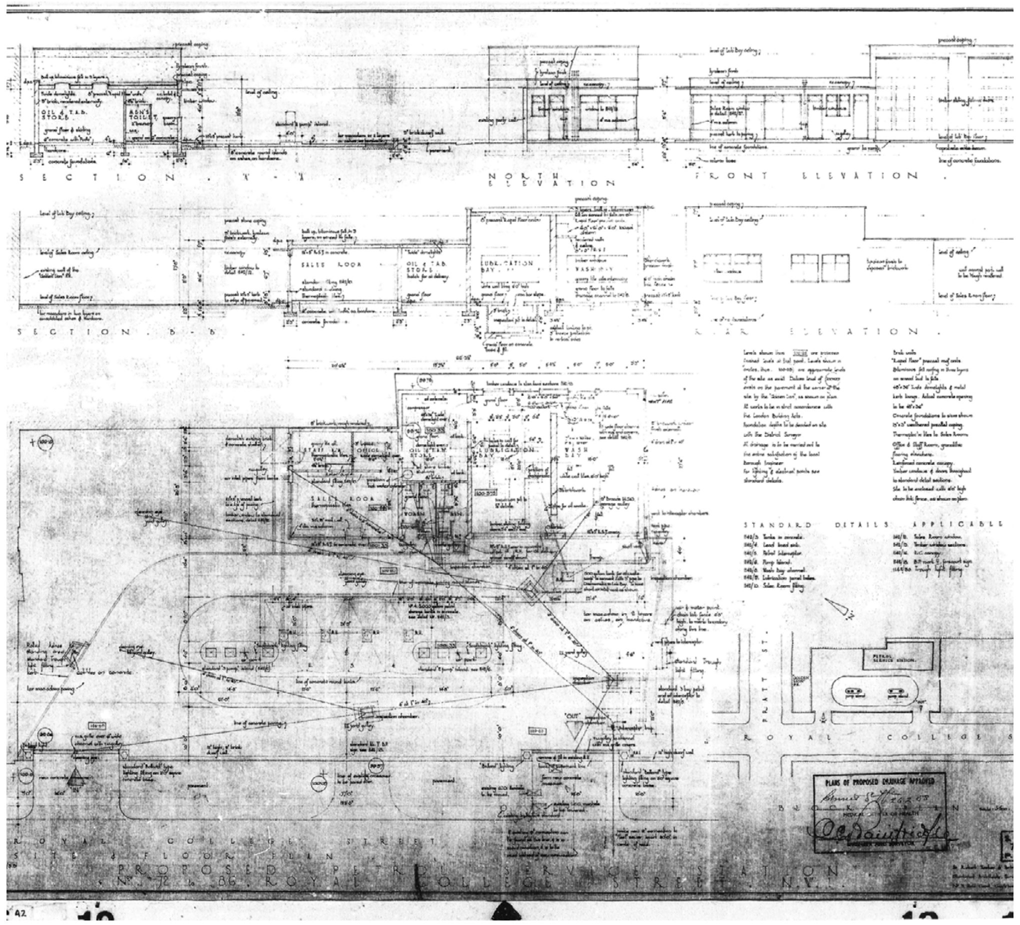
The closest rail tunnel is 400m away from the site and will therefore not have a significant impact on the development. While the site is indicated as a 'very low' risk of surface water flooding it abuts an area of 'low' surface water flood risk.

2.1 Site history

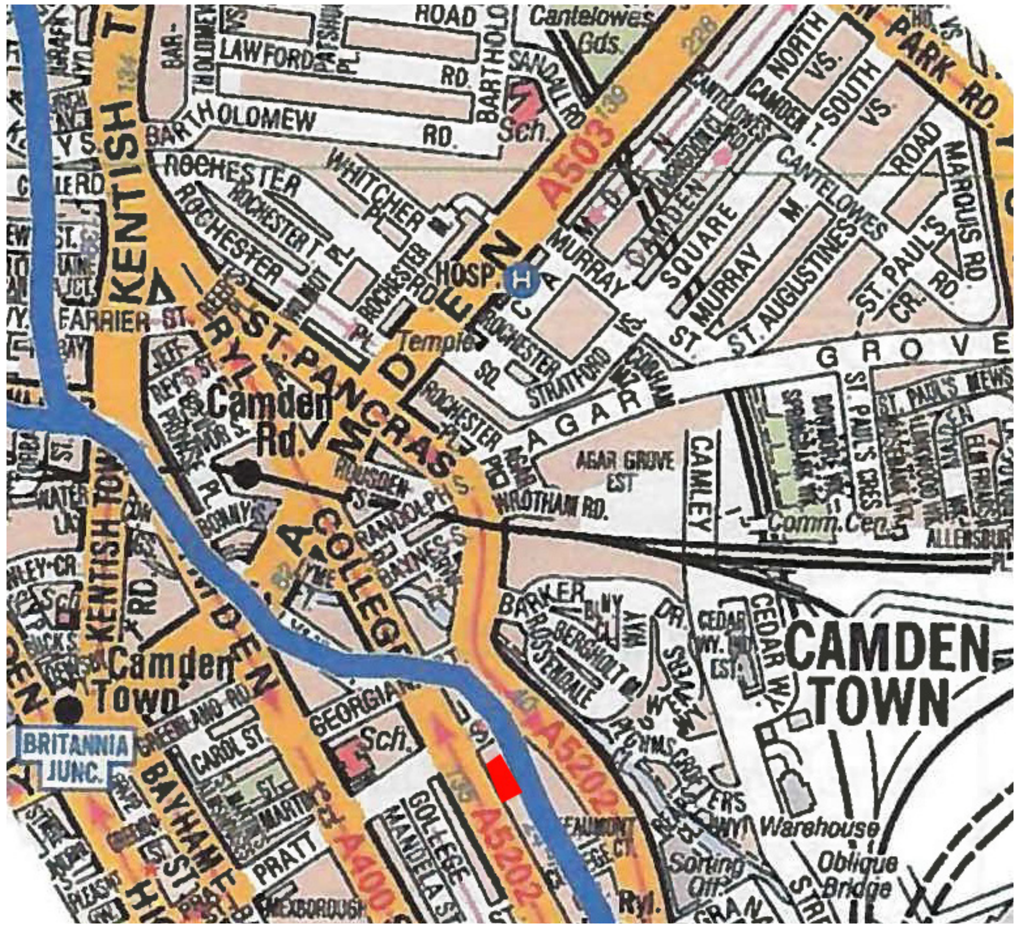
The site currently houses a garage, and historic maps suggest that the building has been on site since the 1960s. This is further evidenced by planning drawings issued in the late 1950s. During construction of the garage it is understood that seven 13,000 litre petroleum tanks were installed below ground level.

2.2 Existing Buildings

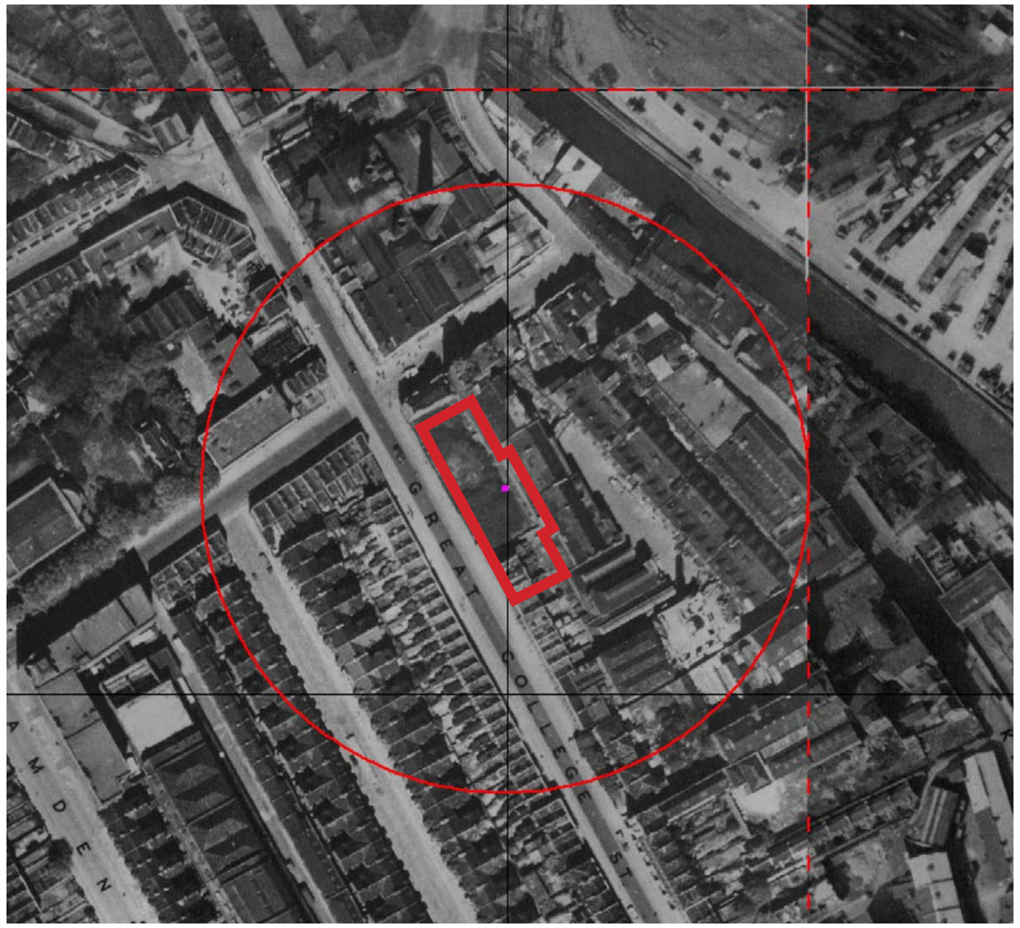
Site investigations suggest that the existing construction is a steel sway-frame construction with brick infill walls to the perimeter and internally. Based on the thickness of the external brick piers these may also be load-bearing with steel columns stopping short above them. The roof construction is likely to be lightweight insulated panels, and the foundations appear to be shallow RC foundations typical for this form of construction.



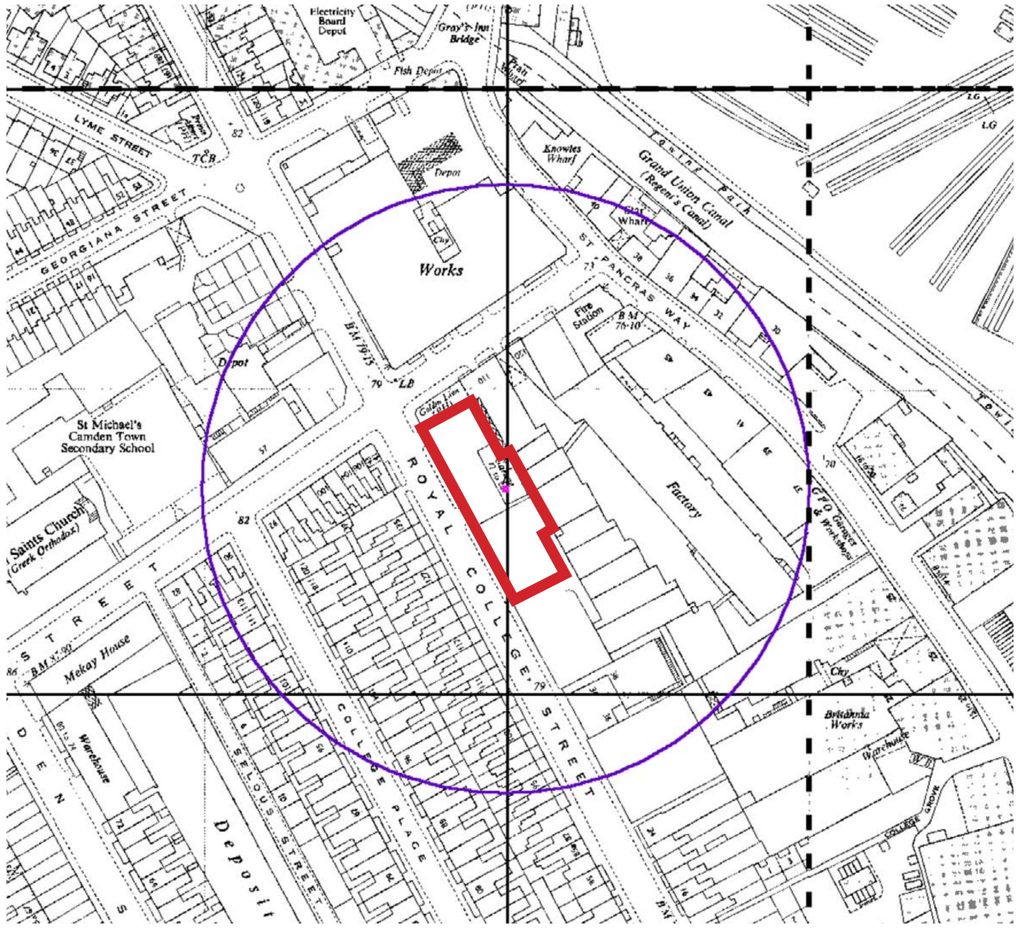
Camden Archive Drawing, Proposed Petrol Station dated 1957



London Lost Rivers Map



Historic Aerial Photography Published 1946



Historic Map Published 1962-1969

2.3 Ground conditions, services and features

2.3.1 Site investigation

A site-specific geotechnical investigation was undertaken by RSK in August 2019. Fieldwork comprised the following activities:

- Two boreholes drilled across the site to depths of 30m in order to confirm the underlying geology, to obtain geotechnical data for design and to install gas/groundwater monitoring wells.
- Three trial pits to expose the existing foundations and made ground.
- Three window samples so get a better understanding of the ground condition at shallow depths and to collect data for laboratory testing.

The RSK GIR Report containing all the details of the fieldwork is included in the Appendices.

2.3.2 Geology

Two boreholes have been carried out from basement level to assess the existing subsoil conditions, obtain geotechnical data and determine the contamination status of the ground beneath the site. A standpipe was also installed to measure ground gas and groundwater levels (borehole logs are contained within the RSK report in the appendix.)

The boreholes were drilled to a depth of 30m below ground level with the ground consisting of the following strata (see appendix for more details):

A groundwater level just above the clay formation was found at approximately 2.69 to 3.48m bgl. This is assumed to be perched water sitting on the clay, but as the ground investigation was inconclusive, there should be an allowance for uplift loading to the underside of the basement slab. In the permanent case this results in an approximate uplift force of 20kPa once slab self-weight has been considered, a significantly lower load than the 164kPa load allowance currently allowed for loading pressure and heave.

Hand excavated trial pits were carried out at locations across the site to expose the existing foundations to the various buildings and level changes and to retrieve samples for chemical testing. Trial pit records can be found in the appendix.

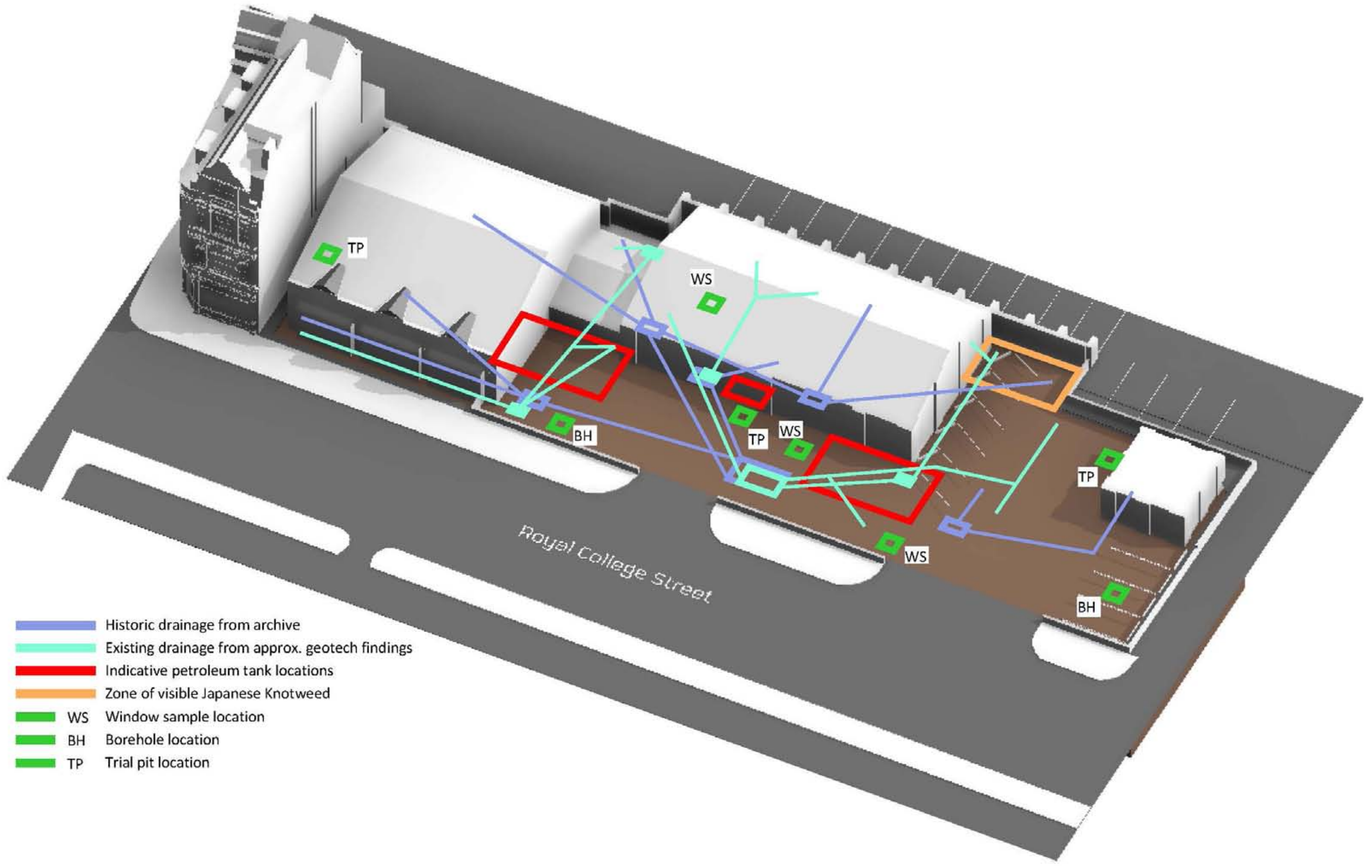
Gas monitoring confirmed that the site falls into Characteristic Situation 1, for which no gas protection measures are required.

BH1

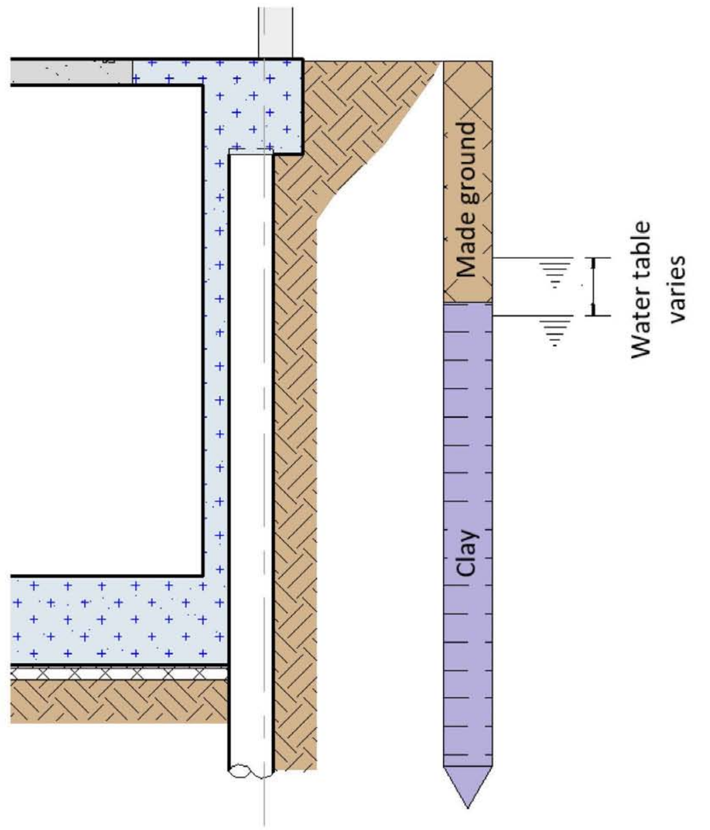
0.00 – 0.20m	Concrete
0.20 – 3.40m	Made Ground
3.40 – 9.60m	Firm light brown silty CLAY (LONDON CLAY FORMATION)
3.40 – 30.00m+	Stiff to very stiff grey silty CLAY (LONDON CLAY FORMATION)

BH2

0.00 – 0.08m	Asphalt
0.08 – 1.30m	Made Ground
1.30 – 2.20m	Firm light brown silty slightly gravelly CLAY (POSSIBLY REWORKED LONDON CLAY)
2.20 – 3.30m	Firm brown gravelly CLAY (POSSIBLY REWORKED LONDON CLAY)
3.30 – 8.30m	Firm light brown silty CLAY (LONDON CLAY FORMATION)
8.30 – 30.00m+	Stiff to very stiff grey silty CLAY (LONDON CLAY FORMATION)



Geotechnical Investigations Map



Typical Borehole Findings

2.3.3 Hydrogeology and hydrology

The London Clay below the site is designated as an unproductive stratum.

The site is not found to lie within the critical area of the London basin sensitive to rising ground water.

Information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone.

No hydrological issues were identified as part of the GIR, but we note the slight risk associated with the river Fleet described in section 3 of this report.

Refer to the RSK GIR in the appendix, sections 3.6 and 3.7, for further information.

2.3.4 Preliminary Waste Assessment

No significantly hazardous materials were identified from on-site sampling, nor were asbestos-containing materials found. The Waste Acceptance Criteria (WAC) of the soil was identified to exceed 'inert', placing the tested material in the 'non-hazardous' class, and as such waste from site should be disposed of at a landfill or treatment facility which is permitted to take non-hazardous waste.

Archive information suggests that seven 13,000 litre petroleum tanks exist on site below ground level. These tanks are likely to have seen some leakage during their life-time (as evidenced by strong hydrocarbon odours on site), and so an allowance should be made for stringent disposal requirements and for local testing to determine the extent of petroleum ingress into the soil. Note that this is unlikely to have a significant impact on the final development as the contaminated soil will be removed.

Further information can be found within the GIR Report in the Appendices.

2.3.5 Unexploded ordnance (UXO)

A preliminary UXO risk assessment suggests a very high density of bombing on site, and as such a significant risk profile associated with ground works. During their works, RSK employed a specialist UXO officer to inspect the works and carry out magnetometer readings. This may not be cost effective during longer periods of ground works, and as such we recommend that a detailed UXO assessment is carried out in the next phase of design which may help reduce the amount of on-site presence and identify local zones of reduced risk.

2.4.1 Drainage and sewers

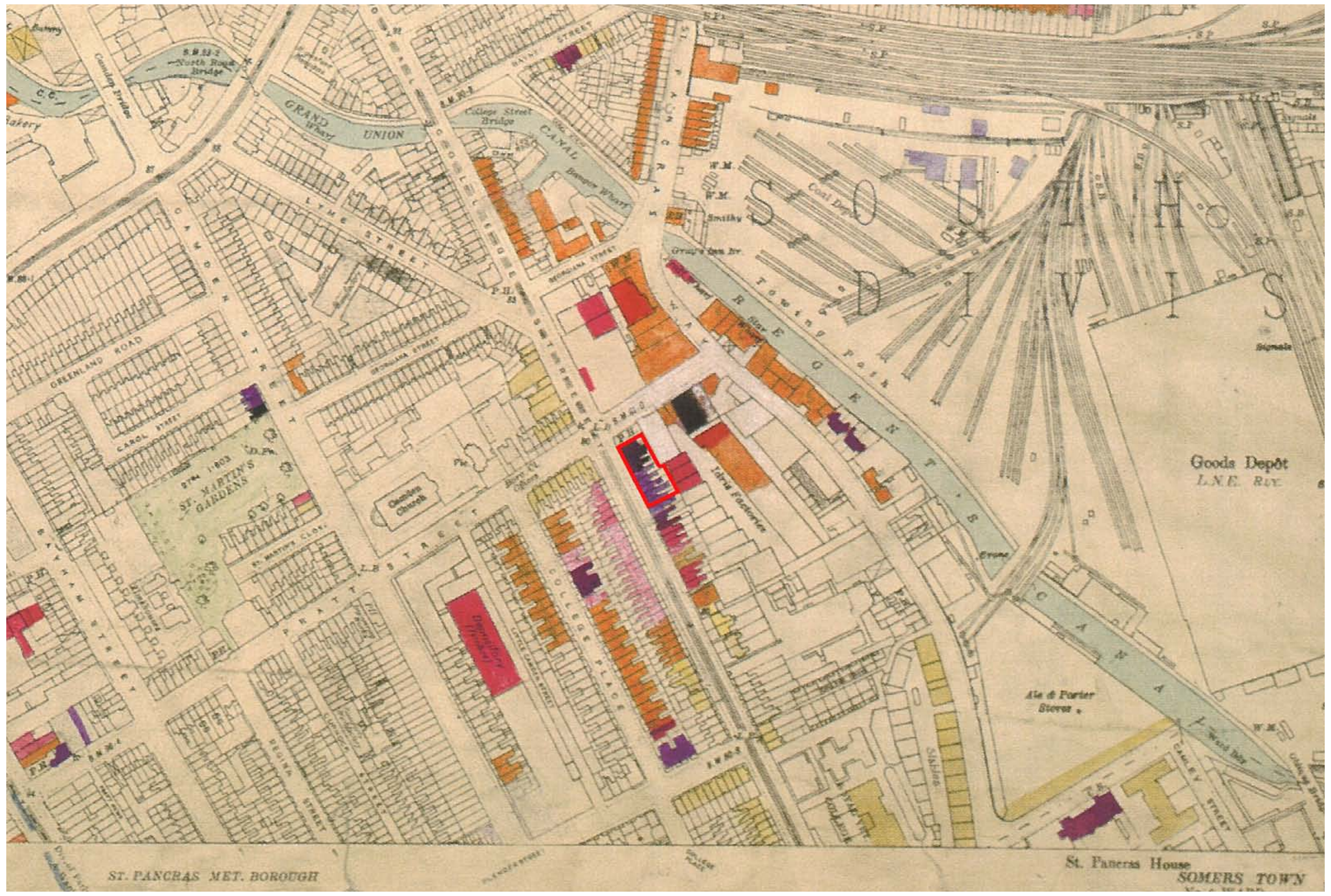
Information from a Thames Water Asset Location Search is included in the Appendices. There are no recorded Thames Water assets within the boundary of the site itself. Thames Water sewers do however run under Royal College Street and Pratt Street. The sewer running below Royal College Street is identified as a trunk sewer.

Where possible, the existing drainage will be retained and reused as part of the proposals. Please refer to the HTS Drainage Strategy & Flood Risk Report for more detailed information.

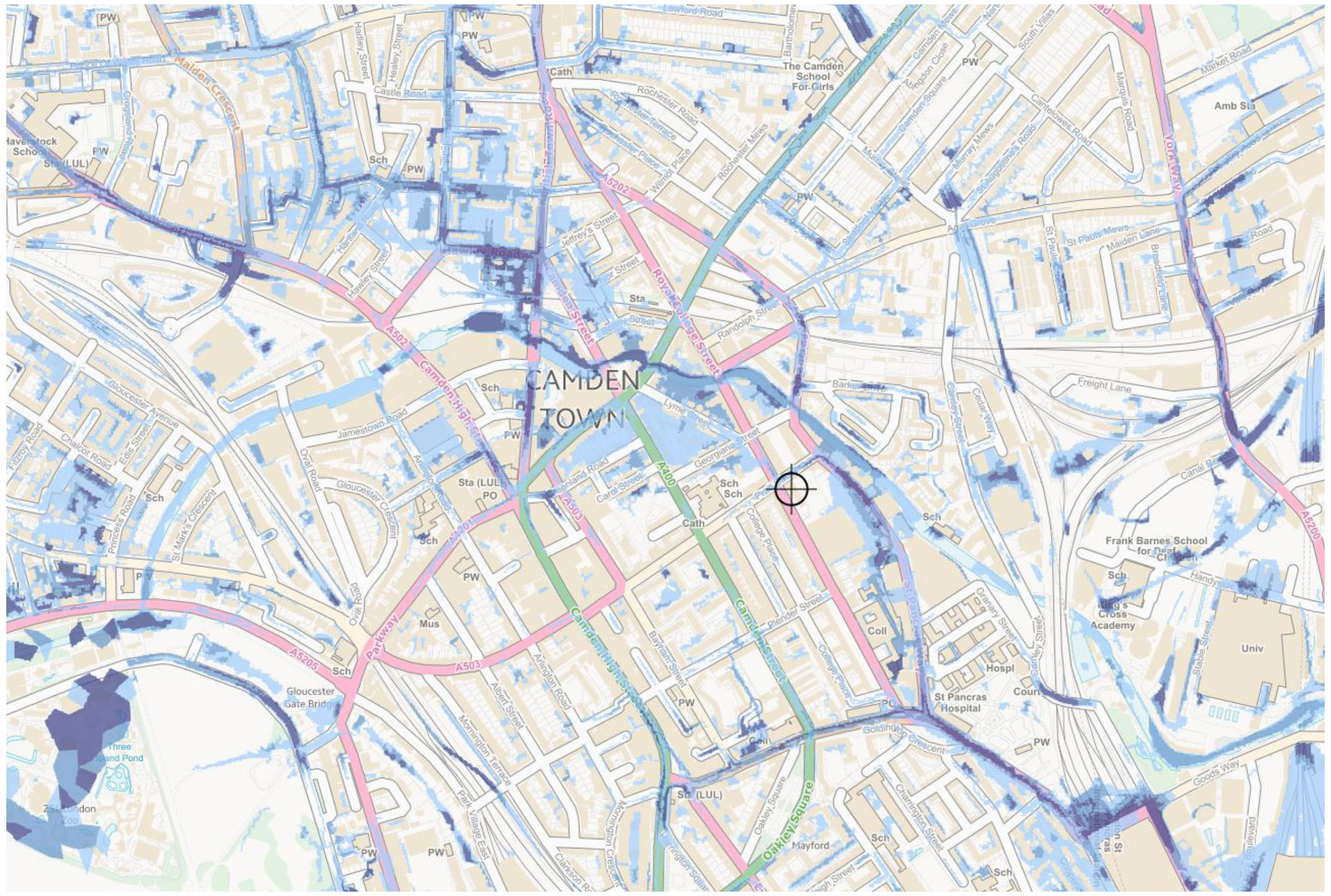
2.5 Flood risk

A detailed Flood Risk Assessment is included within the HTS Drainage Strategy & Flood Risk Report.

The site is in defended Flood Zone 1 (low risk) of the River Thames. The risk of flooding from all sources is considered to be low.



The London County Council: Bomb Damage Maps 1939-1945



Environment Agency Flood Risk from Surface Water

3 Proposed works

The structural proposal includes demolishing the existing garage currently on site, and excavating through layers of made ground, concrete and clay to form a new basement. A new reinforced concrete (RC) structure is proposed on the site with five superstructure storeys, two single storey roof extensions and one deep basement level. The primary proposed usage is for ward units with some office spaces.

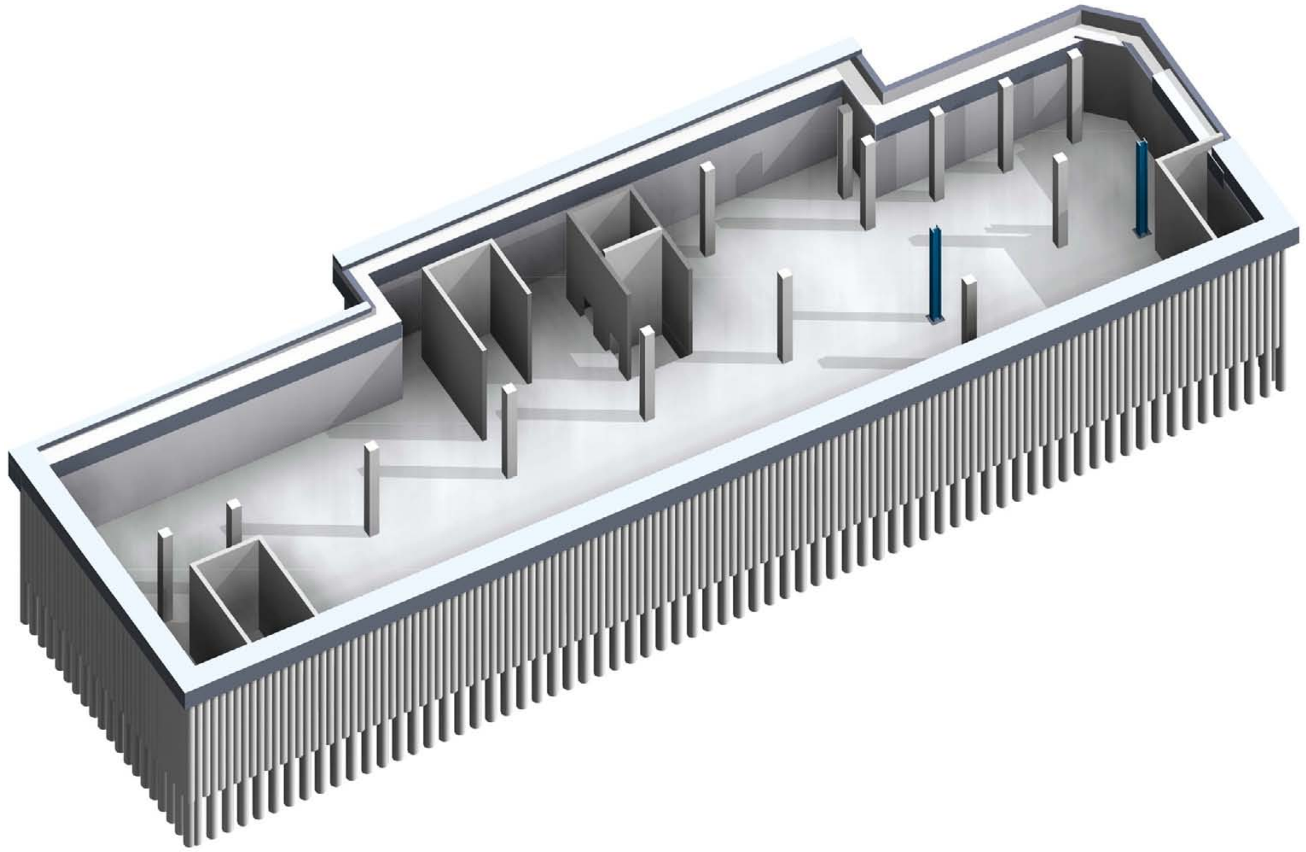
3.1 Basement Construction

The basement construction is proposed as a propped secant piled wall to minimize damage to adjacent properties and control water ingress while limiting works to within the client's site boundary. The secant piled wall carries a majority of the perimeter columns, resulting in a comparatively deep wall construction (i.e. long piles). The load from the perimeter columns is distributed between piles by a 1.3m deep capping beam which spans the perimeter of the basement just below ground floor level. The internal columns are proposed to be supported on a 1.2m deep basement raft slab in line with findings from the geotechnical investigations thus avoiding further piling requirements. The basement slabs and liner walls are currently proposed in water resistive concrete to provide one form of moisture ingress protection. As this is a grade 3 basement two forms of protection will be needed, please refer to the architect's information for proposed solution.

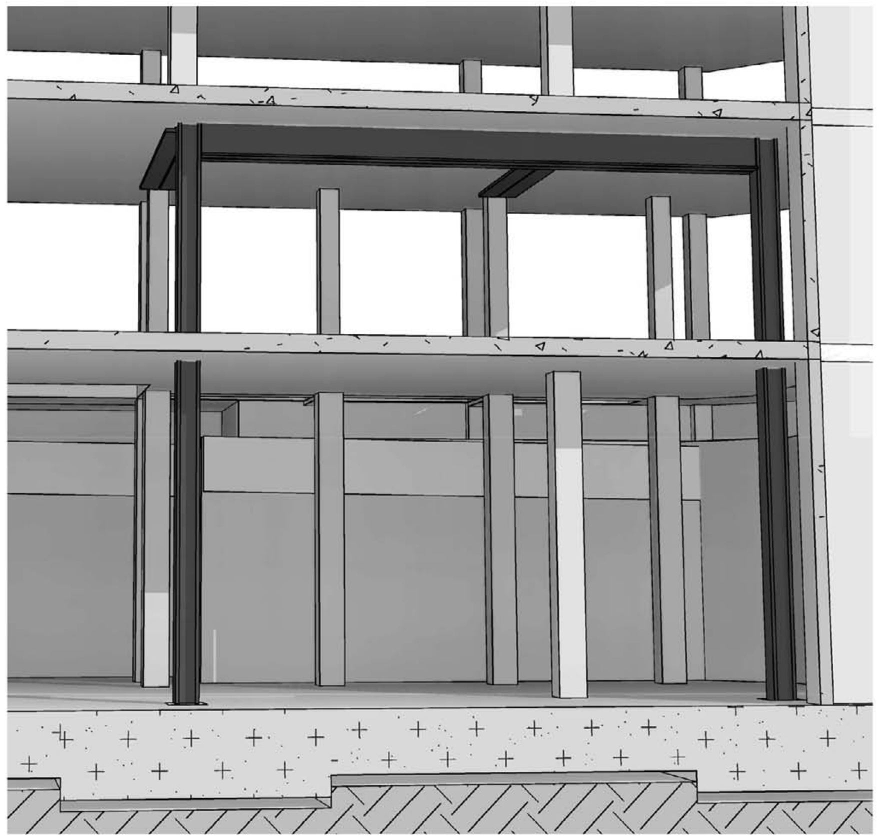
3.2 RC Superstructure

The superstructure is envisaged as RC flat slabs supported on a ~9.5x8m grid of RC columns. The RC flat slabs are 350mm thick, slab depth being dictated by deflection and vibration requirements. The vibrational response of the structure is limited to a response factor of 2.0 in line with NHS guidance. The RC roof slab is designed as 500mm thick to accommodate a green roof build-up with lightweight soil to a depth of 1m in local worst case areas.

A steel transfer structure is introduced between basement and first floor to achieve a large span within the ambulance bay at the east end of the building. This transfer structure carries large gravity loads from the building above and will need to be carefully detailed to achieve load-transfer, tolerance control and material interfaces. We propose that this transfer structure is jacked to allow for redistribution of loads and control of deflections. Further details investigations into the best method of constructing this system to be developed at the next RIBA Stage.



View on Proposed Basement



View on Ambulance Bay Transfer Structure

Balconies to the long back building elevation are conceived as 'cold' steel structures with profiled concrete decking. A set of continuous steel columns, isolated from the primary concrete structure using thermal breaks, carry the bending forces imposed by the cantilevering balcony construction. The durability of this construction will be considered in further detail at the next stage of design and reviewed against alternative solutions. Shorter planter slabs to the front of the building are proposed as thermally broken RC slabs.

Two cross-laminated timber (CLT) roof extensions forming café areas are proposed to sit on the concrete roof slab. CLT is an engineered timber product that is manufactured into large flat panels which are used as structural walls, floors and roofs. The extensions therefore have a flush timber soffit supported on walls within the perimeter of the space. The soffits and walls can be internally exposed with a visual quality timber finish. The use of CLT is to be reviewed further to determine whether it is suitable in this situation in light of recent changes to the use of combustible elements within facades.

3.3 Stability

Stability is achieved through RC core walls distributed across the building footprint. RC floors slabs act as diaphragms to distribute lateral forces into the cores. Cores sit directly on the 1.2m deep structural raft which transfer lateral and push / pull forces into the ground without net tension.

3.4 Disproportionate Collapse

The building is a consequence class 2B building in accordance with the Building Regulations Approved Documents. Vertical and horizontal ties are proposed to ensure robustness, achieved through the inherent rigidity of RC / PT elements and connections.

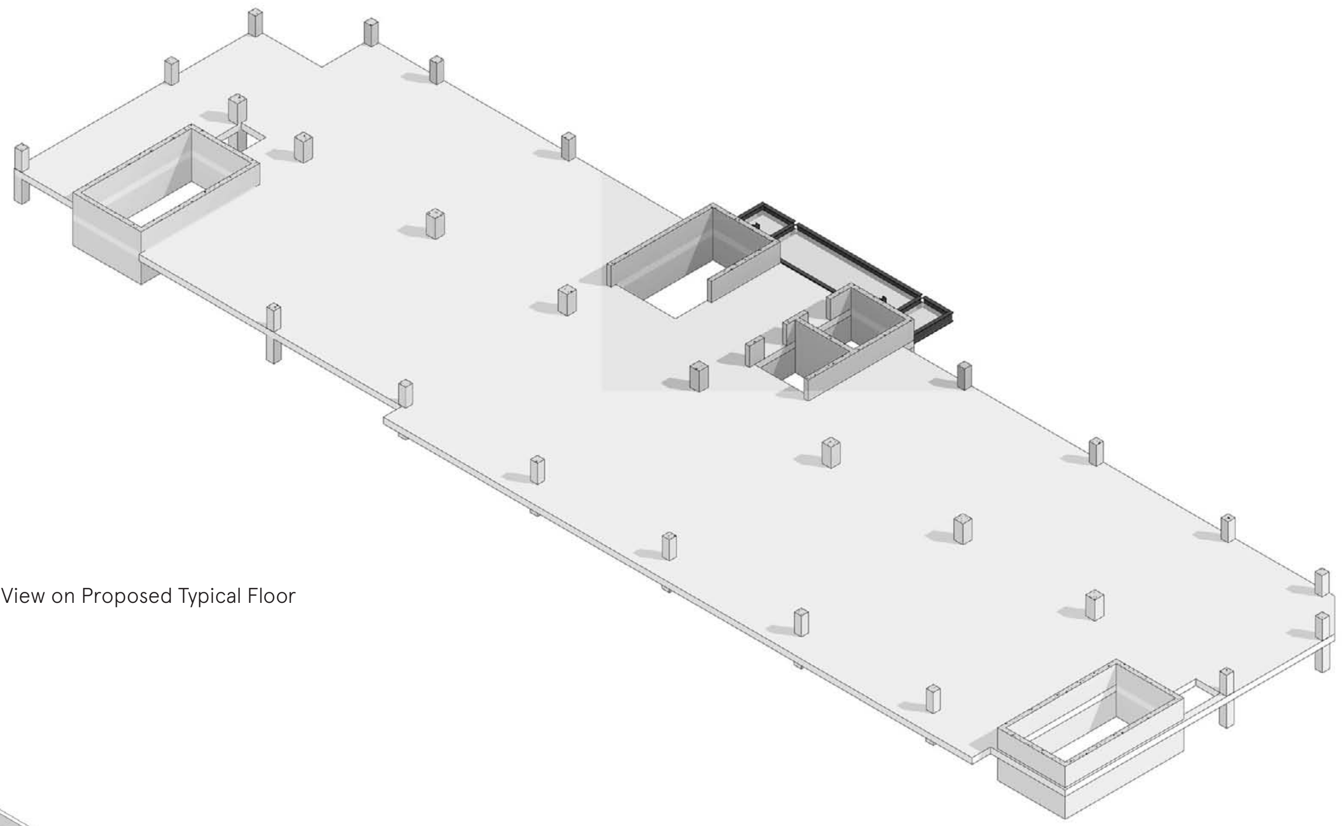
3.5 Fire

The building is designed to a fire rating of 90 minutes. This is addressed with the RC elements through ensuring sufficient cover to reinforcement (axis distance), and to the steel elements through use of intumescent paint to exposed elements and fire rated plasterboard to hidden elements.

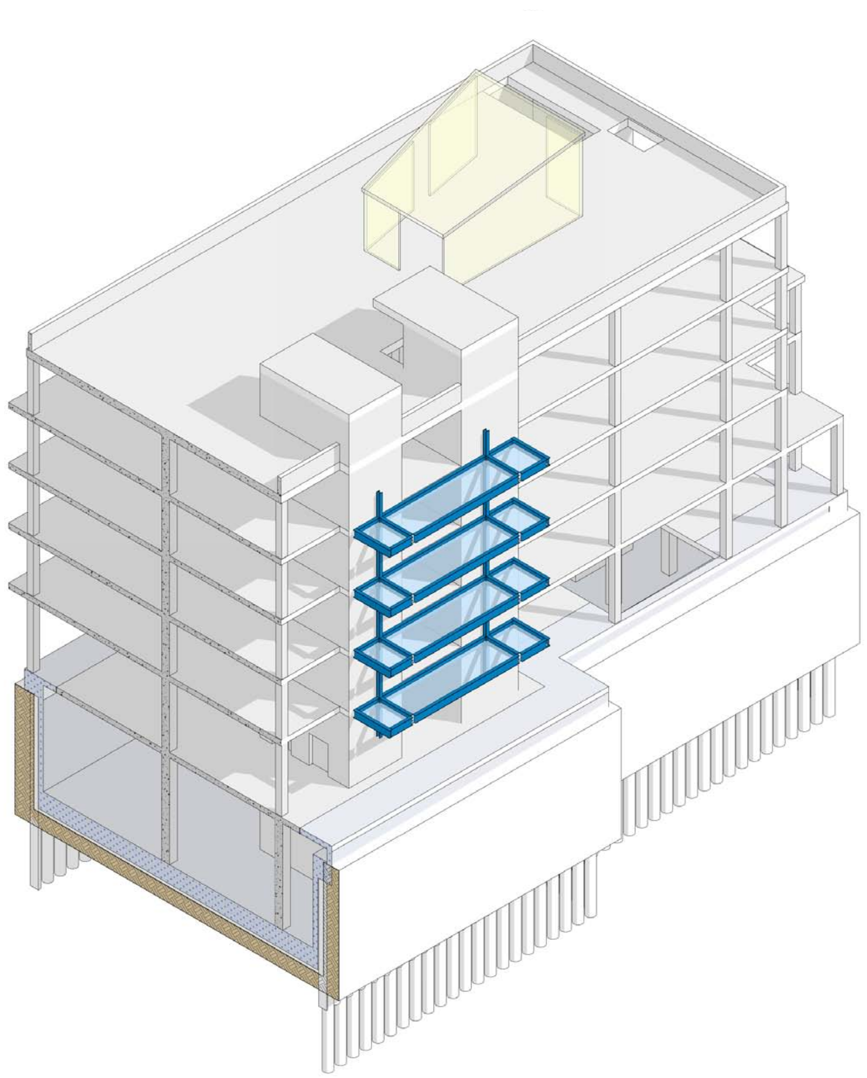
3.6 Below ground drainage strategy

The proposed drainage strategy is to re-use the existing outfall connections into the public sewer. For surface water, attenuation with slow release is proposed via a blue roof to most of the site. The solution is designed to reduce run-off rates, bringing these as close as feasibly possible to green-field run-off rates.

Please refer to the drainage strategy report in Appendix H for further details.



View on Proposed Typical Floor



View on Section Through Proposed

HEYNE TILLETT STEEL

3.7 Structural Optioneering

The early stages of design have included several rounds of optioneering and feasibility studies to find the most cost effective, sustainable and buildable solution which achieves the architectural aesthetic. The table below outlines some of the structural solutions investigated with commentary.

Sketches in the appendix show some of the options investigated.

Solution	Description	Positives
Foundations		
× Bored piling	This is the most common form of construction in London as it brings loads down into more capable strata while reducing movements imposed on adjacent properties, tunnels and infrastructure. The piled solution complements the secant pile wall basement construction proposed and ensures that differential movements are controlled so as to avoid cracking or deformation to the development.	· Typical construction in London · Controls ground movements
✓ RC raft	RC raft construction, when structurally feasible, can provide a significant cost saving compared to a piled alternative. This is a shallow foundation solution effectively floating on the strata just below the lowest building level. Compared to bored piles, rafts do however impose a significant uplift in load on the soil directly below the building and those adjacent possibly imposing additional stresses on adjacent buildings. RSK have carried out an initial assessment of the feasibility of a raft solution and have found that the soil capacity is suitable for this solution. Furthermore, they have shown that this will not adversely affect adjacent properties.	· Economical solution · Suitable for this scheme
Superstructure		
× Concrete decking on steel beams	This solution facilitates long structural spans and is typically more lightweight than reinforced concrete. The stringent healthcare vibration criteria cause this form of construction to become very deep and heavy, and the comparatively high embodied energy associated with manufacturing and recycling steel results in a comparatively high impact on the environment.	· Comparatively light weight construction · Quick erection
× Timber glulam frame construction with CLT floor slabs	Timber construction is arguably the most sustainable form of construction investigated, not only because of its light weight and low embodied energy, but also because the type of timber used in modern timber construction is highly renewable. Transportation of engineered timber products from other parts of Europe can however add somewhat to the carbon footprint of the material. A timber design was investigated for the building frame but was found to be inefficient and too deep. There are also issues associated with timber within external facades of buildings with over-night stay. We do however propose that timber construction is used for the roof pavilions to celebrate the material.	· Comparatively light weight construction · Quick erection · Sustainable
✓ Reinforced concrete construction	Reinforced concrete construction has seen significant improvements in sustainable performance in recent years with recyclable aggregates and cement replacement. A highly efficient and green construction can be achieved with concrete despite its relatively high weight and manufacturing processing. The RCS superstructure is proposed to be formed in reinforced concrete to achieve flush soffits, efficient structural zones and good vibration performance while ensuring that the construction can be made sustainable.	· Cost effective · Only solution suitable for stringent vibration criteria · Reasonably sustainable · Flush soffits · Slim structural zone

4 Basement impact assessment

4.1 Hydrological

The development proposals include for a blue roof system to be installed to control the discharge rate at the permissible rate into the local sewer system. As a result, it is considered the development will present a low risk to hydrological features locally.

A Flood Risk Assessment is included within the HTS Drainage Strategy & Flood Risk Report.

4.2 Impact assessment

The following nearby structures were identified for assessment relating to potential ground movements:

- The Golden Lion Pub
- Parcel Force Depot
- 106 Pratt Street
- 143 Royal College Street
- 141 & 139 Royal College Street
- 137 Royal College Street
- 113 – 135 Royal College Street

Numerical modelling has been undertaken to determine the conditions at key stages in the construction process, namely:

- Unloading due to demolition of the existing buildings
- Excavation for the new basement
- Full loading following construction of the new basement and buildings

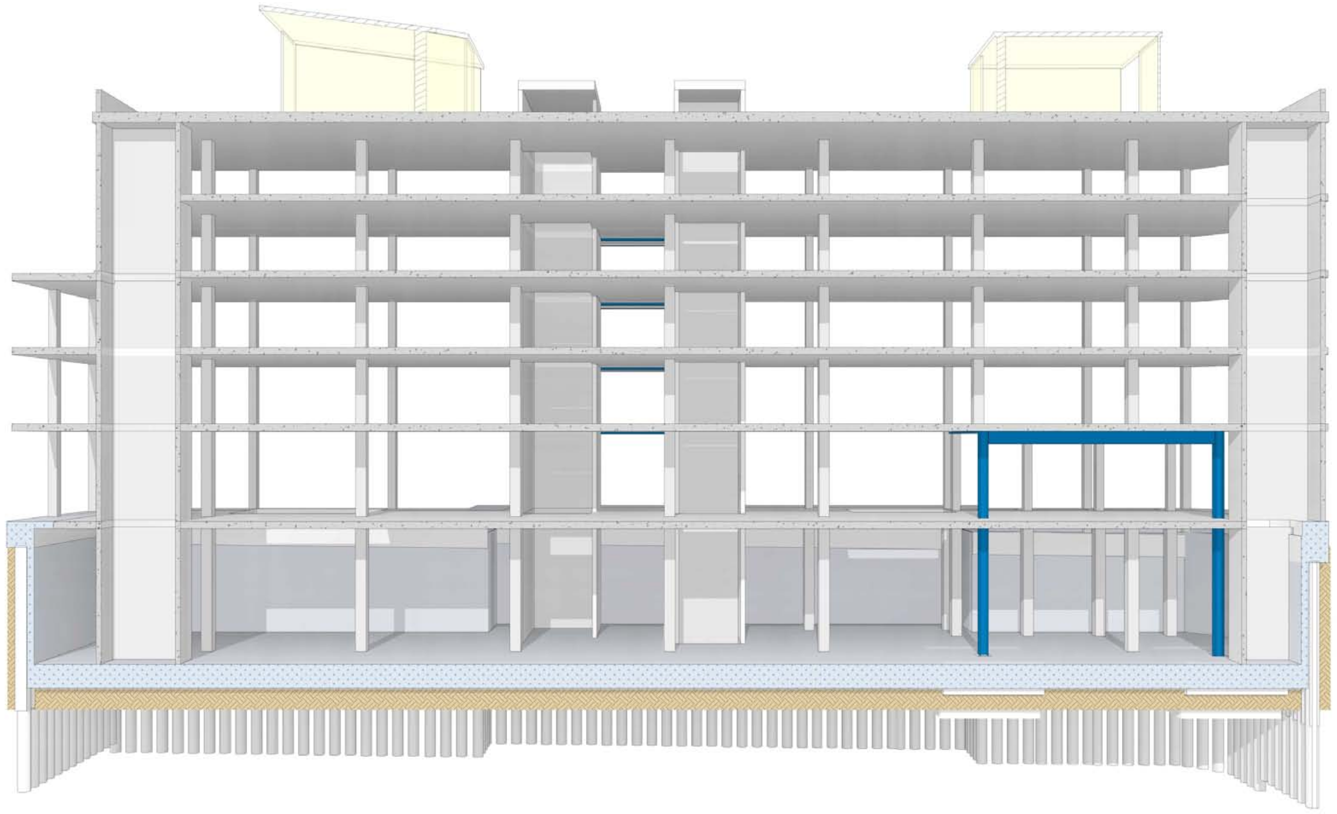
From the assessment it is evident that damage categories exhibited for each of the adjacent structures during the various phases of development are confined to Category 1 (Very Slight) damage with a majority of structures confined to Category 0 (Negligible).

The Camden Planning Guidance document on Basements states that "...applicants must therefore demonstrate in the Basement Impact Assessment that the basement scheme has a risk of damage to neighbouring properties no higher than Burland Scale 1 'very slight'".

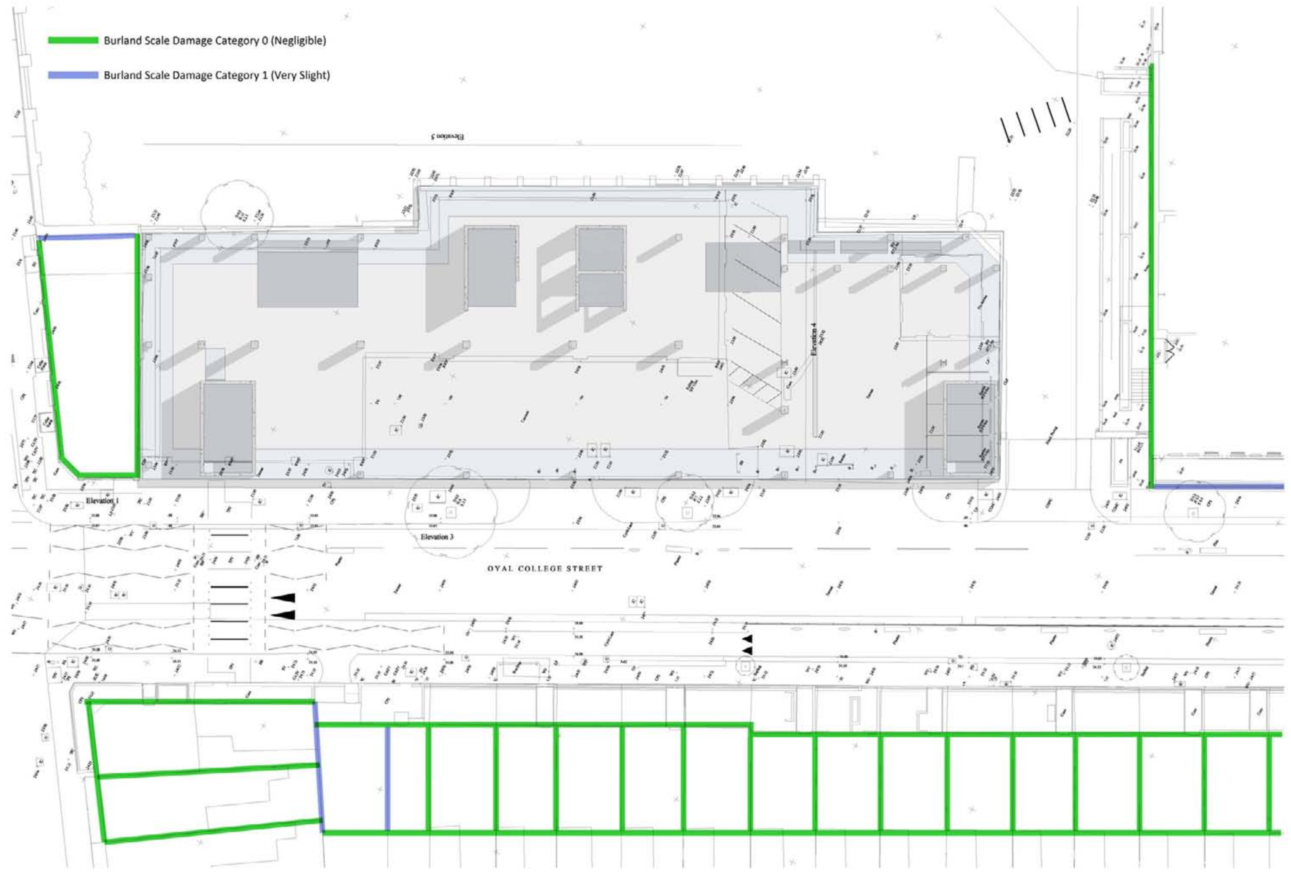
On this basis and given that there is largely no difference between the assessments in CIRIA C580 and CIRIA C760 the damage that has been predicted to occur as a result of the construction of the proposed development falls within the acceptable limits.

4.3 Highways Assessment

The worst-case vertical displacement of Royal College Street is found to be 17mm. It is noted that this is based on a conservative model of the ground movement. An AIP will be sought with Camden Highways at a later design stage.



Proposed Building Section



Ground Movement Results

5 Construction sequence

5.1 Site set up

There is access to the site primarily via Royal College Street. Deliveries, removals and access for operatives will be explained within the Construction Management Traffic Plan.

- Erect site hoarding along the pavement boundaries to provide protection to the public
- Set up site office, welfare and toilets
- Install monitoring survey targets on party walls / neighbouring properties to monitor any potential movement that may occur during the works, and begin monitoring to an agreed frequency and accuracy in line with a traffic light warning system
- Terminate / protect existing services as required. Install temporary drainage as required for site facilities and drainage diversions
- Check current groundwater levels via existing standpipes

5.2 Demolition of Existing Structure

- Commence demolition of the existing superstructure; sequentially demolished from top-down
- Grub out existing foundations and ground bearing slab
- Removal of rubble and waste materials in accordance with the Site Waste Management Plan

6.3 Piling

- Provide a piling mat at ground floor and pile relevant foundations. All piling operations to include a guide wall to control installation tolerances
- Commence installation of the secant piled wall to form the new basement perimeter

5.4 Excavation of Basement

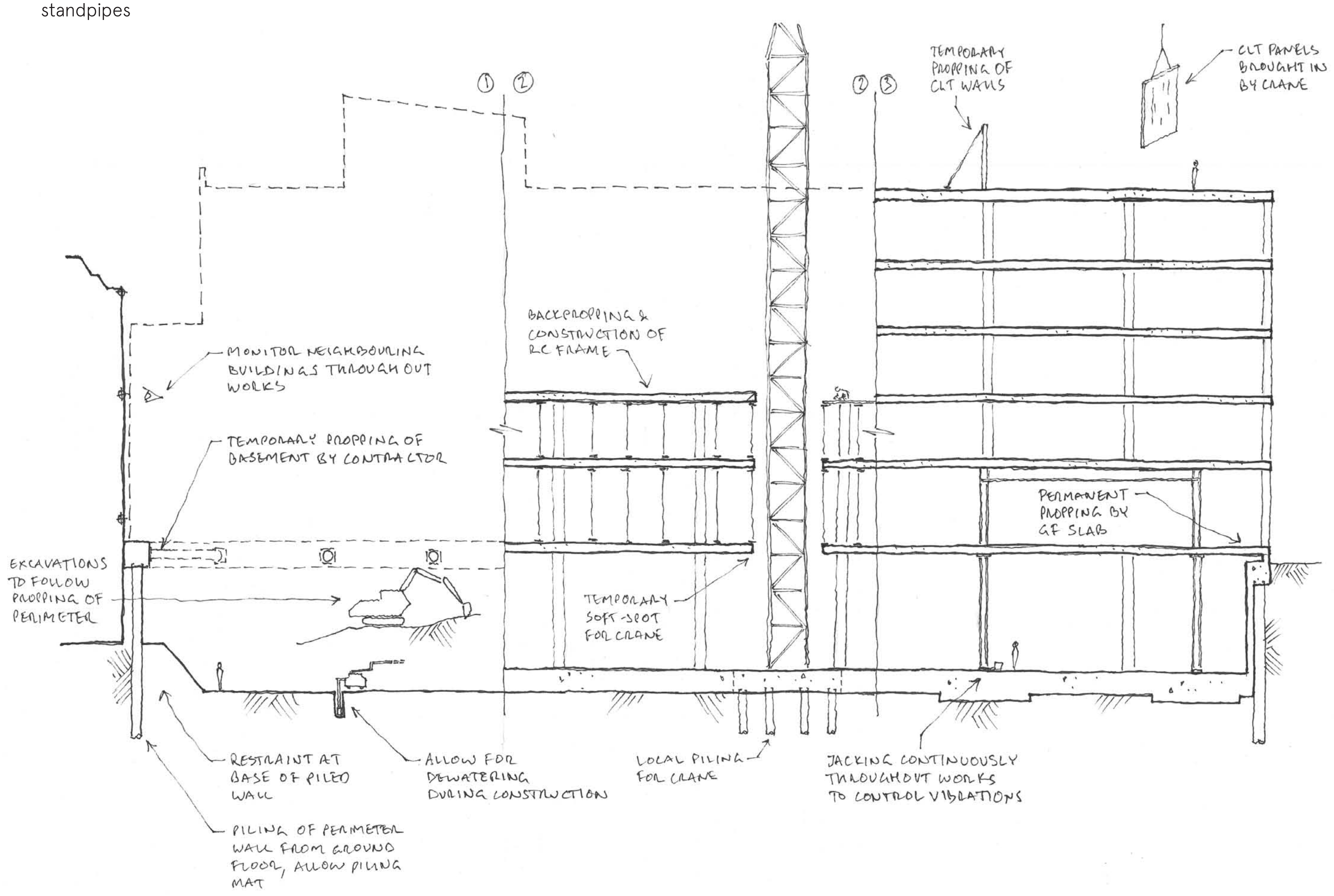
- Upon completion of piling and casting of capping beam, install temporary propping and shoring to restrain the top of the secant piled wall
- Safely remove petroleum tanks from site, investigate extent of contamination and remove contaminated waste from site
- Complete excavations to basement formation level installing additional temporary works as required. Temporary works to contractor design during construction phase
- The principles for removal of spoil shall be agreed
- There's evidence of a water table above formation level which may not be perched. Allow for dewatering of the space during construction

5.5 Foundations, RC wall and Basement Slab

- Install all below ground drainage including pumps
- Lay hardcore and concrete blinding
- Fix reinforcement and cast new raft slab
- Fix reinforcement and cast new basement slab with kicker to perimeter walls
- Fix reinforcement and cast new RC retaining / liner walls to basement perimeter

5.6 Complete Superstructure works

- Erect new basement columns and ground floor structure
- Cast ground floor slab
- Remove temporary propping as construction progresses, once permanent props are in place and sufficiently cured (to contractors design)
- Superstructure works to follow on, progressing floor by floor. The ambulance bay transfer structure to be jacked following each floor construction to control deflections and load distribution
- Once the superstructure is complete, work can concentrate on making the building weather tight
- Finishing trades to commence



6 Project Risks and Opportunities

Item	Risk / Opportunity	Recommended Mitigation
Japanese knotweed	Japanese knotweed has been found on site. We understand that it is illegal to remove any part of the plant or root from site without approval.	We recommend that approval is sough well in advance of ground works.
Timber fire regulations	The timber structures proposed to the roof café areas may not be acceptable under recent regulations on combustibles within facades.	We recommend that fire consultant and building control are consulted as early as possible during the next stage of design.
Review of vibration criteria	The stringent vibration criteria of RF2 for NHS hospital spaces dictates the efficiency of the superstructure design, and considering the likely end use as ward space, if this can be updated it may lead to a more efficient design, and potentially may unlock alternative construction methods.	-
River fleet	The river fleet is unlikely to sit within our site boundary based on site investigations, archive information and TW asset maps, however, its impact on the project if located within or very close to the site may be significant.	We recommend that this is further investigated as soon as possible to reduce the risk. Intrusive and non-intrusive investigation methods should be considered and TW should be contacted to ensure that they have not accidentally omitted the sewer from their asset map.
Petroleum tanks	Several large petroleum tanks are identified within the archive information to exist below ground level on our site. Specialist removal may be required for the tanks themselves and any contaminated ground in their vicinity.	We recommend that the process of legal removal is review as early as possible, and that local window samples near tank locations are carried out to identify the extent of contamination.
Ground obstructions	Several large concrete obstructions were identified within the made ground, and much of the site levelling may have been achieved through mass-concrete pours. This may be difficult to excavate and remove.	We recommend that an allowance for excavation and breaking of these concrete structures is made in the cost plan.

7 Next Steps

This section outlines further investigations, testing and appointments which we recommend should take place during RIBA Stage 3 to help drive the design forward and mitigate design risks.

Item	Why	When
Asbestos survey	An asbestos survey is recommended prior to further investigation and survey work to mitigate the potential risk. Alternatively asbestos trained contractors can be used for the early packages of work.	Early next stage
Timber fire review	The timber structures forming the roof café spaces may cause issues with recent regulations banning combustible materials within the external walls of residential building. We recommend that consultation proceeds with fire consultant and building control to ensure that the proposal is acceptable.	Early next stage
Review of vibration criteria	The stringent vibration criteria of RF2 for NHS hospital spaces dictates the efficiency of the superstructure design, and considering the likely end use as ward space, if this can be updated it may lead to a more efficient design.	At any stage, potential VE opportunity
Detailed UXO assessment	We recommend that a detailed unexploded ordnance assessment is carried out to try to minimise the amount of site presence and investigations required during future ground works as these can be costly.	Prior to demolition
Commencement of party wall process	The party wall process is a general project requirement, but in regard specifically to structure it can help develop an understanding of structure to party walls, adjacent basements and other items critical to the construction and demolition works.	Early next stage
Agreement in principle with Camden highways and Thames Water	Both of these bodies will be interested in the impact of our development on their assets, and we will look to start the Approval in Principle (AIP) process with them.	
Detailed geotechnical foundation design	The proposed foundation solution may impose a significant cost saving compared to piled foundations but does require a more careful design of the ground-structure interaction. We would look to carry out this assessment together with a geotechnical consultant.	Early next stage