STRUCTURAL Design STUDIO

10 Pembroke Villas,
TW9 1QF

Structural Impact Assessment

Job number:	224289
Revision:	P1
Status:	Planning
Date:	October 2024

06.10.23	P1	ISSUED FOR PLANNING	
Structures by:		Approved by:	Sarah Wadley
Qualification			MEng CEng MIStructE
signature:			

Contents

1.0 Non-technical Summary

Structural Design Studio Limited were appointed by the Client, to advise on the structural implications of constructing a single storey basement extension beneath the side of the main house, under the existing garage. The following report has been prepared to help ensure that the structures on both the site and neighbouring sites are safeguarded during the works.

The report provides information in accordance with the advice provided in the London Borough of Richmond Upon Thames' Planning Advice Note (PAN) "Good Practice Guide on Basement Developments" (dated May 2015).

A desktop study of the site has been completed to establish the site's history and a risk-based interpretation used to inform the onsite testing. A site-specific ground investigation comprising of 2no. boreholes was carried out on 25th September 2024 by Site Analytical Services Limited. The results of this investigation has been used to inform the structural scheme design of the proposed basement, in accordance with the PAN "Good Practice Guide on Basement Developments".

A Basement Impact Assessment was also completed by Site Analytical Services (SAS) dated October 2024. This report has been used to inform the structural scheme design of the proposed basement, in accordance with the PAN "Good Practice Guide on Basement Developments".

This report supports the conclusion that should the works be completed by a competent contractor, the basement extension can be constructed without any significant adverse effect on the property, neighbouring properties, groundwater, surface water or on the stability of the adjoining ground.

Based on our current knowledge of the building and calculations, if the works are carried out in accordance with our proposed design then the likelihood of damage to the property should be limited to Category 1 as set out in CIRIA report C580. As the property is detached the likelihood of damage to the neighboring properties should be limited to Category 1 as set out in CIRIA report C580.

2.0 Description of Existing Buildings and Site

The existing building at 10 Pembroke villas is a three-storey semi-detached house located next to Richmond Green within the London Borough of Richmond Upon Thames (LBRUT). The existing house has a lower ground floor level under the full footprint.

10 Pembroke Villas, Front Elevation (Google Maps, taken June 2021)

The main house is square on plan with single frontage onto Park Drive. There is a single storey garage to the side. It is bounded by No.11 Pembroke Villas and No.9 Pembroke Villas to the east and west respectively.

This house is a part of the grade 2 listed "Pembroke Villas".

The earliest map studied showing the existing building having been developed along with those surrounding it is dated 1867. We understand from the electoral roll that the building is likely to have been constructed in around the mid-19th century.

The building appears to be in reasonable condition and is traditionally constructed with timber roof and floors supported on load bearing internal and perimeter walls. The floors are assumed to span between the perimeter walls and the load bearing spine walls in the centre of the building.

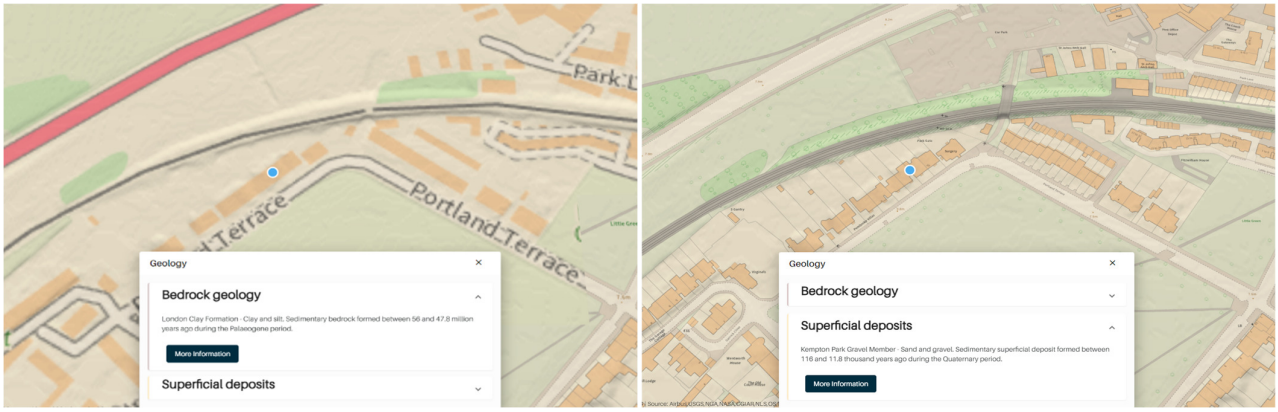
The overall stability of the buildings appears to be provided by the cellular layout of the masonry walls and diaphragm action of the timber floors at each level.

Access is gained to the site from the front of the property via Pembroke Villas.

Prior to works commencing on site, a CCTV survey will be required to determine the location, size and condition of the existing drainage network. The survey should continue through to the connections to the public sewer network to prove connectivity.

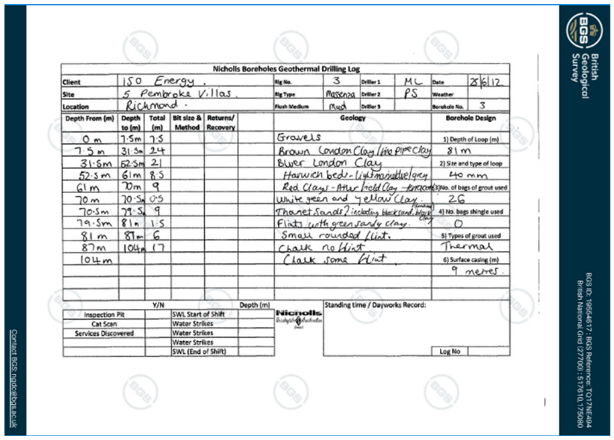
3.0 Ground Conditions

The maps available from the British Geological Survey indicate that the site lies directly on top of superficial deposits of sands and gravels (Kempton Park Gravel Member) with London Clay forming the bedrock beneath.



Excerpt of Geology of Britain Viewer (British Geological Survey. Accessed Sep 24)

There are historic borehole records available on the British Geological Survey website, of which there is one in close proximity of the property. The log shown below taken from the website indicates that sands are gravels were found down to a depth of 7.5m, with London clay continuing on beyond.



Nicholls Boreholes Geothermal Drilling Log

Client	150 Energy.	Rig No.	3	Driller 1	ML	Date	28/6/12
Site	5 Pembroke Villas.	Rig Type	Massenza	Driller 2	PS	Weather	
Location	Richmond.	Flush Medium	Mud	Driller 3		Borehole No.	3

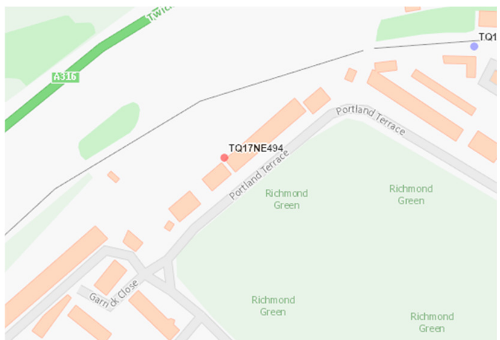
Depth From (m)	Depth to (m)	Total (m)	Bit size & Method	Returns/ Recovery		Geology	Borehole Design
0 m	7.5m	7.5				Gravels	1) Depth of Loop (m)
7.5 m	31.5m	24				Brown London Clay / like pipe clay	81 m
31.5m	52.5m	21				Bluer London Clay	2) Size and type of loop
52.5m	61m	8.5				Harwich beds - light marine blue/grey	40 mm
61m	70m	9				Red Clays - Atherfield Clay - [illegible]	3) No. of bags of grout used
70m	70.5m	0.5				White green and yellow Clay.	26
70.5m	79.5m	9				Thanet Sands? including black sand, black clay	4) No. bags shingle used
79.5m	81m	1.5				Flints with green sandy clay.	0
81m	87m	6				Small rounded flint.	5) Types of grout used
87m	104m	17				Chalk no flint	Thermal
104m						Chalk some flint.	6) Surface casing (m)
							9 metres.

	Y/N		Depth (m)
Inspection Pit		SWL Start of Shift	
Cat Scan		Water Strikes	
Services Discovered		Water Strikes	
		Water Strikes	
		SWL (End of Shift)	

Nicholls

Standing time / Dayworks Record:

Log No



A site-specific soil investigation was carried out by Site Analytical Services Ltd on 25th September 2024, which comprised of 2No. boreholes (see Appendix C for borehole logs). The information gathered was consistent with the ground conditions and water levels noted in the geological maps and the BGS borehole log described above.

In the first borehole, BH1 showed Made Ground to a depth of 2.2m, then sand to about 8.6m, some silty clay to a depth of 15m where the borehole was terminated.

In the second borehole, BH2 stated that Made Ground was observed down to 1.9m, then silty sand to a depth of 7m, then clay observed down to 10m at which the borehole was terminated. Groundwater was encountered at 7m below ground level within the borehole during the investigation.

The presence of water in the future could be subject to seasonal variation.

4.0 Desk Study Summary and Observations

The results of our desk study are as summarised below;

- The site is stated to have a very low chance of yearly flooding from surface water and from rivers and sea, according to Gov.uk data.
- According to LBRUT's online flood-risk maps, the site is located not located within one of Richmonds surface water Floodzones, but has a 75% chance of flooding due to groundwater. However the site does appear to be located in one of Richmond's critical drainage areas. As such a screening assessment and Basement Impact Assessment needs to be completed.
- The site is located within one of Richmond's throughflow catchment areas.
- Public Sewer records are to be obtained from Thames Water to determine whether there are any Thames Water assets located within the proposed site.
- The site lies approximately 430m away from London Underground and 19m away from the overground train, as such any works at No.10 Pembroke Villas will not affect the railway lines.
- There are no records of historical bomb damage to the properties on Park Drive during World War II. (Reference, The LCC London Bomb Damage Maps 1939-1945, LTS).

5.0 Proposed Alterations

The proposed works involve extending the existing basement beneath the footprint of the existing garage, with a new two storey side extension to then be constructed from ground floor level upwards. The proposed basement head height will be approximately 2.4m, which matches that of the existing basement under the main house. The existing external terrace/patio area to the rear of the main house is also proposed to be modified, requiring a minor reconfiguration of the existing retaining walls in the garden.

There are also minor alterations of the flank wall and internal walls at basement level and floor levels above.

L-shaped reinforced concrete underpins will be used to form all perimeter walls to the proposed basement box.

Mass concrete underpins will also be used to underpin the existing boundary wall as required to avoid undermining the existing foundations.

A set of proposed structural scheme drawings can be seen in Appendix A.

Vertical loads from the superstructure perimeter will be transferred to the ground by the RC edge thickenings to the basement slab.

The reinforced concrete underpins will be designed to act as cantilevers, supporting the surcharge from the soil and neighbouring buildings.

The groundwater level will be monitored as part of the site specific ground investigation by SAS, via the boreholes using standpipes. Water is not likely to be encountered at basement formation level given the depth of water measured in the boreholes. If groundwater is experienced during excavation, suitable control of any inflows would be achieved using sump pumping and appropriate filters should be used to avoid the migration of fines. A detailed method statement for this process will need to be prepared by the Contractor for comment by all relevant parties including party wall surveyors and their engineers.

Trial underpins will be dug when the contractor first starts on site to confirm the stability of the soil and to further investigate the presence of any groundwater inflows.

6.0 Basement Waterproofing

The basement waterproofing will be the responsibility of the Contractor.

We assume that the reinforced concrete retaining walls and basement slabs will be cast using water resistant concrete to form an initial barrier with an internal drained cavity system as a primary barrier against possible water ingress. As part of the system, any water that seeps through will be collected in a sump to be pumped up to high level where it will drain under gravity into the main drainage system.

7.0 Party Wall Matters

The proposed works development falls within the scope of the Party Walls Act 1996. Procedures under the act will be dealt with in full by the Employers Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary notices under the provisions of the Act and agree Party Wall awards. The Contractor will be required to provide the Party Wall Surveyor with appropriate drawings, method statements and other relevant information covering the works that are notifiable under the Act. The resolution of matters under the Act and provisions of the Party Wall Awards will protect the interests of the owners.

The proposed works on the site of No.10 Pembroke Villas will be developed so as not to inhibit any works on the adjoining properties. This will be verified by the Surveyors as part of the process under the Act.

8.0 Hydrological Statement Summary

The borehole record produced by Site Analytical Services indicates that ground water is unlikely to be encountered during the excavation. Arup's Subterranean Development Scoping Study (para 5.1), June 2008, notes that the impact of subterranean development on groundwater flows is negligible as groundwater flows will find an alternative route if blocked by a subterranean structure.

9.0 Impacts on Proposed Below Ground Drainage

A CCTV survey of the drainage on the site will be completed to confirm the size and condition of the existing drainage prior to works commencing on site. It is proposed to maintain gravity connections at ground floor level and above, where possible. The new drainage at basement level will be routed to a submersible pumping station which will pump waste directly to the outfalls. A non-return valve will be installed to protect against sewer surcharging.

A cavity drain system will be incorporated into the design to provide the second means of defence against water ingress. The waterproofing will be to a specialist design.

Thames Water Public Sewer Records will also be procured to ensure there are no Thames Water assets within the boundary of the property.

10.0 Ground Movement

Should the works be completed by a competent contractor, the proposed basement construction should be constructed without any significant adverse effect on the property, neighbouring properties, or on the stability of the adjoining ground.

Based on our current knowledge of the building, if the works are carried out in accordance with our proposed design, then the likelihood of damage to the property and neighbouring should be limited to being no greater than Category 1 'Slight' (as defined on the Burland Scale), as set out in CIRIA report C580. If the adjoining properties then the likelihood of damage to the neighbouring properties should be limited to Category 1 as set out in CIRIA report C580.

The above damage category is within the acceptable range set out in the London Borough of Richmond Upon Thames' Planning Advice Note (PAN) "Good Practice Guide on Basement Developments" (dated May 2015).

In order to mitigate the risk of Category 1 'Very Slight' damage to the surrounding properties, the temporary works installed during the works will be designed to support the surcharge from the soil and surrounding buildings.

If deemed necessary and in agreement through the Party Wall process ground movement monitoring system may also be installed to the neighbouring properties No.9 and No.11, with trigger values set to allow the works to be controlled appropriately in the event of ground movement occurring (as outlined in section 14.0).

With the implementation of these mitigation measures, any damage caused to the property and surrounding properties should be limited to Category 1 at worst.

11.0 Construction Method Statement (to be read in conjunction with drawings in Appendix A)

Some of the issues that affect the sequence of works on this project are:

- The stability of the main house structures;
- The stability of adjoining and adjacent buildings;
- Forming sensible access onto the site to minimise disruption to the neighbouring residents; and
- Providing a safe working environment.

The proposed works involve the construction of an extension to the existing basement on the footprint of the existing garage, with a new two-storey side extension to be constructed from ground floor level above. This basement extension will be linked to the main house above via a staircase at existing ground floor level. It is expected that these works will be completed in a "bottom up" construction sequence.

The undertaking of such projects to existing buildings is specialist work and SDS Ltd. will be involved in the selection of an appropriate Contractor with the relevant expertise and experience for this type of project.

The Contractor is entirely responsible for maintaining the stability of all existing buildings and structures, within and adjacent to the works, and of all the works from the date of possession of the site until practical completion of the works.

A full set of temporary works drawings and calculations will be provided by the Contractor and will be reviewed by SDS Ltd. prior to works starting on site.

Please refer to section 13.0 for noise, vibration and dust assessment with proposed associated mitigation methodologies.

Stage 1 – Site Setup and Enabling Works

- All incoming services to the property are to be located and marked. Their location and depths should be communicated to the design team.
- Schedules of conditions for the adjoining properties to be completed.
- If movement monitoring has been agreed as part of the Party Wall awards this should be installed and base readings taken.
- Soft Strip of the existing building.
- Install temporary hoarding and protection to the neighbouring properties.

Stage 2 – Demolition

- Demolish the non-original existing garage and roof
- Remove the existing ground floor slab in the garage area.
- Install Temporary lateral propping and protection to the flank wall and Party Wall.

Stage 3 – Install Mass Concrete underpins to Existing Boundary Wall

- Dig trial underpins for inspection by SDS Ltd. to check how well the existing soil is cemented, ground water levels and flows, and in particular the ability of the ground to "stand up" whilst the individual underpin is completed.
- The underpins to the existing boundary wall are to be formed in mass concrete. All underpins are to be taken down to proposed basement formation level.
- Dig the underpins in maximum 1 metre sections in the agreed sequence, installing localised trench sheeting and props around the perimeter of the shaft.
- Cast the underpin.

- Leave the underpin to cure for 3 days. If the underpin is under an existing wall then drypack to the underside of the wall above with 3:1 sharp sand to cement dry-pack well rammed in.
- Remove the trench sheeting and props and backfill with well compacted arisings from the excavation. This method of construction will be used to limit any horizontal ground movement associated with the construction of the underpins and limits the risk of the underpinning works on the neighbouring buildings.
- The Contractor should wait a minimum of 24 hours after drypacking before digging an adjacent underpin. The exact sequence of mass concrete underpinning will be advised by the Contractor as it will relate to their sequence of construction.

Stage 4 – Install Perimeter of New basement extension in an Underpinning Sequence

- Dig trial underpins for inspection by SDS Ltd. to check how well the existing soil is cemented, ground water levels and flows, and in particular the ability of the ground to "stand up" whilst the individual underpin is completed.
- The underpins to the perimeter of the basement extension are to be formed in reinforced concrete. All underpins are to be taken down to proposed basement formation level.
- Dig the underpins in maximum 1 metre sections in the agreed sequence, installing localised trench sheeting and props around the perimeter of the shaft.
- The reinforcement in the toe of the underpin can be tied and the toe cast.
- The reinforcement in the stem of the underpin can be tied, lapping with the reinforcement from the toe and the stem cast.
- Leave the underpin to cure for 3 days. If the underpin is under an existing wall then drypack to the underside of the wall above with 3:1 sharp sand to cement dry-pack well rammed in.
- Install temporary lateral props between the face of the underpinning and the central bund of soil. These will be removed as part of the bulk excavation. This method of construction will be used to limit any horizontal ground movement associated with the construction of the underpins and limits the risk of the underpinning works on the neighbouring buildings.
- The Contractor should wait a minimum of 24 hours after drypacking before digging an adjacent underpin. Adjacent underpins should be dowelled together. An assumed sequence of underpinning is shown on the attached drawing however, the exact sequence of underpinning will be advised by the Contractor as it will relate to their sequence of construction.

Stage 5 – Install Horizontal Temporary Props and Reduced Level Dig

- Once all the underpins are complete, reduce level dig to allow the high level horizontal temporary props to be installed to the tops of the underpins cast in Stage 3.
- Temporary propping to be provided to the underpinning across the basement to prevent sliding and overturning.
- Reduce level dig down to the new basement level installing low level horizontal props across the basement to prop the underpins cast in Stage 3.

Stage 6 – Cast the New Basement Slab and Remove Temporary Low Horizontal Props

- Install the new drainage including the surface water runs and pump sumps. The drainage should be tested prior to casting the slab.
- The basement slab can be cast with reinforcement continuous with the underpin bases.
- Once the slab has cured, the bases of the RC underpins are propped by the slab, avoiding sliding and overturning in the permanent case. Hence, the low level horizontal temporary propping to the underpins can be removed.

Stage 7 – Install Mass Concrete Strip Footings, Ground Floor Steelwork and RC Slabs

- Install the new mass concrete strip footing to the front of the new side extension.
- Install the new steel beams at ground floor level to support the new ground floor slab. Install new concrete slab at ground floor level.
- Remove high level temporary horizontal props.

Stage 8 – Superstructure Works

- Construct new side extension from above ground floor level and complete superstructure works
- Install the new cavity drain system
- Complete the fit out

12.0 Noise, Vibration and Dust Mitigation

The London Borough of Richmond Upon Thames' Planning Advice Note "Good Practice Guide on Basement Developments" (dated May 2015) states that during the undertaking of any basement works it is necessary to "mitigate or maintain the amenity of neighbouring residents during construction, as well as guide the use of the highway and minimise noise and air pollution."

The proposed works at No.10 Pembroke Villas involve the construction of a new basement extension beneath the footprint of a new single storey side extension.

The construction works involve the demolition of existing concrete floor slabs, underpinning beneath existing walls, as well as excavation and construction of the basement shell. A more detailed sequence of the works has been given in section 12.0. Those most likely to be affected by noise, dust and vibration will be the immediate neighbours at No.9 and No.11 Pembroke Villas. The properties opposite and behind No.10 Pembroke Villas are remote from the proposed development and are therefore less likely to be affected, however need to be considered. There may be some impact on other residents around the surrounding area due to the related construction traffic, but this should be minimal.

Below we have described the mitigation measures that are proposed to keep noise, dust and vibration to acceptable levels.

Mitigation Measures for Demolition of Existing Ground Floor Slab

The breaking out of existing structures shall be carried out by diamond saw cutting and hydraulic bursting where possible to minimise noise and vibration to the adjacent properties. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise. The contractor will need to utilise non-percussive breaking techniques where practicable.

As the property is semi-detached, careful consideration needs to be given to minimise noise and vibration transfer to the adjoining properties. The contractor should ensure that where any slab is adjacent to the boundary the concrete slab should be diamond saw cut first along the boundary to isolate the slab from any adjoining structures.

Dust suppression equipment should be used during the demolition process to ensure that any airborne dust is kept to a minimum. Where practical, concrete should also be wetted down prior to and during breakout to further inhibit airborne dust.

Mitigation Measures for Underpinning works to the Perimeter

The underpin shafts will be excavated using hand tools where possible. At the base of the underpin shaft it may be found that compressed air tools are required due to the compaction of the ground. Care should be taken in selecting a suitable air compressor that keeps noise to a minimum. The air compressor should be located within the site and behind a hoarding to minimise noise transfer to the adjoining properties.

The spoil will be removed from the excavation using an electrically powered conveyor. The contractor will need to ensure that this is regularly serviced and inspected to ensure any noise from this is kept to a minimum. In order to minimise dust, skips and conveyors should be covered or completely enclosed to ensure that dust cannot escape.

Mitigation Measures for Bulk Excavation

It is likely that the bulk excavation will be completed by hand. The contractor should ensure that any mechanical plant is switched off when not in use and is subject to regular maintenance checks and servicing. An electrically powered conveyor will be used as detailed above for large volumes of spoil removed.

Mitigation Measures for the Construction of the Concrete Basement Shell

The contractor should ensure that any concrete pours are completed within the permitted hours for noise generating works. The contractor should allow for a contingency period to ensure that concrete pours can be completed within these hours regardless of unforeseen circumstances such as batching plant delays and traffic congestion.

The fabrication and cutting of steelwork for the reinforced concrete underpins and slabs shall take place off site. If any rebar needs to be trimmed on site this should be completed using hydraulic or pneumatic tools instead of angle grinders.

Dust Control

In order to reduce the amount of dust generated from the site, the contractor should ensure that any cutting, grinding and sawing should be completed off site where practicable. If cutting, grinding and sawing is being carried out on site, surfaces are to be wetted down prior to and during these types of work whenever possible. Any equipment used on site should be fitted with dust suppression or a dust collection facility.

The contractor will be responsible for ensuring good practice with regards to dust and should adopt regular sweeping, cleaning and washing down of the hoardings and scaffolding to ensure that the site is kept within good order. The Contractor selected will be a member of the Considerate Contractors Scheme. Contact details of the contractor who will be responsible for containing dust and emissions within the site will be displayed on the site boundary so that the local residents can contact the contractor to raise any concerns regarding noise and dust.

The building will be enclosed within suitable scaffold sheeting and any stockpiles of sand or dust-generating materials will be covered. Cement, fine aggregates, sand and other fine powders should be sealed after use.

13.0 Structural Monitoring Proposals

Monitoring and limits on ground movements during excavation and construction

The Contractor shall provide monitoring in line with the agreements made in the Party Wall agreements.

Monitoring shall be completed as follows:

1) One month prior to any works being started to provide a base reading.

2) Weekly readings during the excavation and until the basement slab and lining wall has been cast.

3) On a monthly basis thereafter for a three-month period following completion of the notifiable works.

Cumulative movement of survey points must not exceed:

a). Settlement

Code amber trigger values: +/-6mm

Code red trigger values: +/-10mm

b). Lateral displacement

Code amber trigger values: +/-4mm

Code red trigger values: +/-8mm

Movement approaching critical values:

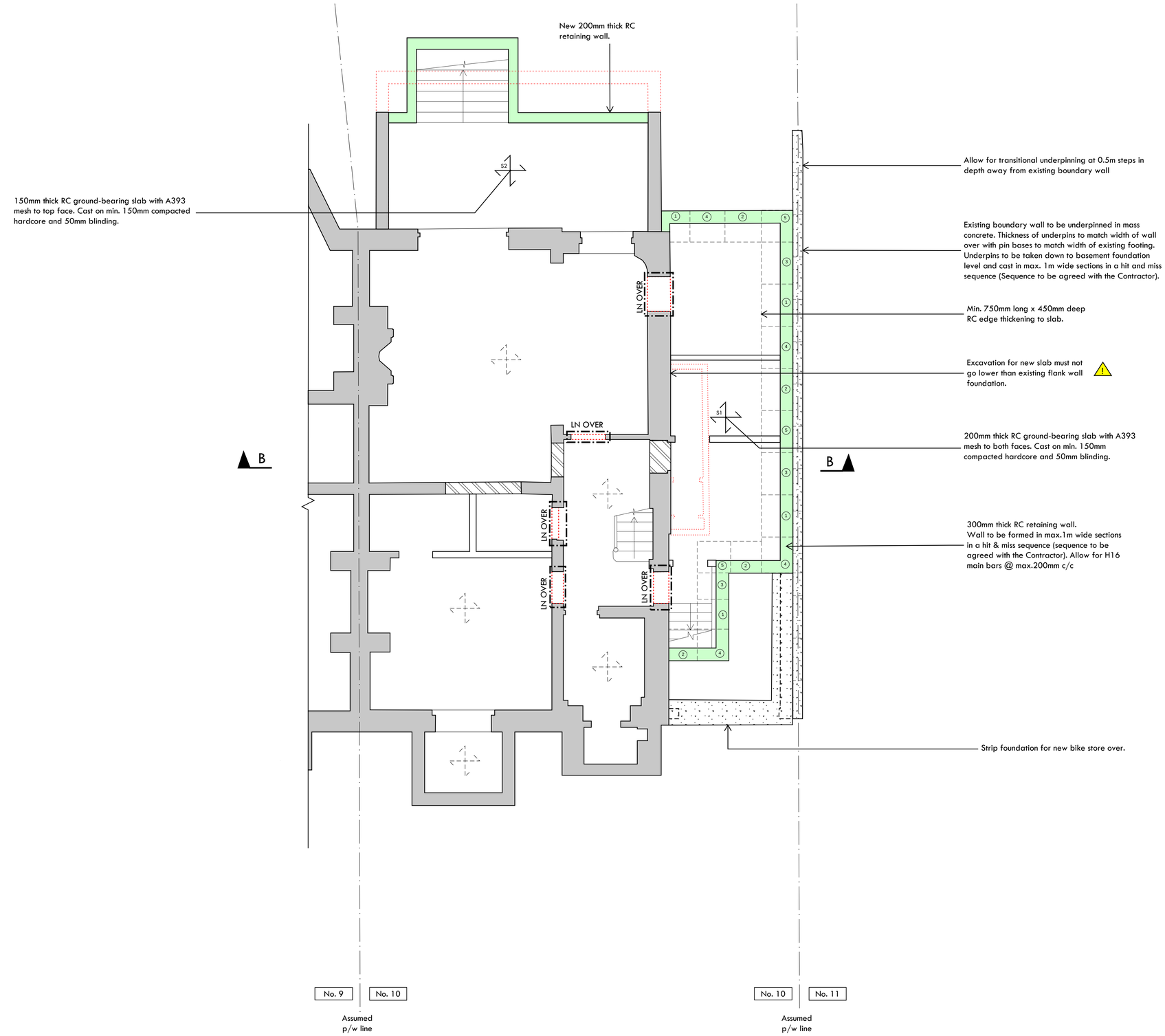
Code amber trigger value:

All interested parties, including the Adjoining Owner's Surveyor and his Engineer should be informed and further actions immediately agreed between two of the three Surveyors and implemented by the Building Owner. The Contractor is to ensure that he has 24 hour/7 days a week access to emergency support provision including but not limited to additional temporary props, needles, waling beams and concrete supply at the start of the excavation and prior to any likelihood of this trigger value being reached. If this value is reached the Contractor must without delay provide all interested parties with his plan to implement any emergency remedial and supporting works deemed necessary. The Contractor must be ready to carry out these works without delay if the movement continues and approaches the trigger value above.

Code red trigger value:

All interested parties including Adjoining Owner's Surveyor and Engineer will be informed immediately. Works will stop and be made safe using methods and equipment agreed at the above stage. The Contractor is to ensure that the movement has stopped as a result of the implemented remedial works designed and installed at this stage. The requirements of the Party Wall Act will also ensure that two of the three Surveyors and their advising Engineers shall then enter into an addendum Award, setting out whether or not the Building Owner's works can re-commence and when, and if so agree additional precautions or modifications to the proposals prior to re-commencement.

APPENDIX A – Proposed Structural Scheme Drawings



General notes:

1. Do not scale from this drawing
2. To be read in conjunction with all other structural drawings and the structural specification
3. To be read in conjunction with all other relevant disciplines drawings and specifications
4. All levels, setting out, waterproofing and fireproofing to be confirmed with the Architect
5. The Contractor is responsible for the temporary stability of the existing and proposed structure throughout the works. The sequencing and method of installation should be carefully considered and the temporary works should be designed and detailed by a suitably qualified person (appointed by the Contractor) prior to commencing the works
6. Contractor to request splices if required for handling purposes

Waterproofing is the responsibility of others. SDS take no responsibility for the waterproofing of any part of the structure

STRUCTURAL Design STUDIO

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Project:

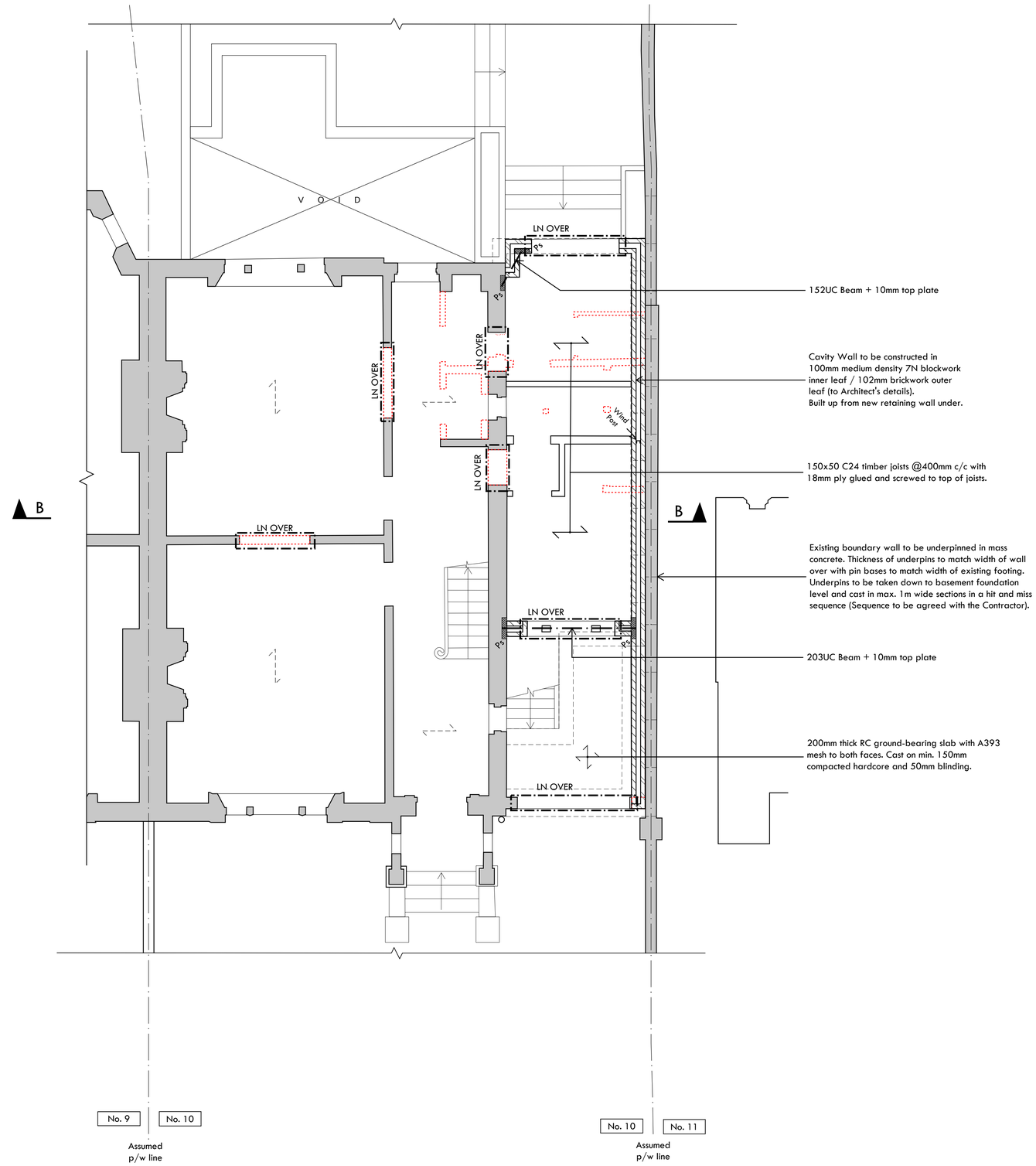
10 Pembroke Villas, TW9 1QF

Drawing Title:

Proposed Basement Plan

Job. No.	Drawing no.	Revision
224289	S090	Preliminary

Scale	Date	Drawn by	Rev. no:
1:50@A1	Sep 24	AP	P1



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Project:

10 Pembroke Villas, TW9 1QF

Drawing Title:

Proposed Ground Floor Plan

Job. No.	Drawing no.	Revision
224289	S100	Preliminary

Scale	Date	Drawn by	Rev. no:
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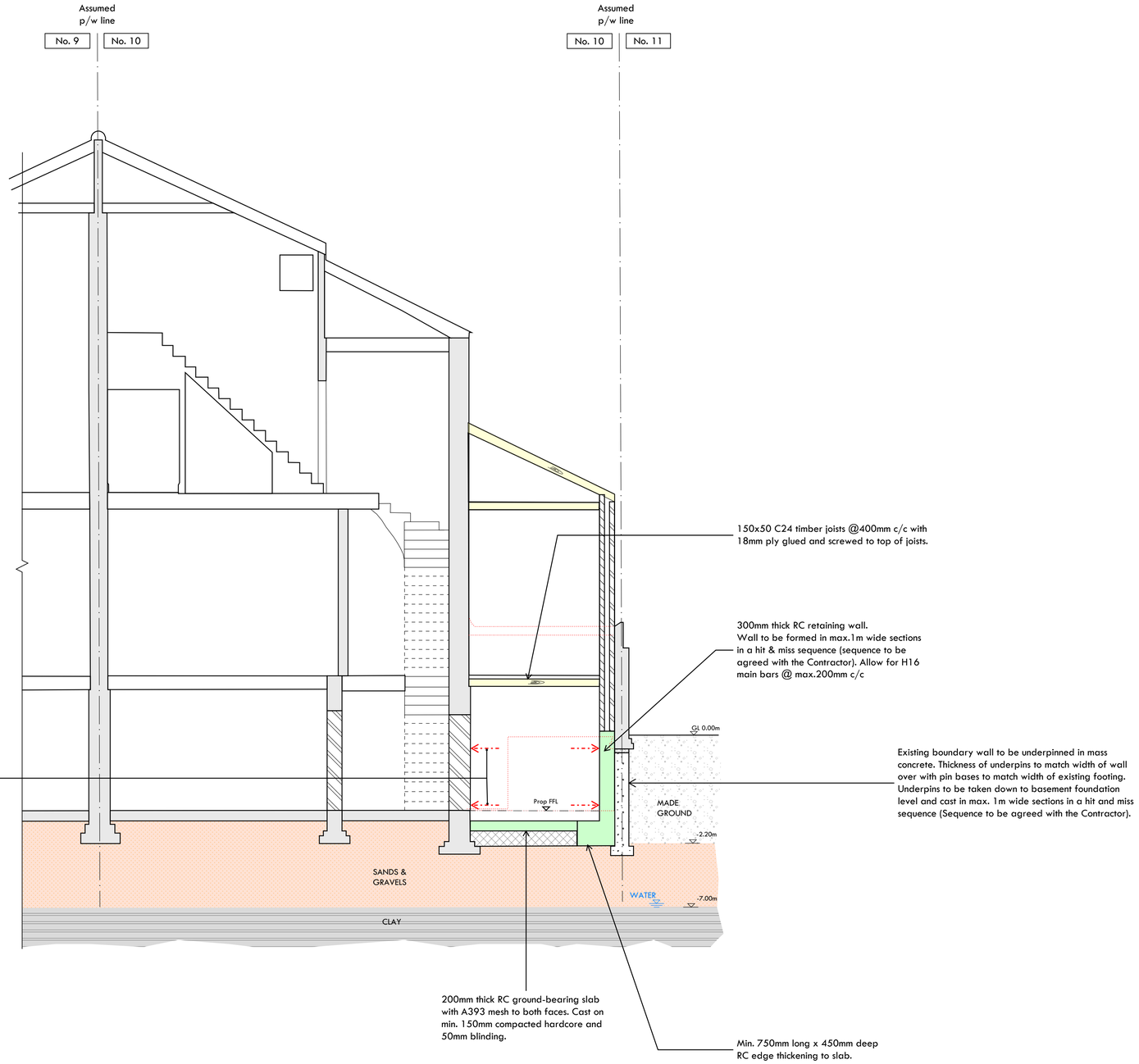

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Project:

10 Pembroke Villas, TW9 1QF

Drawing Title:

Proposed Section B-B

Job. No.	Drawing no.	Revision
224289	S200	Preliminary

Scale	Date	Drawn by	Rev. no:
1:50@A1	Oct 24	AP	P1

APPENDIX B – Borehole Log

Site Analytical Services Ltd.

Site	Borehole Number
10 PEMBROKE VILLAS, THE GREEN, RICHMOND, TW9 1QF	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARY PERCUSSIVE	128mm cased to 0.00m		MICHAEL JONES ARCHITECTS	2438980
	Location TQ176750	**Dates** 25/09/2024	**Engineer** STRUCTURAL DESIGN STUDIO	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.04	MADE GROUND: Natural stone slab		
						0.15	MADE GROUND: Sand and cement		
0.25	D1					0.19	MADE GROUND: York stone slab		
0.50	D2						MADE GROUND: Loose becoming very loose, brown silty fine to coarse grained sand containing brick fragments		
0.75	D3								
1.00-1.45	SPT(C) N=6		DRY	1,2/2,1,2,1					
1.00	D4					(2.01)			
1.50	D5								
2.00-2.45	SPT(C) N=1		DRY	0,1/0,1,0,0					
2.00	D6					2.20	Loose, orange fine to coarse grained SAND		
2.50	D7								
						(1.20)			
3.00-3.45	SPT(C) N=7		DRY	1,1/1,2,2,2					
3.00	D8					3.40			
3.50	D9						Very dense, orange yellow gravelly fine to coarse grained SAND		
4.00-4.45	SPT(C) N=43		DRY	3,3/10,10,11,12					
4.00	D10								
4.50	D11								
5.00-5.45	SPT(C) N=52		DRY	8,9/12,13,13,14					
5.00	D12								
						(5.20)			
6.00-6.45	SPT(C) N=63		DRY	10,10/15,15,16,17					
6.00	D13								
7.00	D14								
7.50-7.95	SPT(C) N=61		WET	9,9/14,15,16,16					
7.50	D15			Water Strike (1) at 7.80m.					▽1
8.00	D16								
						8.60			
9.00-9.45	SPT(C) N=16		WET	2,3/3,4,4,5			Firm becoming stiff, medium to dark grey silty CLAY		
9.00	D17								

Remarks
Water level at 7.00m depth on completion
S= Standard Penetration Test
C= Dynmaic penetration Test - Cone
D= Disturbed Sample
Excavating from 0.00m to 1.00m for 1 hour.

Scale (approx)	Logged By
1:50	EW

Figure No. 2438980.BH1

Site Analytical Services Ltd.

Site	Borehole Number
10 PEMBROKE VILLAS, THE GREEN, RICHMOND, TW9 1QF	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARY PERCUSSIVE	128mm cased to 0.00m		MICHAEL JONES ARCHITECTS	2438980
Location	**Dates**	**Engineer**		**Sheet**
TQ176750	25/09/2024	STRUCTURAL DESIGN STUDIO		2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	D18					(3.60)			
10.50-10.95	SPT N=22		WET	3,4/5,5,6,6					
10.50	D19								
11.00	D20								
12.00-12.45	SPT N=69		WET	4,5/10,36,18,5		12.20			
12.00	D21						Stiff, dark grey very silty CLAY containing shell fragments Claystone present at 12.40m depth		
13.00	D22								
13.50-13.95	SPT N=25		WET	4,5/5,6,7,7		(2.80)			
13.50	D23								
14.00	D24								
15.00-15.45	SPT N=30		WET	5,5/7,6,8,9		15.00			
15.00	D25						Complete at 15.00m		

Remarks
Water level at 7.00m depth on completion
S= Standard Penetration Test
C= Dynmaic penetration Test - Cone
D= Disturbed Sample

Scale (approx)	Logged By
1:50	EW

Figure No. 2438980.BH1

Site Analytical Services Ltd.

Standard Penetration Test Results

Site : 10 PEMBROKE VILLAS, THE GREEN, RICHMOND, TW9 1QF

Client : MICHAEL JONES ARCHITECTS

Engineer : STRUCTURAL DESIGN STUDIO

Job Number 2438980

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH1	1.00	1.15	1.45	CPT	1	2	2	1	2	1	N=6	
BH1	2.00	2.15	2.45	CPT	0	1	0	1	0	0	N=1	
BH1	3.00	3.15	3.45	CPT	1	1	1	2	2	2	N=7	
BH1	4.00	4.15	4.45	CPT	3	3	10	10	11	12	N=43	
BH1	5.00	5.15	5.45	CPT	8	9	12	13	13	14	N=52	
BH1	6.00	6.15	6.45	CPT	10	10	15	15	16	17	N=63	
BH1	7.50	7.65	7.95	CPT	9	9	14	15	16	16	N=61	
BH1	9.00	9.15	9.45	CPT	2	3	3	4	4	5	N=16	
BH1	10.50	10.65	10.95	SPT	3	4	5	5	6	6	N=22	
BH1	12.00	12.15	12.45	SPT	4	5	10	36	18	5	N=69	
BH1	13.50	13.65	13.95	SPT	4	5	5	6	7	7	N=25	
BH1	15.00	15.15	15.45	SPT	5	5	7	6	8	9	N=30	

Site Analytical Services Ltd.

Site	Borehole Number
10 PEMBROKE VILLAS, THE GREEN, RICHMOND, TW9 1QF	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
CONTINUOUS FLIGHT AUGER	128mm cased to 0.00m		MICHAEL JONES ARCHITECTS	2438980
	Location	**Dates**	**Engineer**	**Sheet**
	TQ176750	26/09/2024	STRUCTURAL DESIGN STUDIO	1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.10	MADE GROUND: Stone slab over aggregate		
0.25	D1						MADE GROUND: Very loose, medium to dark brown silty fine to coarse grained sand containing brick and concrete fragments		
0.50	D2					(1.10)			
0.75	D3								
1.00	D4								
1.00-1.30	M1 35/300					1.20			
							MADE GROUND: Loose, medium brown silty fine to coarse grained sand containing occasional brick fragments		
1.50	D5					(0.70)			
1.50-1.80	M2 56/300								
						1.90			
2.00	D6						Loose brown orange silty fine to coarse grained SAND		
2.00-2.30	M3 86/300					(0.90)			
						2.80			
							Medium dense, brown orange silty gravelly fine to coarse grained AND		
3.00	D7								
3.00-3.30	M4 133/300								
3.50	D8								
3.50-3.70	M5 145/200								
4.00	D9								
4.00-4.10	M6 100/100								
4.50	D10								
4.50-4.60	M7 100/100								
						(4.20)			
5.00	D11								
5.00-5.10	M8 100/100								
6.00	D12								
6.00-6.10	M9 100/100								
7.00	D13			Water Strike (1) at 7.00m.		7.00	Stiff, dark brown grey silty CLAY		▽1
7.00	V1 140+								
8.00	D14								
8.00	V2 140+								
						(3.00)			
9.00	D15								
9.00	V3 140+								
10.00	D16								
10.00	V4 140+					10.00			

Remarks
C= Dynmaic penetration Test - Cone
S= Standard Penetration Test
D= Disturbed Sample
Excavating from 0.00m to 1.00m for 1 hour.

Scale (approx)	Logged By
1:50	EW

Figure No. 2438980.BH2