Soil Consultants
Ground Investigation
Geotechnical Analysis
Contamination Assessment

GROUND MOVEMENT ANALYSIS REPORT

PROPOSED BASEMENT CONSTRUCTION:
31 ELSWORTHY ROAD, LONDON NW3 3BY

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This analysis has been undertaken within the constraints of the client's instruction/contract, together with those set out in the 'General information, Limitations and exceptions' section at the end of this report. The SCL 'Standard Terms of Appointment' are also included at the end of this report and these identify the contractual arrangements for the investigation. Conclusions or recommendations made in this report are limited to those which can be reasonably based upon the research, intrusive investigation work and/or analysis carried out. Any comments which rely on third-party information which has been provided to us are made in good faith and on the assumption that such information is accurate. SCL have not carried out independent validation of any third-party information.

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- Figures 1 to 4: Foundation settlement and heave due to excavation - results from Boussinesq-based analysis (input sheets and contour plots)
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- BB Partnership Ltd: plans/sections of proposed development (various)
- Laser Surveys 'Topographical Survey' (Ref: L10058)

EXECUTIVE SUMMARY

Proposed works

- Construction of a new basement beneath the entire building footprint and extending into the rear and front gardens
- Excavation depths of between 3.5m and 6.5m will be required

Existing site conditions and ground sequence

- Ground level is approximately +46.5mOD to +46.8mOD
- Intrusive investigation works by SCL indicate that made ground is present to approximately 3m depth, resting upon the London Clay Formation, which is expected to extend to >50m in this area
- The groundwater level has been measured at about +44.95mOD (March 2021). Note that water levels vary seasonally

Ground movements and damage assessment

- The adjacent properties No 29 and 33 are the 'at-risk' structures
- Analysis has predicted that the magnitudes of the ground movements result in Category 0 (negligible) or Category 1 (very slight) damage classification if a high stiffness support system is used. Jacked propping may be required in the vicinity of the deepest excavation (for the swimming pool) to maintain stability beneath No 29 Elsworthy Road. The results suggest that it should be possible to satisfy Camden requirements with respect to adjacent properties
- Groundwater levels above excavation level have been measured. If significant inflows occur this could compromise excavation stability and advance trial excavations are recommended prior to construction to assess inflow rates and allow appropriate mitigation measured to be designed and implemented

1.0 INTRODUCTION

Consideration is being given to the construction of a new basement beneath this existing residential property and extending into the front and rear gardens. In connection with the proposed works, Soil Consultants Ltd (SCL) were commissioned by Michael Barclay Partnership (MBP), on behalf of the client Elsworthy Road Investments) Ltd, to carry out a) a combined Stage 1 Desk Study/intrusive investigation with Basement Impact Assessment (BIA) and b) a Ground Movement Analysis (GMA). The combined Stage 1 investigations and BIA are described in our Site Investigation Report (Ref: 10588/JRCB, 26/03/21).

This report describes the GMA, the specific purpose of which is to identify the potential horizontal and vertical movements beneath the most critical areas of the adjacent properties and to allow an assessment of the damage classification; it includes the following elements:

- Estimation of the movements due to the installation of underpinning and excavation to the new basement level. We have used empirical relationships contained within the CIRIA report 'Guidance on embedded retaining wall design' (C760:2017) for this element. Whilst the current development proposals do not include embedded retaining walls, the CIRIA empirical relationships are considered to provide a robust and conservative estimate of ground movements and are currently regarded by many engineers as industry best practice. This approach has been agreed in the past on previous projects with Campbell Reith, who are responsible for auditing basement submissions on behalf of the London Borough of Camden
- Calculation of settlement due to underpinning at basement level
- Calculation of the net long-term (post construction) movement resulting from a) the foundation/underpinning settlement and b) soil heave due to the excavation
- Assessment of Damage Classification for adjacent buildings/infrastructure

The SCL combined Stage 1 report should be read in conjunction with this GMA report.

2.0 SITE DESCRIPTION AND GROUND SEQUENCE

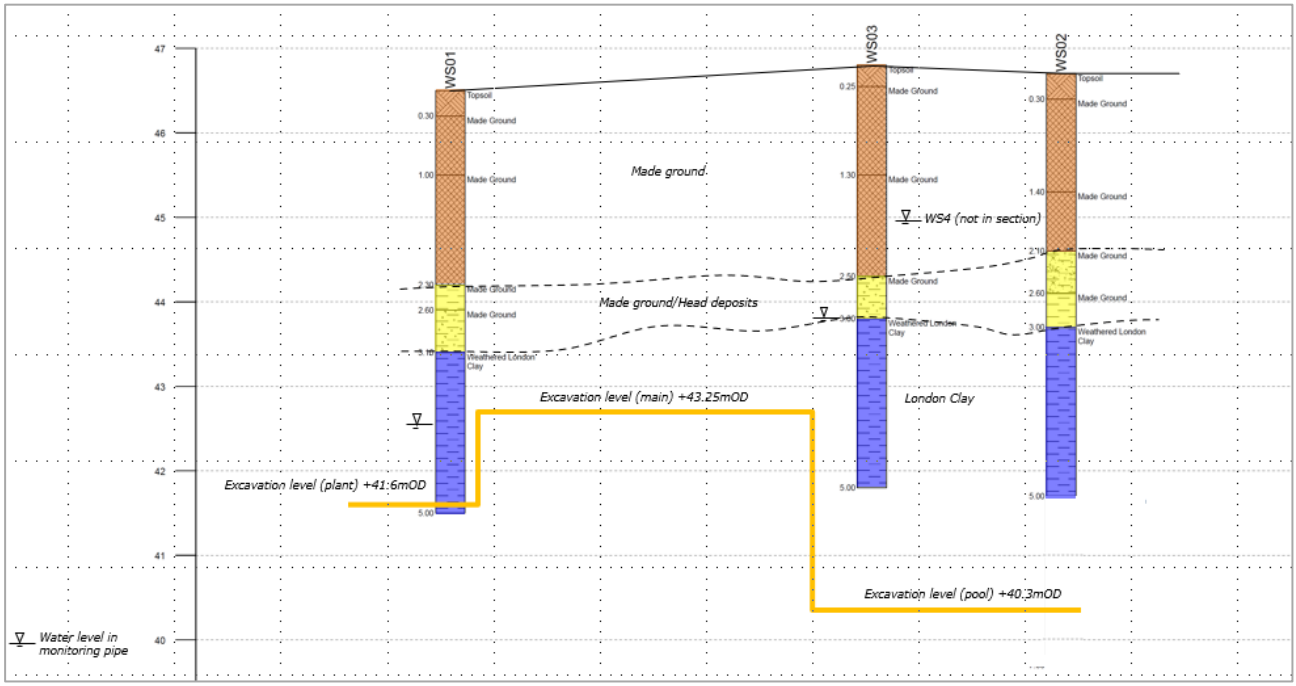
Site location and setting	▪ Large residential property on south-eastern side of Elsworthy Road ▪ Located in London Borough of Camden ▪ Predominantly residential area, with Primrose Hill (park) present immediately to the south-east ▪ Centre of site NGR 527255E 183970N approximately
Site dimensions	▪ Approximately 60m (NW-SE) x 20m (NE-SW)
Site boundaries	▪ Residential properties either side (29 and 33 Elsworthy Road). ▪ Residential street (Elsworthy Road) to north-west and further residential streets beyond ▪ Treeline at back of garden (south-east) with Primrose Hill (park) beyond.
Site description	▪ Existing 2-storey house of traditional construction with habitable roof space and two integral single garages ▪ Paved driveway at the front of the property (approximately 7.5m x 5.0m) ▪ Rear garden, measuring approximately 30m x 15m, accessed from ground level via a pathway along the south-western boundary. Mostly laid to lawn except for a paved patio area on the rear elevation and extending along the south-western boundary
Topography and site levels	▪ Laser Surveys Topographical Survey (Drawing No. L 10058/T) indicates the front driveway slopes down to road level from about +46.80mOD adjacent to the property to a minimum of +46.15mOD on the footpath to Elsworthy Road ▪ The rear garden slopes from about +46.83mOD at patio level to a minimum of +46.55mOD at its southern corner
Existing vegetation within site and adjacent properties	▪ A number of semi-mature and mature trees and shrubs are present within the front and rear gardens, and within the footpath of Elsworthy Road ▪ Based on our observations, species include (but are not limited to) mature London plane on the footpath bordering the site, pine within the front garden, palm, silver birch and olive within the rear garden, and a cypress screen line part of the south-western site boundary ▪ Tree species should be confirmed by a professional arboriculturalist prior to construction

Published BGS information (1:50,000 and 1:10,560 scale maps) indicates that the site is underlain by the London Clay Formation without superficial deposits. Historical BGS borehole records (17-19 Elsworthy Road – approximately 200m ENE) identify made ground extending to 3m depth. The intrusive investigation recently completed by SCL included four boreholes using dynamic sampler techniques, taken to depths of up to 5m.

A summary of the ground sequence and groundwater observations is as follows:

- **Made ground (upper):** extended to depths of between 2.10m and 2.50m. Comprised generally firm slightly gravelly clay
- **Made ground (lower):** this was a distinct layer present in all boreholes between the obvious made ground and the underlying natural London Clay. The soils appear to be natural with no obvious anthropogenic materials, but their high variability and general appearance suggest that they may well be made ground; for the purposes of this report, we have referred to them as 'probable' made ground, although they could also be classified as 'head' deposits. They varied in thickness between 0.50m and 0.90m
- **London Clay:** this natural stratum was met at depths of between 3.00m and 3.10m (+43.4mOD and +43.8mOD). Extended to the full depth investigated
- **Groundwater:** shallowest standing water level measured at 1.90m depth (+44.9mOD)

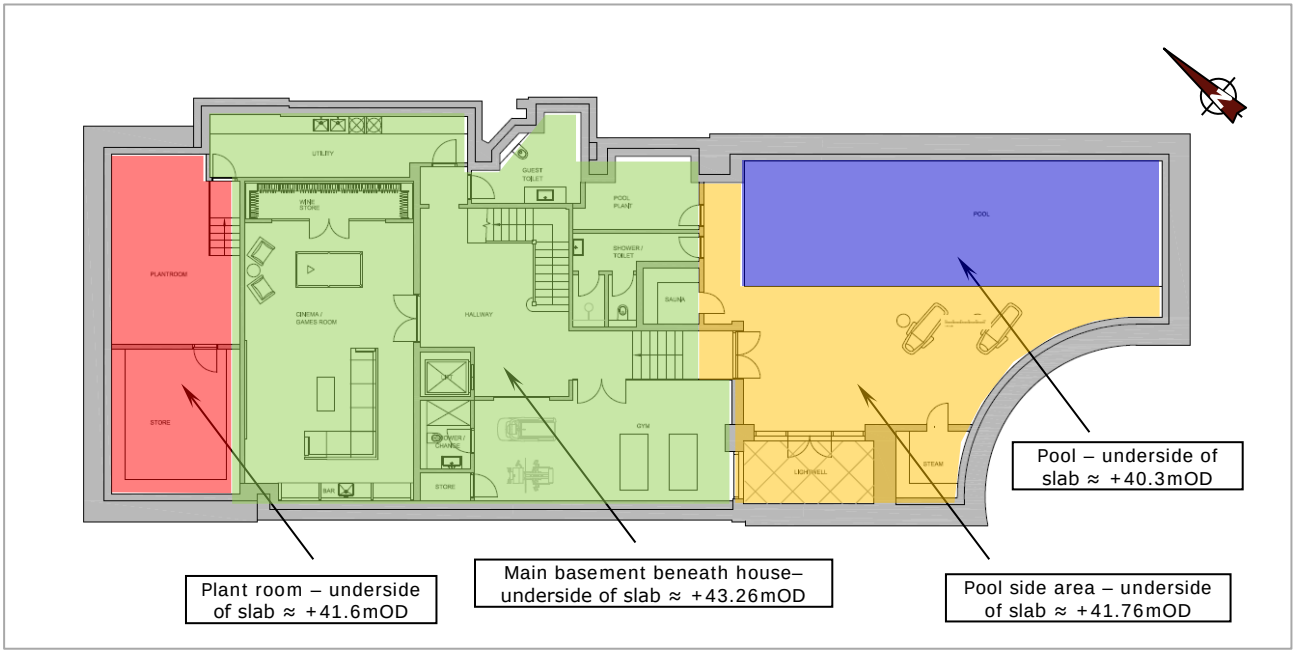
A schematic cross section through the boreholes is as follows:



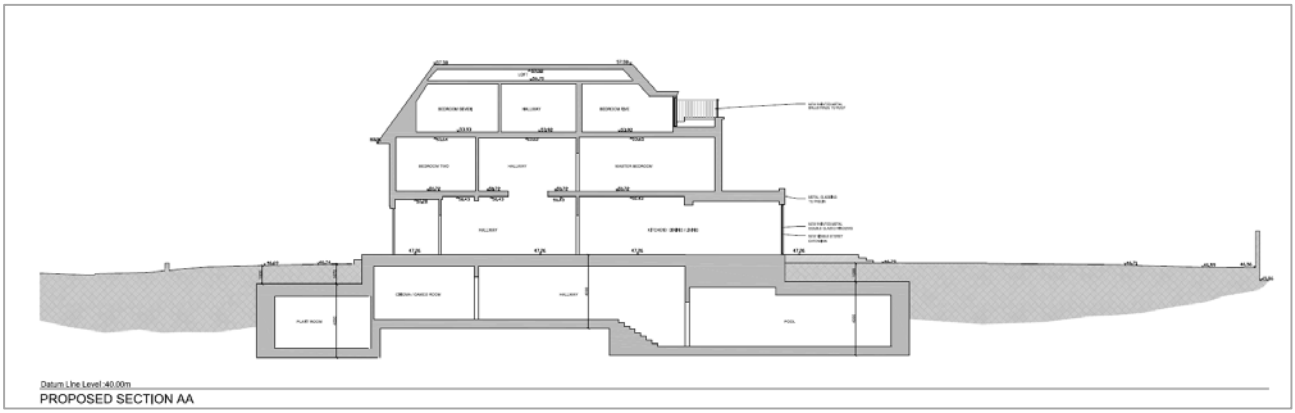
It is noted that the boreholes did not extend to the level of the deepest basement. We are confident that the in-situ London Clay was encountered in the boreholes and that the risk of unforeseen ground below 5m depth is low. Historical BGS borehole records indicate that the London Clay extends to >50m depth in this area.

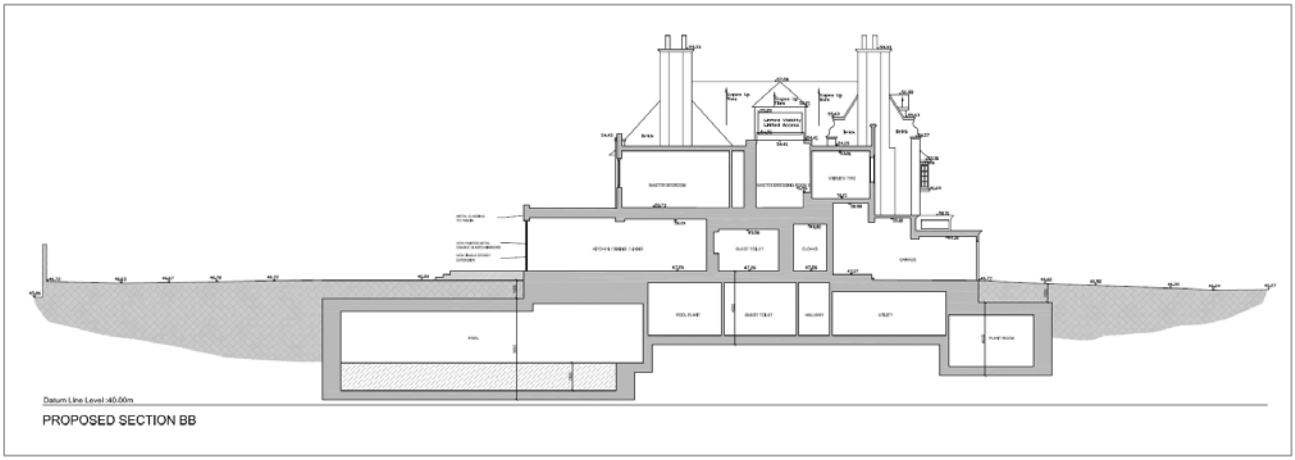
3.0 PROPOSED SCHEME

A plan of the proposed basement footprint is shown below (BB Partnership Ltd drawing GEO_201, Jan 21):



In section, the proposed layout is as follows (BB Partnership Ltd drawing GEO_215, Dec 20):





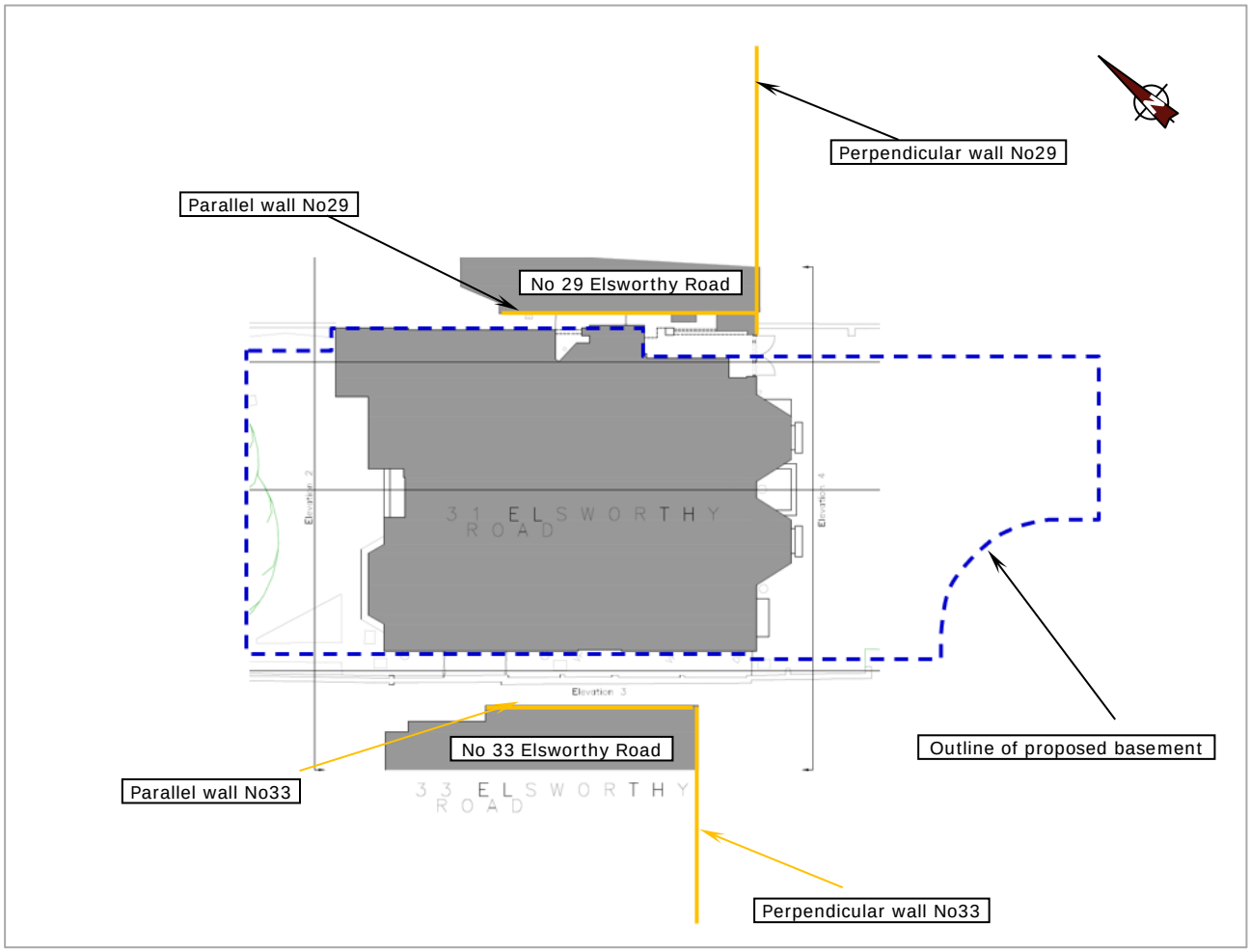
Current proposals envisage the following:

- Conventional underpinning of the existing foundations down to new basement levels
- Sequential basement wall construction in rear and front gardens where no structure is currently present
- Excavation of basement

Details of the foundations of the adjacent properties, Nos 29 and 31 Elsworthy Road, were not available at the time of reporting. Following MBP guidance, it is assumed that they are both supported on conventional shallow strip foundations.

4.0 METHODOLOGY AND ASSESSMENT

The purpose of this analysis is to calculate the potential horizontal and vertical movements beneath the most critical zones of the adjacent properties/infrastructure and allow an assessment of the damage classification. A sketch showing the existing site layout, the proposed basement and the adjacent properties is as follows:



Structures within the zone of influence of the basement excavation and potentially at risk (highlighted in yellow above) are taken as the perpendicular and parallel walls of both adjacent properties.

4.1 Installation of underpinning

The stress relief that occurs during any underpinning process can cause both vertical and horizontal movements in its zone of influence. Some guidance on ground movements is included in CIRIA C760:2017 (Guidance on embedded retaining wall design) in the form of empirical curves for the installation of diaphragm walls. Whilst not strictly intended for underpinning, we assess that the ground movement mechanisms are reasonably well matched. We have used CIRIA C760 Figure 6.9 to estimate the horizontal and vertical movements associated with installation.

4.2 Settlements due to underpinning

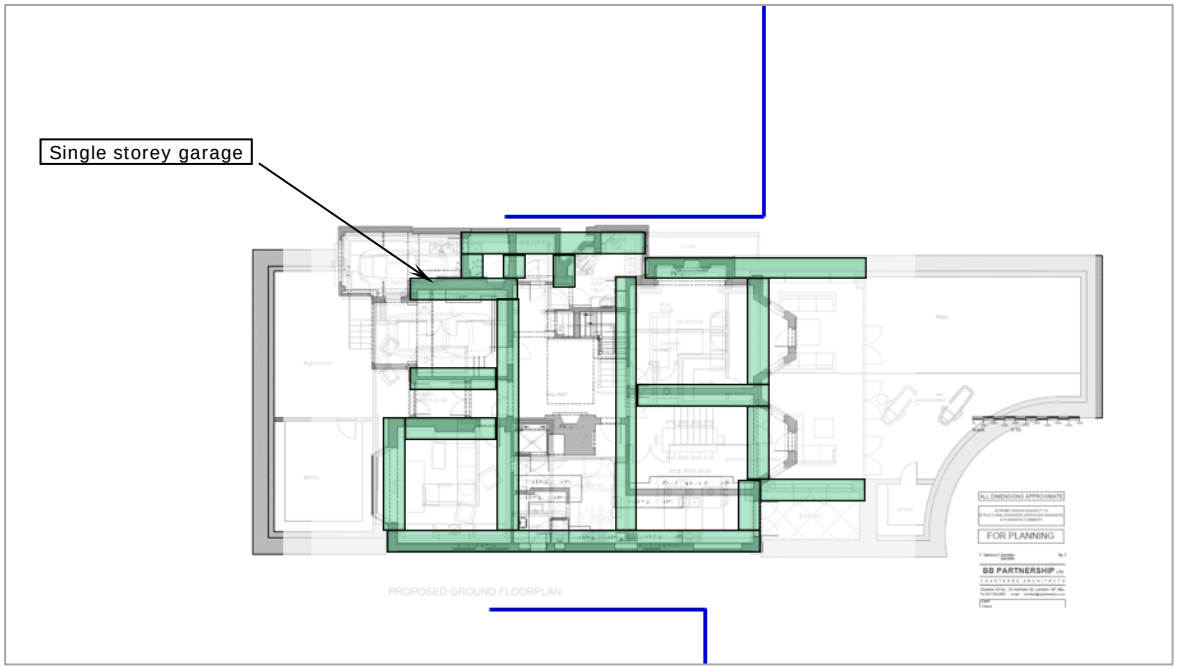
The existing walls of No 31 Elsworthy Road are to be underpinned down to new basement levels, resulting in load redistribution from the existing foundations to the new underpins. MBP have advised that the existing house is probably supported by conventional strip foundations with an applied load of 70kN/m run. We have assumed that this loading will be taken directly to the new foundations at basement level and have taken a width of 1m for the underpins.

We have modelled the settlements due to the new foundation loads using the closed-form solution for vertical loading of an elastic half-space originally formulated by Boussinesq. This solution is incorporated within our in-house software, which allows the superposition of loaded areas to be applied to deduce the overall applied stress field in the ground. Elasticity theory is then used to determine associated ground movements, with appropriate stiffness values used to model both short and long-term behaviour of the soil. The stiffness parameters for use in the Boussinesq analysis have been derived from the assessed undrained strength of the London Clay as determined during the intrusive investigation. The following correlation factors have been applied to provide undrained and drained moduli for the load condition:

Clay:	Undrained	-	Eu = cu x 450
	Drained	-	Ed = cu x 200

Based upon the investigation, we have assumed the London Clay profile as cu = 60kPa at +43mOD, increasing at 7kPa/m.

The analytical technique depends on the selection of appropriate rectangular areas to simulate loading by the new underpins. We have assumed that the following peripheral walls and internal walls will be underpinned (green shading):



The analysis assumes that all elements equate to loads over a series of rectangular areas representing the foundations, with uniform loading below each of the represented areas. The input parameters of the Boussinesq-based analysis are shown in appended Figure 1, with the results summarised as contour plots in Figure 2 (end of construction and long term).

4.3 Vertical and horizontal movements due to basement excavation / wall deflection

These movements will occur as a result of the inward deflection of the basement wall as the soil support is removed during excavation. We have used CIRIA C760:2017 to estimate the vertical and horizontal movements at, and remote from, the line of the excavation. Whilst mainly applicable to embedded walls, this publication is widely used to predict the movement due to basement excavations. The CIRIA charts are based upon historical case-study observation and therefore combine the movements at and behind the wall (due to the inward wall deflection) together with the upward global heave which occurs due to the soil unloading. The predicted net movements will be highly dependent on the stiffness and effectiveness of the support system which is used during excavation; we have assessed the potential ground movements assuming 'high' stiffness support and also an 'intermediate' stiffness support (theoretical line mid-way between the CIRIA 'high' and 'low' stiffness lines) for comparison. The movements predicted by this chart are taken as those occurring up to the end of construction.

4.4 Long-term heave due to unloading:

The immediate (end of construction) heave due to excavation is deemed to be included in the movements from the CIRIA charts, as described above in Section 4.3. There will, however, be a theoretical element of long-term heave due to the overall excavation. This has been estimated using the Boussinesq closed-form solution as described above. The soil will exhibit a stiffer response in unloading and the following correlation factors have been used:

Clay:	Undrained	-	Eu = cu x 500
	Drained	-	Ed = cu x 250

The input parameters of the Boussinesq-based analysis are shown in Figure 3, with the heave results summarised as a contour plot in Figure 4 (post construction long-term).

5.0 RESULTS OF GROUND MOVEMENT PREDICTIONS

Summaries of the estimated ground movements are included in the following sections.

5.1 No 29 Elsworthy Road perpendicular wall

This wall is probably the most vulnerable structure affected by the proposed construction. It is located at the rear of the house and will be influenced by the deeper pool/pool area basement excavation. For the purposes of this assessment, we have assumed that the foundations to No 29 lie at about +46mOD, and thus the excavation depth is about 5.7m below the foundation; the wall is about 1m from the basement line at its nearest point.

Profiles of the assessed vertical movement along the line of this wall are shown for both high and intermediate stiffness support in Figures 5 to 8. The Δv values obtained from these profiles are used in assessing vertical strains for damage assessment.

Horizontal movements within the length of this wall due to basement wall installation and then excavation have been estimated using C760 Figures 6.9 and 6.15 respectively. The following δh values are obtained and have been used for determining the horizontal tensile strains:

High stiffness - δh = 6mm
Intermediate stiffness - δh = 9mm

5.2 No 29 Elsworthy Road, parallel side wall

This wall is approximately 1m from the basement excavation, parallel to the basement wall. The basement in front of the wall is shallower than the pool area and we have taken a depth of excavation of 2.7m in assessing movements.

Profiles of the assessed vertical movement along the line of this wall are shown for both high and intermediate stiffness support in Figures 9 to 12. The Δv values obtained from these profiles are used in assessing vertical strains for damage assessment.

The horizontal movements within the length of this wall are expected to be very small/negligible because it is parallel to the excavation. The main horizontal movement would be 'bulging' towards the excavation, and this would be controlled by temporary propping during construction and by the new basement floor slabs in the permanent case. A nominal value of 2mm horizontal movement has been assumed for this wall for the purposes of estimating horizontal strain for both high and intermediate stiffness support.

5.3 No 33 Elsworthy Road perpendicular wall

This wall is located at the rear of No 33 and is about 3m from the basement excavation at its nearest point. We have again assumed that the foundations lie at about +46mOD with a resulting excavation depth of about 5.7m.

Profiles of the assessed vertical movement along the line of this wall are shown for both high and intermediate stiffness support in Figures 13 to 16. The Δv values obtained from these profiles are used in assessing vertical strains for damage assessment.

Horizontal movements within the length of this wall due to basement wall installation and then excavation have been estimated using C760 Figures 6.9 and 6.15 respectively. The following δh values are obtained and have been used for determining the horizontal tensile strains:

High stiffness - $\delta h = 4mm$
Intermediate stiffness - $\delta h = 7mm$

5.4 No 33 Elsworthy Road, parallel side wall

This wall is approximately 3m from the basement excavation, parallel to the basement wall. Again, we have assumed an excavation depth of 2.7m beneath the foundations of No 33.

Profiles of the assessed vertical movement along the line of this wall are shown for both high and intermediate stiffness support in Figures 17 to 20. The Δv values obtained from these profiles are used in assessing vertical strains for damage assessment.

As with No 29, the horizontal movements within the length of this wall are expected to be very small/negligible because it is parallel to the excavation. The main horizontal movement would be 'bulging' towards the excavation, and this would be controlled by temporary propping during construction and by the new basement floor slabs in the permanent case. A nominal value of 2mm horizontal movement has been assumed for this wall for the purposes of estimating horizontal strain for both high and intermediate stiffness support.

6.0 DAMAGE CLASSIFICATION

This assessment is generally in accordance with the procedure described in C760:2017 as follows:

(i) Determine the vertical settlement profile along the theoretical wall lines; these have been chosen as the most critical by inspection

(ii) Where applicable, determine the Deflection Ratio (Δ/L), which relates vertical settlement to wall length

(iii) Determine the horizontal strain within the length of the wall. This has been achieved by using the predicted horizontal movements. Note that horizontal movements within the length of the walls parallel to the excavation side are expected to be negligible; we have used a presumed value of 2mm in these instances to assess the horizontal strain

(iv) Establish L/H which is the ratio of the building length and height; a value for L/H of 1.0 has been taken for these properties

(v) Using these vertical and horizontal strain values, the category of damage is determined using Burland's classification. This has been carried out for two cases, 'intermediate' stiffness and 'high' stiffness support systems, as shown on the CIRIA charts

The graphical results are shown in Figures 21 to 28 appended. A summary of the assessed damage categories is shown overleaf:

Construction stage	Wall length	Δv (vertical movement)	Deflection Ratio Δ/L	Horizontal movement δ_h	Horizontal strain ε_h	Damage category
No 29 Elsworthy Road – Perpendicular wall HIGH stiffness						
End of construction	10.00m	2.5mm	0.025	6.0mm	0.060%	1/2 borderline (very slight/slight)
Long term	10.00m	2.0mm	0.020	6.0mm	0.060%	1 (very slight)
No 29 Elsworthy Road – Perpendicular wall INTERMEDIATE stiffness						
End of construction	10.0m	3.00m	0.030	9.0mm	0.090%	2 (slight)
Long term	10.0m	2.0mm	0.020	9.0mm	0.090%	2 (slight)
No 29 Elsworthy Road – Parallel wall HIGH stiffness						
End of construction	13.0m	1.0mm	0.015	2.0mm	0.015%	0 (negligible)
Long term	13.0m	1.0mm	0.008	2.0mm	0.015%	0 (negligible)
No 29 Elsworthy Road – Parallel wall INTERMEDIATE stiffness						
End of construction	13.0m	2.0mm	0.015	2.0mm	0.015%	0 (negligible)
Long term	13.0m	1.0mm	0.008	2.0mm	0.015%	0 (negligible)
No 33 Elsworthy Road – Perpendicular wall HIGH stiffness						
End of construction	10.0m	2.5mm	0.030	4.0mm	0.040%	1 (very slight)
Long term	10.0m	3.0mm	0.030	4.0mm	0.040%	1 (very slight)
No 33 Elsworthy Road – Perpendicular wall INTERMEDIATE stiffness						
End of construction	11.0m	3.00mm	0.027	7.0mm	0.064%	2 (slight)
Long term	11.0m	3.0mm	0.027	7.0mm	0.064%	2 (slight)
No 33 Elsworthy Road – Parallel wall HIGH stiffness						
End of construction	10.0m	1.0mm	0.010	2.0mm	0.020%	0 (negligible)
Long term	10.0m	1.0mm	0.010	2.0mm	0.020%	0 (negligible)
No 33 Elsworthy Road – Parallel wall INTERMEDIATE stiffness						
End of construction	10.0m	2.0mm	0.020	2.0mm	0.020%	0 (negligible)
Long term	10.0m	1.0mm	0.010	2.0mm	0.020%	0 (negligible)

The London Borough of Camden requires that any basement scheme should have a risk of damage to neighbouring properties no higher than Category 1 (very slight). It can be concluded from the above summary table that a high stiffness support system will be needed to keep ground movements beneath Nos 29 and 33 Elsworthy Road within acceptable levels. Most at risk are the perpendicular walls, particularly at the rear of No 29 where the wall is in relatively close proximity to the deepest excavation which is for the proposed swimming pool.

The results suggest, therefore, that the proposed scheme, if carefully designed and executed, could be prevented from causing excessive ground movements beneath the adjacent properties. Careful attention will need to be paid to the section of wall at the rear of No 29 Elsworthy Road. Propping should be designed appropriately, and a high level of workmanship and control will be required; jacked propping may well be necessary to limit the lateral movements to within acceptable levels.

7.0 CONCLUSIONS

This report addresses the potential horizontal and vertical movements which may occur as a result of underpinning/retaining wall installation, basement excavation and loading by new foundations. The Camden guidelines state that the design should aim to limit the damage categories for adjacent buildings to Category 1. Within this context, with appropriate measures the proposed scheme is expected to be able to satisfy the Camden requirements.

Any temporary support system will need to be well-designed and is capable of limiting the movements appropriately; it may be necessary to adopt jacked props in the vicinity of the deepest (pool) excavation. It is assumed that the lateral restraint provided by the new ground and basement floors will be sufficient for the permanent case.

Whilst we consider that the above estimates of ground movement are relatively conservative, the success of the project will be dependent on a very high quality of workmanship from specialists who have good experience of this type of construction. A comprehensive monitoring programme will be required to provide early warning of excessive deflections and a suitable contingency plan will need to be in place with appropriate mitigation measures.

Groundwater levels above excavation level have been measured. If significant inflows occur this could compromise excavation stability. We therefore recommend that advance trial excavations are undertaken prior to construction to assess inflow rates and allow appropriate mitigation measured to be specified and implemented.

GENERAL INFORMATION, LIMITATIONS AND EXCEPTIONS

Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in EN1997-2. Any 'design' recommendations which are provided are for guidance only and are intended to allow the designer to assess the results and implications of our investigation/testing and to permit preliminary design of relevant elements of the proposed scheme.

The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access and space limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique we have adopted a practical technique to obtain indicative soil parameters and any interpretation is based upon our engineering experience and relevant published information.

The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during our investigation. In addition, Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

Comments made relating to ground-water or ground-gas are based upon observations made during our investigation unless otherwise stated. Ground-water and ground-gas conditions may vary with time from those reported due to factors such as seasonal effects, atmospheric effects and and/or tidal conditions. We recommend that if monitoring installations have been included as part of our investigation, continued monitoring should be carried out to maximise the information gained.

Specific geotechnical features/hazards such as (but not limited to) areas of root-related desiccation and dissolution features in chalk/soluble rock can exist in discrete localised areas - there can be no certainty that any or all of such features/hazards have been located, sampled or identified. Where a risk is identified the designer should provide appropriate contingencies to mitigate the risk through additional exploratory work and/or an engineered solution.

Where a specific risk of ground dissolution features has been identified in our Report (anything above a 'low' risk rating), reference should be made to the local building control to establish whether there are any specific local requirements for foundation design and appropriate allowances should be incorporated into the design. If such a risk assessment was not within the scope of our investigation and where it is deemed that the ground sequence may give rise to such a risk (for example near-surface chalk strata) it is recommended that an appropriate assessment should be undertaken prior to design of foundations.

Where spread foundations are used, we recommend that all excavations are inspected and approved by suitably experienced personnel; appropriate inspection records should be kept. This should also apply to any structures which are in direct contact with the soil where the soil could have a detrimental effect on performance or integrity of the structure.

Ground contamination often exists in small discrete areas - there can be no certainty that any or all such areas have been located, sampled or identified.

The findings and opinions conveyed in this Report may be based on information from a variety of sources such as previous desk studies, investigations or chemical analyses. Soil Consultants Limited cannot and does not provide any guarantee as to the authenticity, accuracy or reliability of such information from third parties; such information has not been independently verified unless stated in our Report.

Our Report is written in the context of an agreed scope of work between Soil Consultants Ltd and the Client and should not be used in any different context. In light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or the Report in part or in whole may be necessary after its original publication.

Unless otherwise stated our investigation does not include an arboricultural survey, asbestos survey, ecological survey or flood risk assessment and these should be deemed to be outside the scope of our investigation.

STANDARD TERMS OF APPOINTMENT OF SOIL CONSULTANTS LTD FOR GEOTECHNICAL SERVICES

1 Unless previously withdrawn, our offer remains valid for a period of sixty days from date of offer. If an instruction is given after the sixty days we reserve the right to reasonably adjust any cost associated with the project to reflect any variance on the original offer. In placing an instruction to proceed with exploratory work, whether directly from the Client or Client's representative, the Client is deemed to have accepted our Terms of Appointment.

2 Our offer is on the basis that free, unhindered access and working conditions are available and that the investigation can be completed in one visit, if applicable. Delays beyond our control will incur additional charges. If additional works outside our offer are required to facilitate the investigation these will be advised and any costs will be passed on to the Client.

3 In our quotation we will provide an estimate of any mobilisation period following an instruction to proceed. This estimate will be accurate at the time of quotation, but it should be noted that the mobilisation period may vary at a later date due to factors such as sub-contractor availability and workload.

4 In commissioning this work, the Client has a responsibility for the health, safety and welfare of operatives invited to undertake work on their site. The Client shall indemnify us in respect of any failure to fulfil their obligations in connection with all relevant and current Health and Safety Regulations.

5 The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access, space and budgetary limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique, or where a non-compliant technique has been specified, we will adopt practical and appropriate techniques to obtain indicative soil parameters.

6 Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in BS EN1997-2. Any interpretation which is provided is for guidance only and must not be regarded as design or design recommendation.

7 Where excavation is required as part of the exploratory work, the Client shall provide drawings or plans showing accurate and complete locations of all underground services and structures. In performing our service, we shall take reasonable precautions to avoid damage to underground services or structures. We will not be responsible for any damage caused to underground services or structures and will not be liable for any claims for damage, expenses arising or losses unless the location of all underground services or structures are accurately shown on drawings and those plans have been provided to us in good time prior to commencement of the exploratory work. Risk to the Client can be further reduced by undertaking a scan of the site using a specialist underground scanning service which would be intended to identify traceable services at shallow depth.

8 With some sites, especially those in certain areas of London and other large towns and cities, there may be a risk of unexploded ordnance (UXO) being present. Unless otherwise stated our offer is on the basis that the Client or their representative provides a preliminary UXO risk assessment for the site. It should be noted that if the site is deemed to be in an area of risk then further measures will be required. These would normally comprise either a more detailed risk assessment and/or specialist site attendance by an EOD engineer. These measures can be commissioned either by the Client or Soil Consultants Ltd. If the Client requires, we would be pleased to obtain a preliminary risk assessment at cost+10%.

9 The Client will supply a site plan (to a rational scale), an indication of the scope and type of the proposed development and an indication of any relevant structural loading information.

10 Should the Client terminate the contract after instruction, we reserve the right to recover costs associated to work carried out between the time of instruction and the point of termination. Cancellation fees, and material costs shall be charged at cost plus 20% (+VAT). Engineer/technician time shall be charged at £95+VAT per hour and principal consultant/director time shall be charged at £125+VAT per hour.

11 The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during the investigation. In addition Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

12 If and when instructed, an agreed number of contamination tests will be carried out to give an outline assessment of potential contaminants. In some circumstances it may be necessary to recommend further monitoring, contamination testing and assessment and the scope of this work would be agreed with the Client. Notwithstanding this additional scope, local regulatory authorities may have specific requirements which need to be addressed. Unless otherwise agreed or stated our reporting will constitute neither a Quantitative Risk Assessment nor a Remediation Statement or Strategy.

13 Our reports are counter-checked by one of our suitably qualified and experienced engineers/geologists.

14 Notwithstanding anything to the contrary contained in these terms, our liability under or in connection with these terms whether in contract or in tort, in negligence, for breach of statutory duty or otherwise (other than in respect of personal injury or death) shall not exceed the sum equivalent to ten times our contract fee or £100,000 whichever is less in the aggregate for geotechnical and environmental matters unless otherwise agreed.

15 Without prejudice to any other exclusion or limitation of liability, damages, loss, expense or costs our liability for any claim or claims under this agreement be further limited to such sum as it would be just and equitable for us to pay having regard to the extent of our responsibility for the loss or damage giving rise to such claim or claims ("the loss and damage") and on the assumptions that:

(a) All other consultants, contractors, sub-contractors, project managers or advisers engaged in connection with the Project have provided contractual undertakings to the Client on terms no less onerous than those set out in the original contracts in respect of the carrying out of their obligations in connection with the Project; and

(b) There are no exclusions of or limitations of liability nor joint insurance or co-insurance provisions between the Client and any other party referred to in this clause and any such other party who is responsible to any extent for the loss and damage is contractually liable to the Client for the loss and damage; and

(c) All such other consultants, contractors, sub-contractors, project managers or advisers have paid to the Client such proportion of the loss or damage which it would be just and equitable for them to pay having regard to the extent of their responsibility for the loss and damage.

16 Further and notwithstanding anything to the contrary contained in this agreement and without prejudice to any provision in this agreement whereby liability is excluded or limited to a lesser amount, our liability under or in connection with this agreement whether in contract or in tort, in negligence, for breach of statutory duty or otherwise for any claim shall not exceed the amount, if any, recoverable by us by way of indemnity against the claim in question under professional indemnity insurance taken out by us and in force at the time that the claims or (if earlier) circumstances that may give rise to the claim is or are reported to the insurers in question. The limitation shall not apply if no such amount is recoverable due to us having been in breach of our obligations or the terms of any insurance maintained in accordance therewith or having failed to report any such claim or circumstances to the Insurers in question timeously.

17 Whilst our investigation may include asbestos screening/quantification on selected samples, this must not be deemed to constitute a full asbestos survey or be taken as sufficient to definitively identify the presence or quantity of asbestos within or on the ground. We will not accept responsibility if asbestos is encountered during any subsequent construction or development works and in placing a contract with us the Client accepts this condition. Where the fabric of a building is to be disturbed, the Client shall provide an appropriate asbestos survey to us prior to exploratory work and make adequate provision to allow us to provide relevant protective/remedial measures to progress the work safely.

18 The Client agrees that they shall not bring any claim personally against any director/employee of Soil Consultants Ltd or consultant to us in respect of loss or damage suffered by the Client arising out of this contract.

19 Our appointment shall be under simple agreement and our liability under this contract shall be for a period of six years from date of appointment.

20 Our reports are non-assignable and are prepared for the benefit of the Client. No reliance can be assumed by others without written agreement from Soil Consultants Ltd. We will provide a letter of reliance at our discretion and this will be subject to payment of our fee, which will be 10% of contract value, subject to a minimum fee of £750 plus VAT. The terms of our letter of reliance are non-negotiable and the beneficiary should be aware that the information shall only apply to the scheme for which the report was originally produced and the original rights and benefits will apply.

21 A VAT invoice (at current rate) will be presented in respect of the work undertaken. Payment of our account is to be made within twenty-eight days of issue of our invoice unless otherwise agreed. On no account shall payment be on a 'pay-when-paid' basis. The information contained within our report remains the property of Soil Consultants Ltd and no reliance may be assumed by any party with an interest in the project until payment has been received in full. After one calendar month interest shall be chargeable at 10% above the Bank of England Rate and compensation claimed in accordance with 'Late Payments of Commercial Debts (Interest) Act 1998 and subsequent revisions. If the debt is referred to a debt collection agency then we have the right to recover associated fees under the terms of our contract.

APPENDIX

- Figures 1 to 4: Foundation settlement and heave due to excavation - results from Boussinesq-based analysis (input sheets and contour plots)
- Figures 5 to 20: movement profiles along selected walls
- Figures 21 to 28: damage categories for selected walls
- BB Partnership Ltd: plans/sections of proposed development (various)
- Laser Surveys 'Topographical Survey' (Ref: L10058)

Site & Location	31 Elsworthy Road London NW3 3BT	Report No: 10588A/JRCB

Boussinesq analysis – input parameters (underpinning/foundation loading)

Loaded areas: 17

Ref	X1	Y1	X2	Y2	p	za
1	29.1	22.4	30.1	27.6	70.0	43.000
2	29.1	21.4	46.4	22.4	70.0	43.000
3	30.0	33.0	35.1	34.0	70.0	43.000
4	32.5	35.2	41.0	36.2	70.0	43.000
5	34.1	22.4	35.1	33.0	70.0	43.000
6	39.6	22.4	40.6	34.0	70.0	43.000
7	41.0	34.0	51.4	35.0	70.0	43.000
8	45.4	22.4	46.4	24.6	70.0	43.000
9	46.4	23.6	51.4	24.6	70.0	43.000
10	32.6	34.0	33.6	35.0	70.0	43.000
11	34.6	34.0	35.6	35.0	70.0	43.000
12	36.8	33.7	37.8	35.0	70.0	43.000
13	40.6	28.0	46.8	29.0	70.0	43.000
14	30.2	28.8	34.1	29.8	70.0	43.000
15	30.1	26.6	34.1	27.6	70.0	43.000
16	45.8	24.6	46.8	28.0	70.0	43.000
17	45.8	29.0	46.8	34.0	70.0	43.000

Strata: 1

No	Ref level [mOD]	Cu or N	d(Cu or N)/dz	Eu [kN/m^2]	Ed [kN/m^2]	νu	νd	Name
1	43.000	60	7.00	24,000	9,000	0.5	0.15	LC

Layers: 11

No	Top	Bottom	Stratum	H	MidLevel	Stratum Name
1	43.00	42.50	1	0.50	42.75	LC
2	42.50	42.00	1	0.50	42.25	LC
3	42.00	41.50	1	0.50	41.75	LC
4	41.50	41.00	1	0.50	41.25	LC
5	41.00	40.50	1	0.50	40.75	LC
6	40.50	40.00	1	0.50	40.25	LC
7	40.00	39.50	1	0.50	39.75	LC
8	39.50	39.00	1	0.50	39.25	LC
9	39.00	38.50	1	0.50	38.75	LC
10	38.50	38.00	1	0.50	38.25	LC
11	38.00	37.50	1	0.50	37.75	LC

Geometry

Geometry	X1	0.0	Width	65	units
extents	Y1	0.0	Breadth	55	units
	X2	65.0	Points	3696	
	Y2	55.0			

Grid dx 1.00 — Stresses and settlements are calculated at each point of the grid

dy 1.00

FIGURE 1

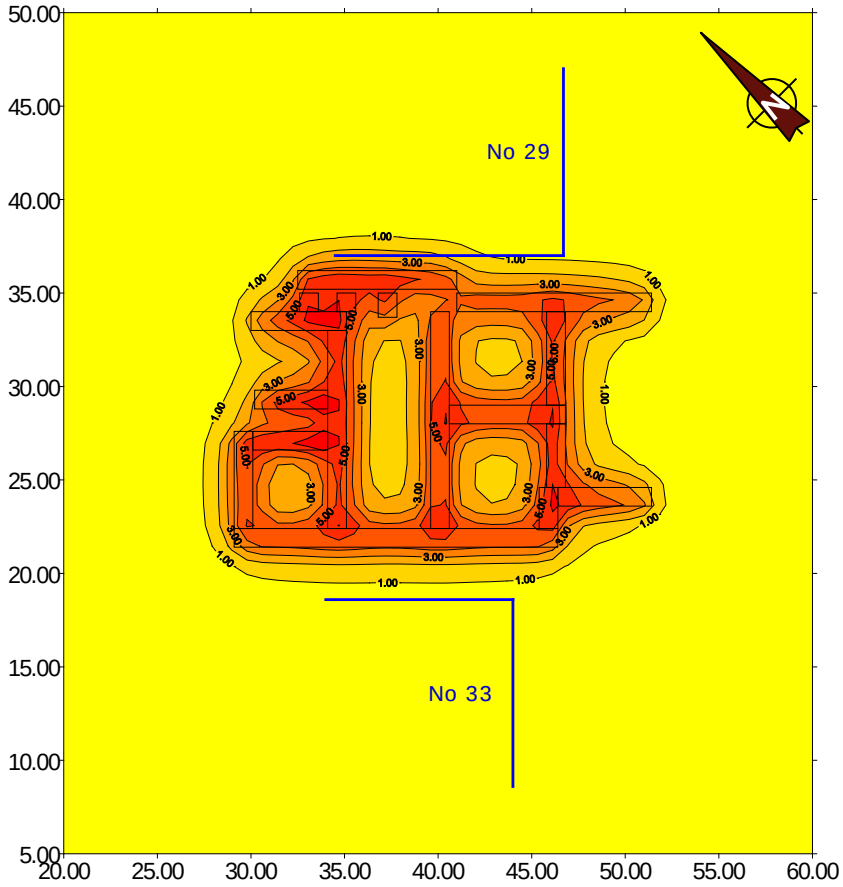
Soil Consultants

Site & Location	31 Elsworthy Road London NW3 3BT	Report No: 10588A/JRCB

Settlement due to underpinning/foundation loading

Contour output

End of construction (100% immediate and 20% long term)



Post construction (0% immediate and 80% long term)

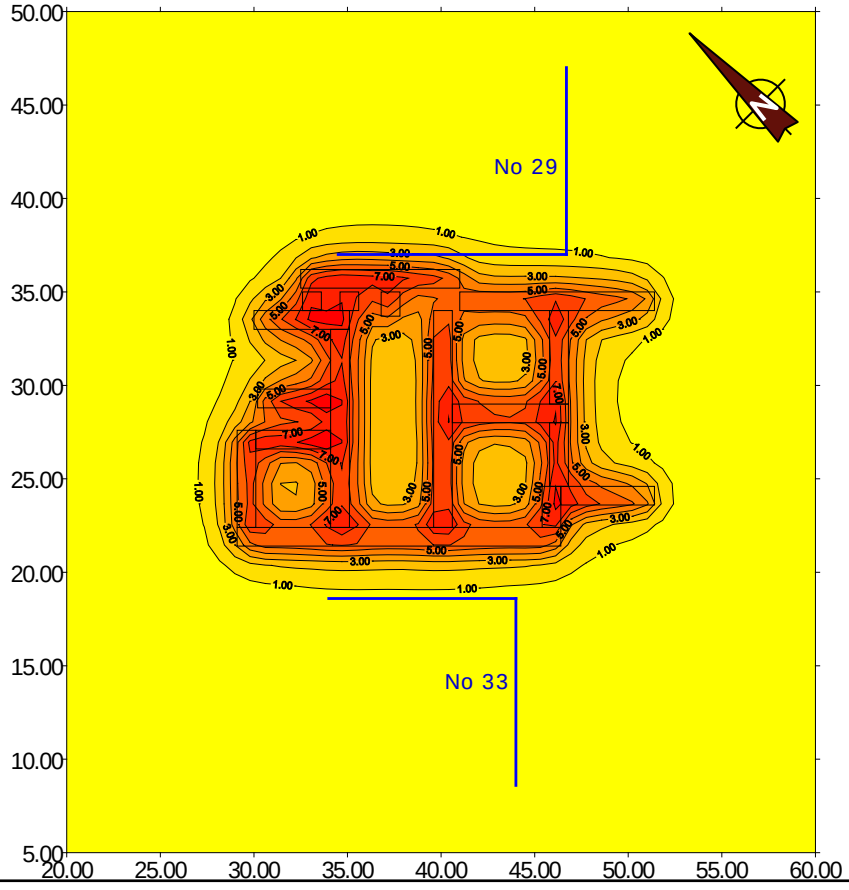


FIGURE 2

Soil Consultants

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No:	10588A/JRCB

Boussinesq analysis – input parameters (excavation unload)

Loaded areas: **14**

Ref	X1	Y1	X2	Y2	p	za
1	24.0	22.3	28.6	27.5	-98.0	41.600
2	24.0	27.5	27.4	34.4	-98.0	41.600
3	27.4	27.5	28.6	33.5	-98.0	41.600
4	28.6	22.0	41.9	33.5	-70.8	43.260
5	27.4	33.5	36.6	35.7	-70.8	43.260
6	36.6	33.5	40.4	35.7	-70.8	43.260
7	41.9	22.0	44.8	34.2	-70.8	43.260
8	44.8	22.0	46.6	26.2	-70.8	43.260
9	44.8	26.2	46.6	33.4	-100.8	41.760
10	46.6	22.0	55.2	29.6	-100.8	41.760
11	55.2	25.9	57.1	27.8	-100.8	41.760
12	55.2	27.8	61.4	29.6	-100.8	41.760
13	55.2	29.6	61.4	33.4	-130.0	40.300
14	46.6	29.6	55.2	33.4	-130.0	40.300

Strata: **1**

No	Ref level [mOD]	Cu or N	d(Cu or N)/dz	Eu [kN/m^2]	Ed [kN/m^2]	νu	νd	Name
1	43.000	60	7.00	30,000	15,000	0.5	0.15	LC

Layers: **11**

No	Top	Bottom	Stratum	H	MidLevel	Stratum Name
1	43.26	43.00	1	0.26	43.13	LC
2	43.00	42.00	1	1.00	42.50	LC
3	42.00	41.76	1	0.24	41.88	LC
4	41.76	41.60	1	0.16	41.68	LC
5	41.60	41.00	1	0.60	41.30	LC
6	41.00	40.30	1	0.70	40.65	LC
7	40.30	40.00	1	0.30	40.15	LC
8	40.00	35.00	1	5.00	37.50	LC
9	35.00	30.00	1	5.00	32.50	LC
10	30.00	25.00	1	5.00	27.50	LC
11	25.00	20.00	1	5.00	22.50	LC

Geometry

Geometry	X1	0.0	Width	65	units
extents	Y1	0.0	Breadth	55	units
	X2	65.0	Points	3696	
	Y2	55.0			

Grid dx 1.00 — Stresses and settlements are calculated at each point of the grid

dy 1.00

FIGURE 3

Soil Consultants

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Heave due to basement excavation

Contour output

Post construction (0% immediate and 80% long term)

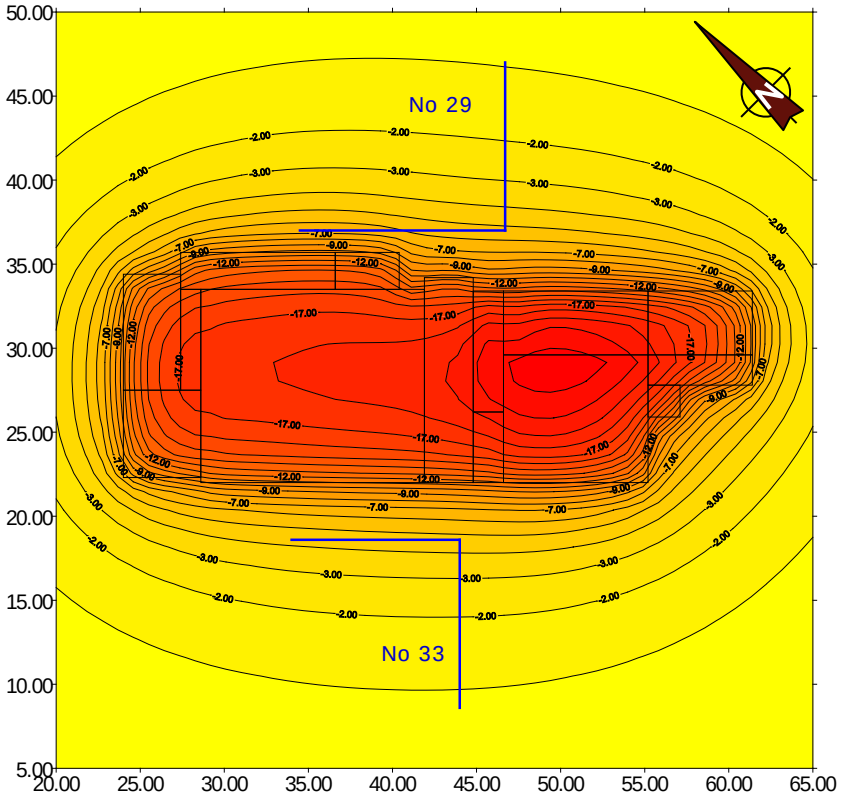


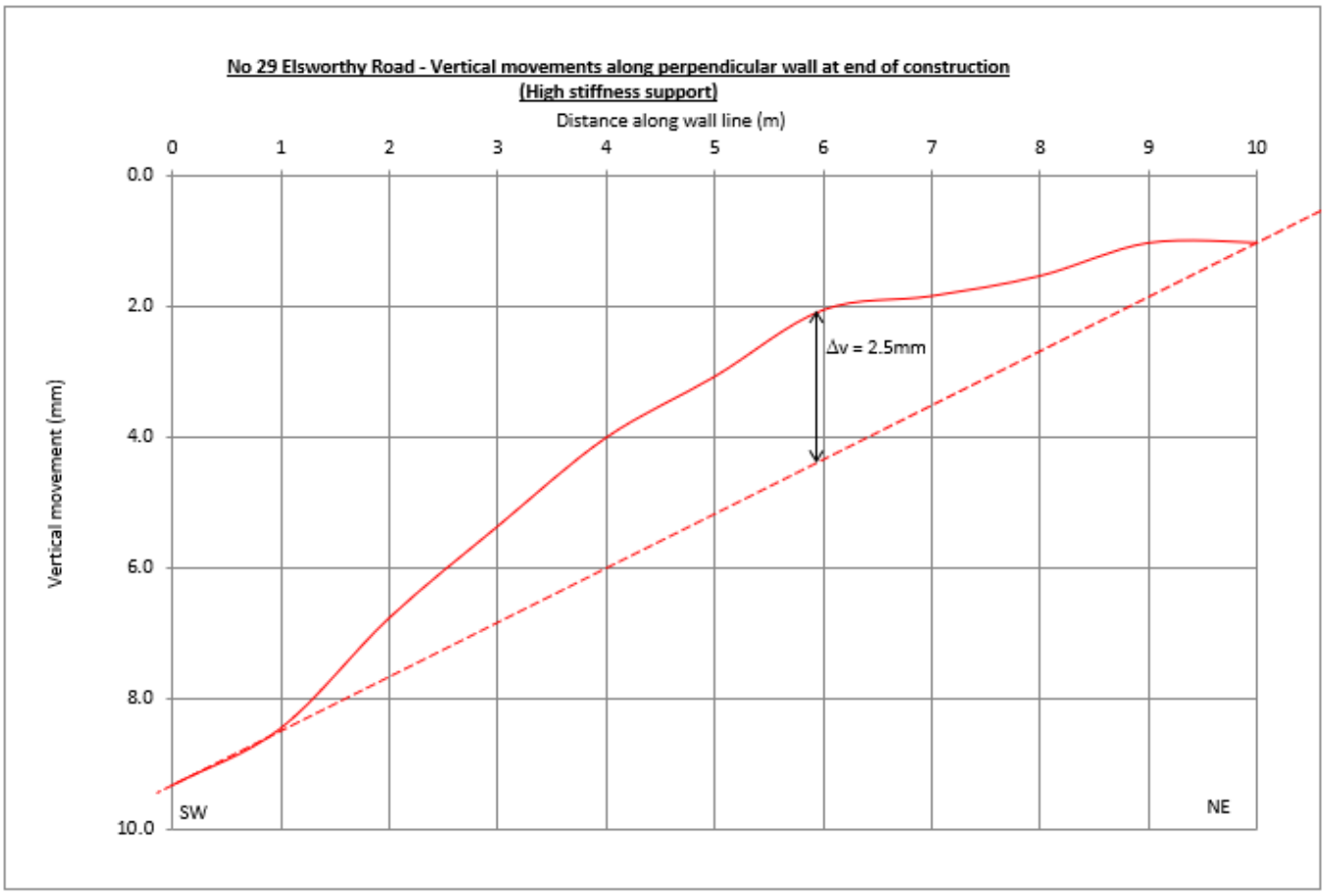
FIGURE 4

Soil Consultants

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 29 Elsworthy Road perpendicular wall (High stiffness)

End of construction



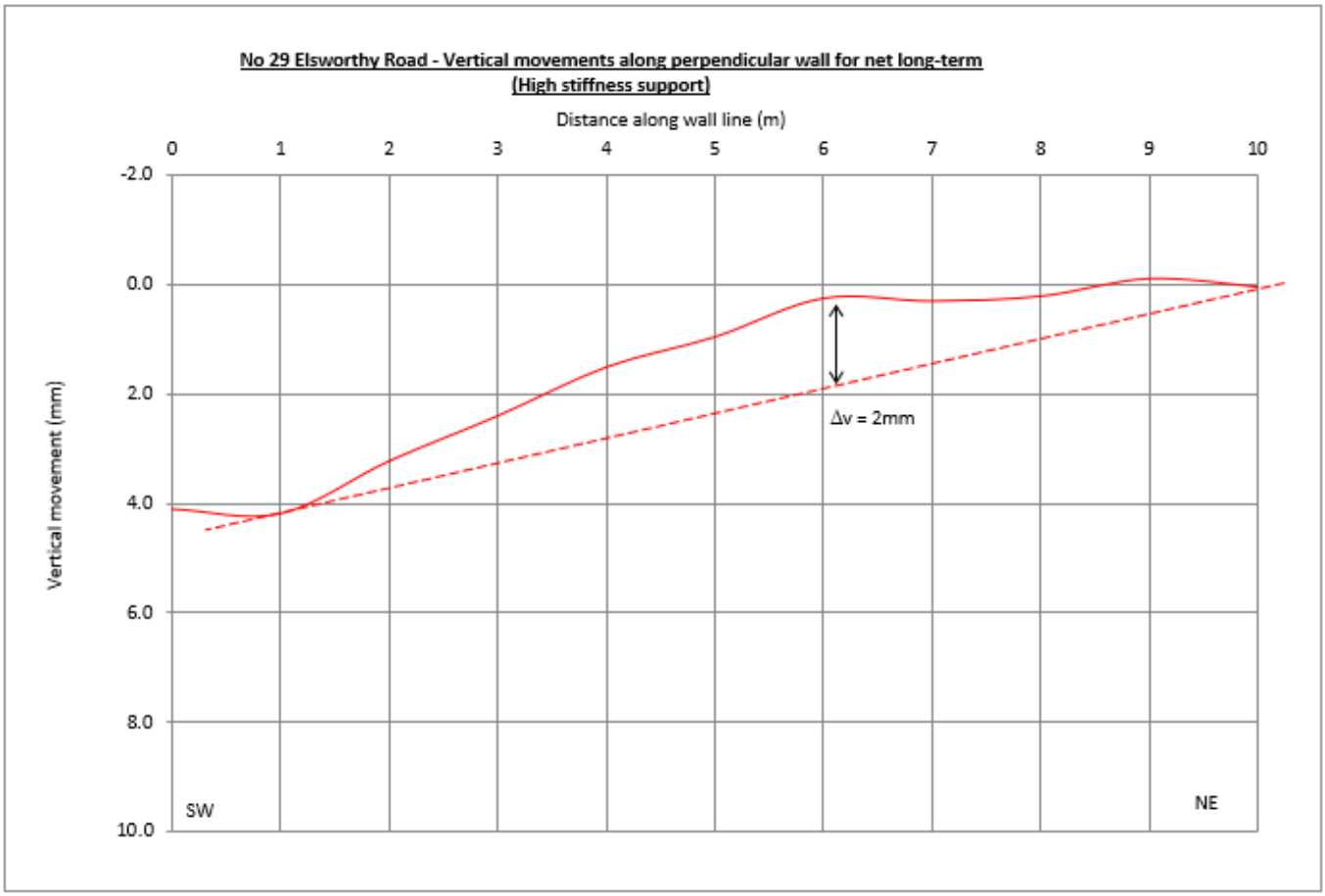
	Perpendicular wall - vertical movement at end of construction HIGH			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	5.0	0.8	3.5	9.3
1.0	4.0	0.5	4.0	8.5
2.0	3.0	0.3	3.5	6.8
3.0	2.0	0.2	3.2	5.4
4.0	1.0	0.1	2.9	4.0
5.0	0.5	0.1	2.5	3.1
6.0	0.0	0.0	2.0	2.0
7.0	0.0	0.0	1.8	1.8
8.0	0.0	0.0	1.5	1.5
9.0	0.0	0.0	1.0	1.0
10.0	0.0	0.0	1.0	1.0

FIGURE 5

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 29 Elsworthy Road perpendicular wall (High stiffness)

Long term



	Perpendicular wall - vertical movement long-term HIGH		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	1.1	-5.2	4.1
1.0	0.6	-4.3	4.2
2.0	0.4	-3.5	3.2
3.0	0.2	-3.0	2.4
4.0	0.1	-2.5	1.5
5.0	0.1	-2.1	1.0
6.0	0.1	-1.8	0.3
7.0	0.0	-1.5	0.3
8.0	0.0	-1.3	0.2
9.0	0.0	-1.1	-0.1
10.0	0.0	-1.0	0.1

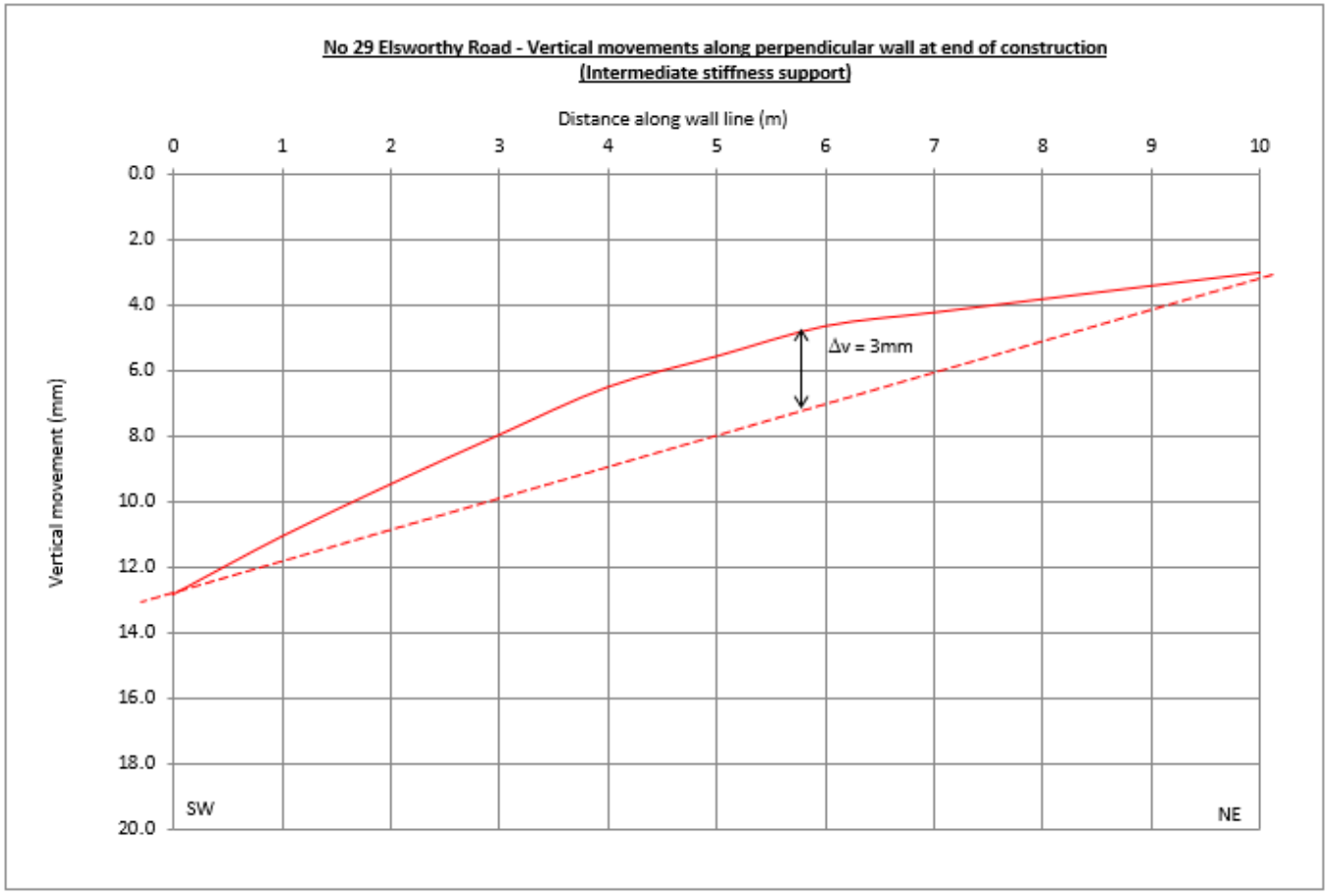
(Note: total long term net is determined using the end of construction movement and the post construction movements)

FIGURE 6

Soil Consultants

Settlement profile – No 29 Elsworthy Road perpendicular wall (Intermediate stiffness)

End of construction

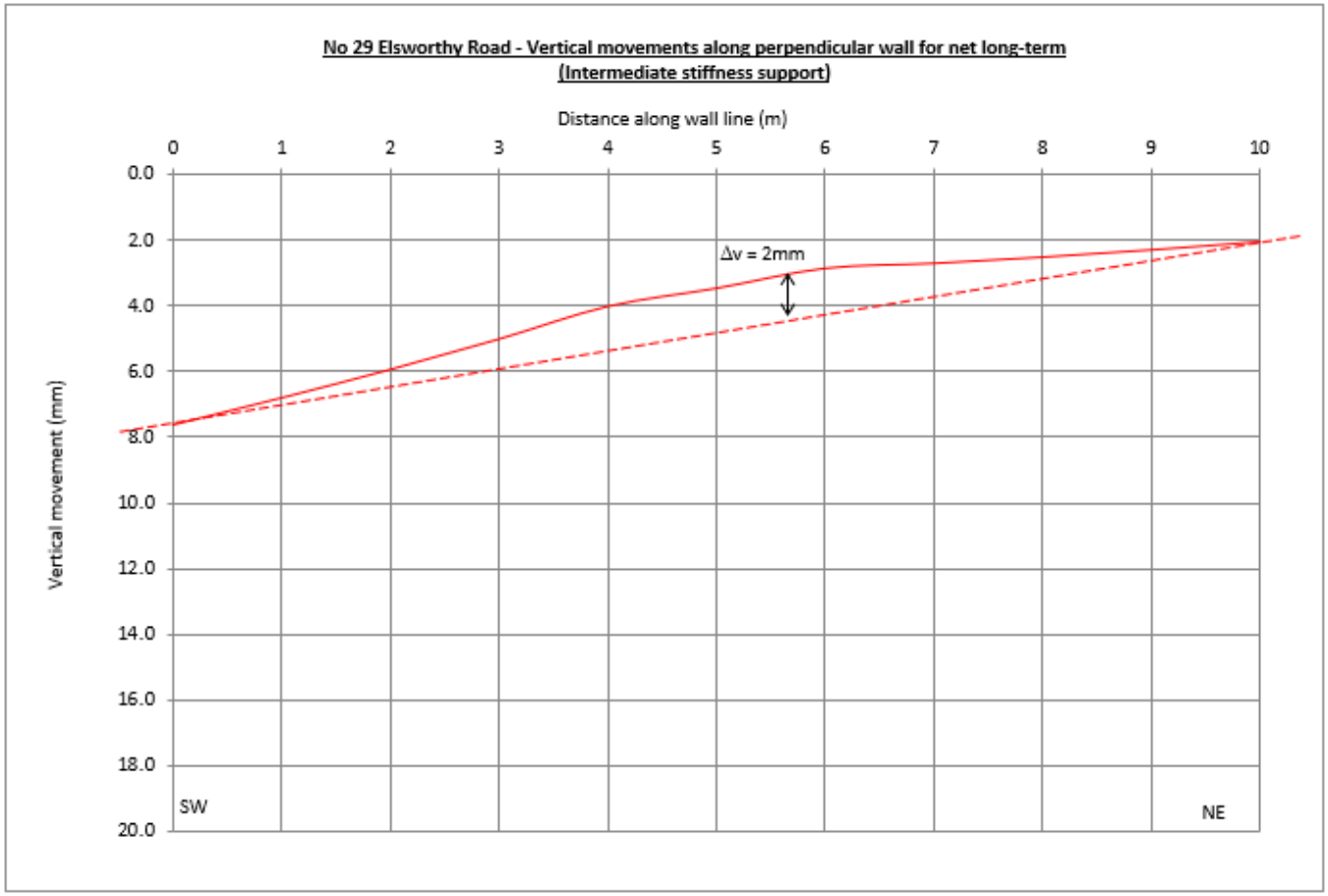


	Perpendicular wall - vertical movement at end of construction INTERMEDIATE			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	5.0	0.8	7.0	12.8
1.0	4.0	0.5	6.6	11.1
2.0	3.0	0.3	6.2	9.5
3.0	2.0	0.2	5.8	8.0
4.0	1.0	0.1	5.4	6.5
5.0	0.5	0.1	5.0	5.6
6.0	0.0	0.0	4.6	4.6
7.0	0.0	0.0	4.2	4.2
8.0	0.0	0.0	3.8	3.8
9.0	0.0	0.0	3.4	3.4
10.0	0.0	0.0	3.0	3.0

FIGURE 7

Settlement profile – No 29 Elsworthy Road perpendicular wall (Intermediate stiffness)

Long term



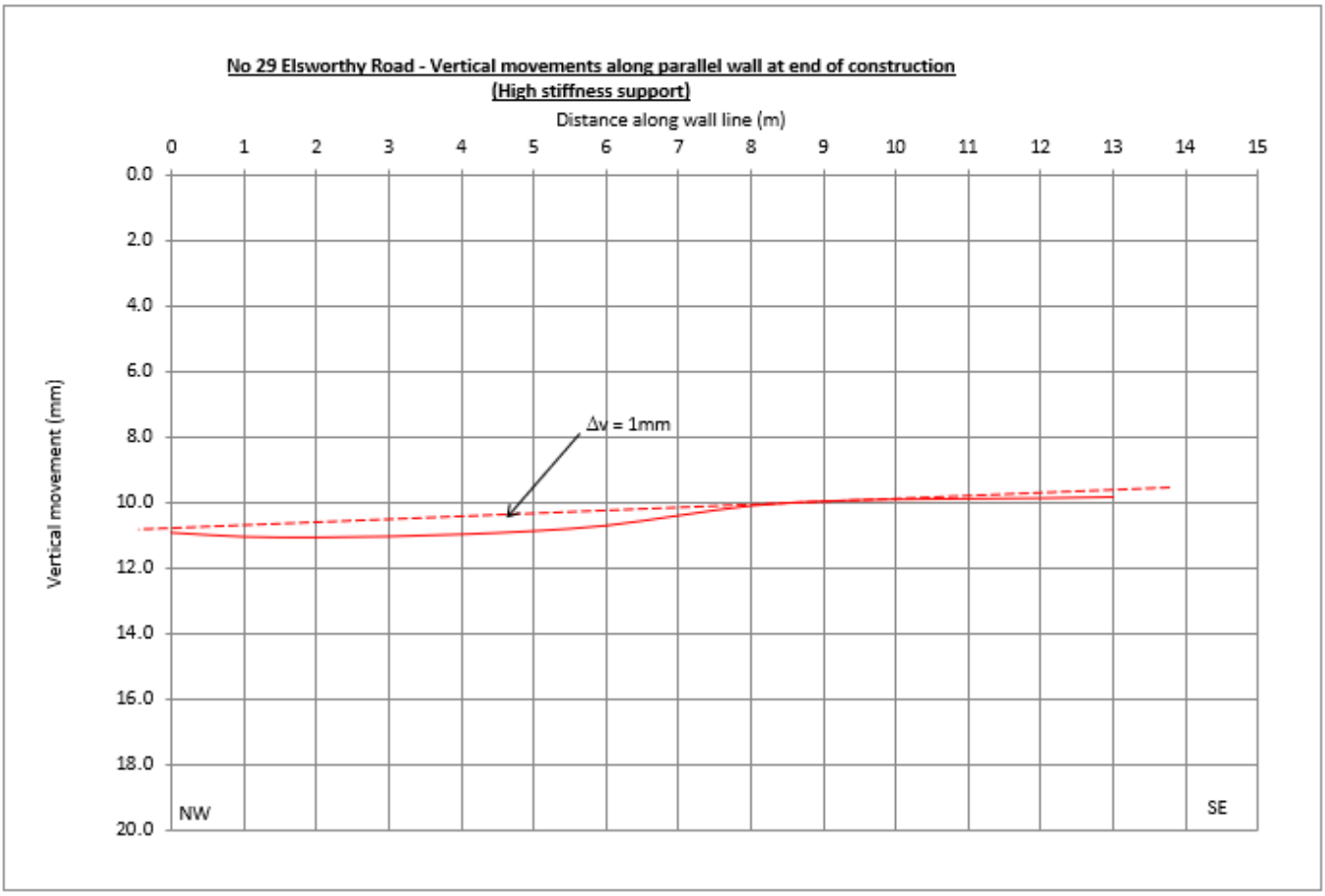
	Perpendicular wall - vertical movement long-term INT		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	1.1	-5.2	7.6
1.0	0.6	-4.3	6.8
2.0	0.4	-3.5	5.9
3.0	0.2	-3.0	5.0
4.0	0.1	-2.5	4.0
5.0	0.1	-2.1	3.5
6.0	0.1	-1.8	2.9
7.0	0.0	-1.5	2.7
8.0	0.0	-1.3	2.5
9.0	0.0	-1.1	2.3
10.0	0.0	-1.0	2.1

(Note: total long term net movement is determined using the end of construction movement and the post construction movements)

FIGURE 8

Settlement profile – No 29 Elsworthy Road parallel wall (High stiffness)

End of construction



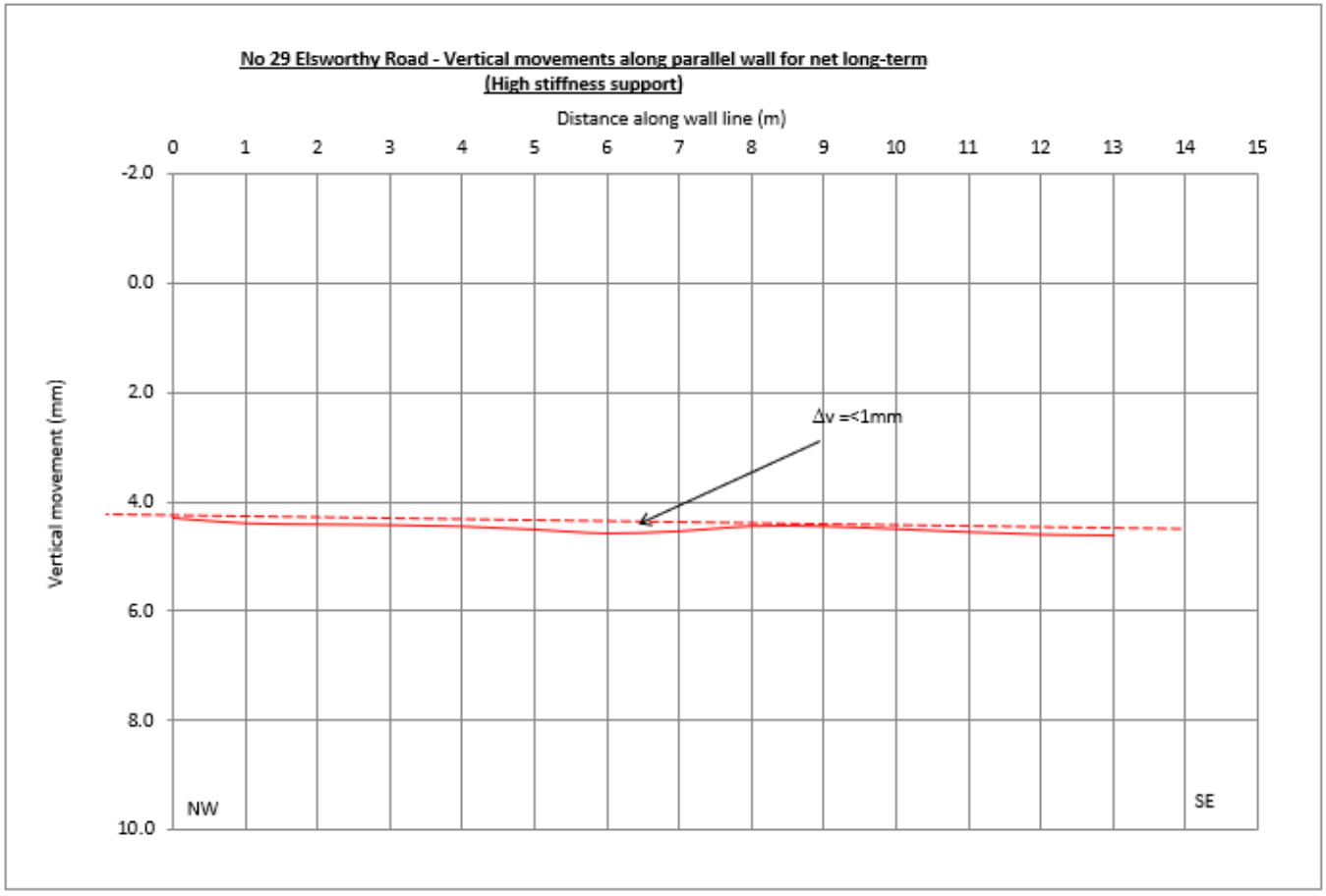
	Parallel wall - vertical movement at end of construction HIGH			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	5.0	1.9	4.0	10.9
1.0	5.0	2.0	4.0	11.0
2.0	5.0	2.1	4.0	11.1
3.0	5.0	2.0	4.0	11.0
4.0	5.0	2.0	4.0	11.0
5.0	5.0	1.9	4.0	10.9
6.0	5.0	1.7	4.0	10.7
7.0	5.0	1.4	4.0	10.4
8.0	5.0	1.1	4.0	10.1
9.0	5.0	1.0	4.0	10.0
10.0	5.0	0.9	4.0	9.9
11.0	5.0	0.9	4.0	9.9
12.0	5.0	0.9	4.0	9.9
13.0	5.0	0.8	4.0	9.8

FIGURE 9

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 29 Elsworthy Road parallel wall (High stiffness)

Long term



	Parallel wall - vertical movement long-term HIGH		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	2.5	-6.6	4.3
1.0	2.7	-6.6	4.4
2.0	2.7	-6.6	4.4
3.0	2.7	-6.6	4.4
4.0	2.6	-6.5	4.4
5.0	2.5	-6.4	4.5
6.0	2.2	-6.1	4.6
7.0	1.8	-5.9	4.5
8.0	1.4	-5.7	4.4
9.0	1.3	-5.5	4.4
10.0	1.2	-5.4	4.5
11.0	1.2	-5.3	4.5
12.0	1.1	-5.3	4.6
13.0	1.1	-5.2	4.6

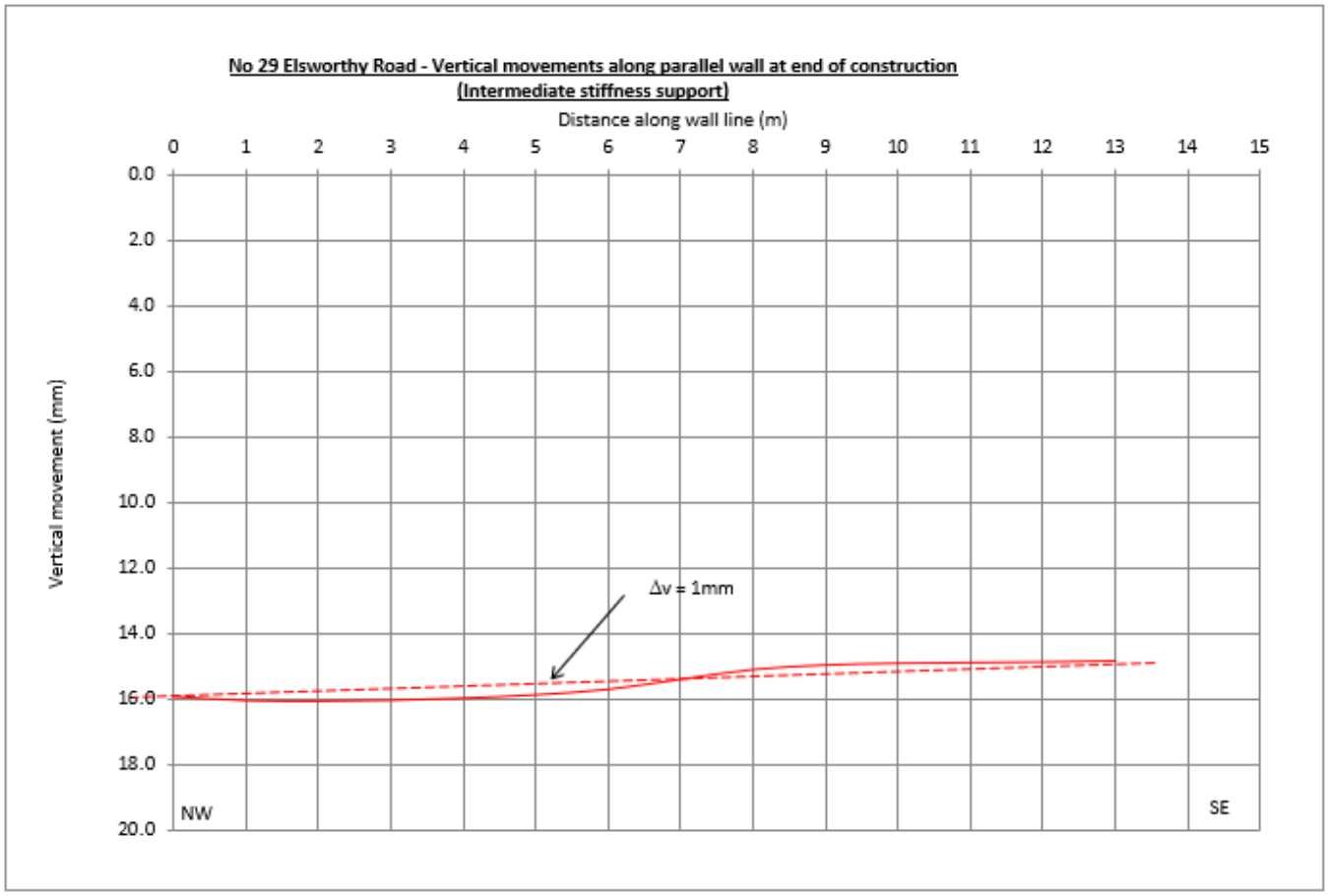
(Note: total long term net is determined using the end of construction movement and the post construction movements)

FIGURE 10

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 29 Elsworthy Road parallel wall (Intermediate stiffness)

End of construction



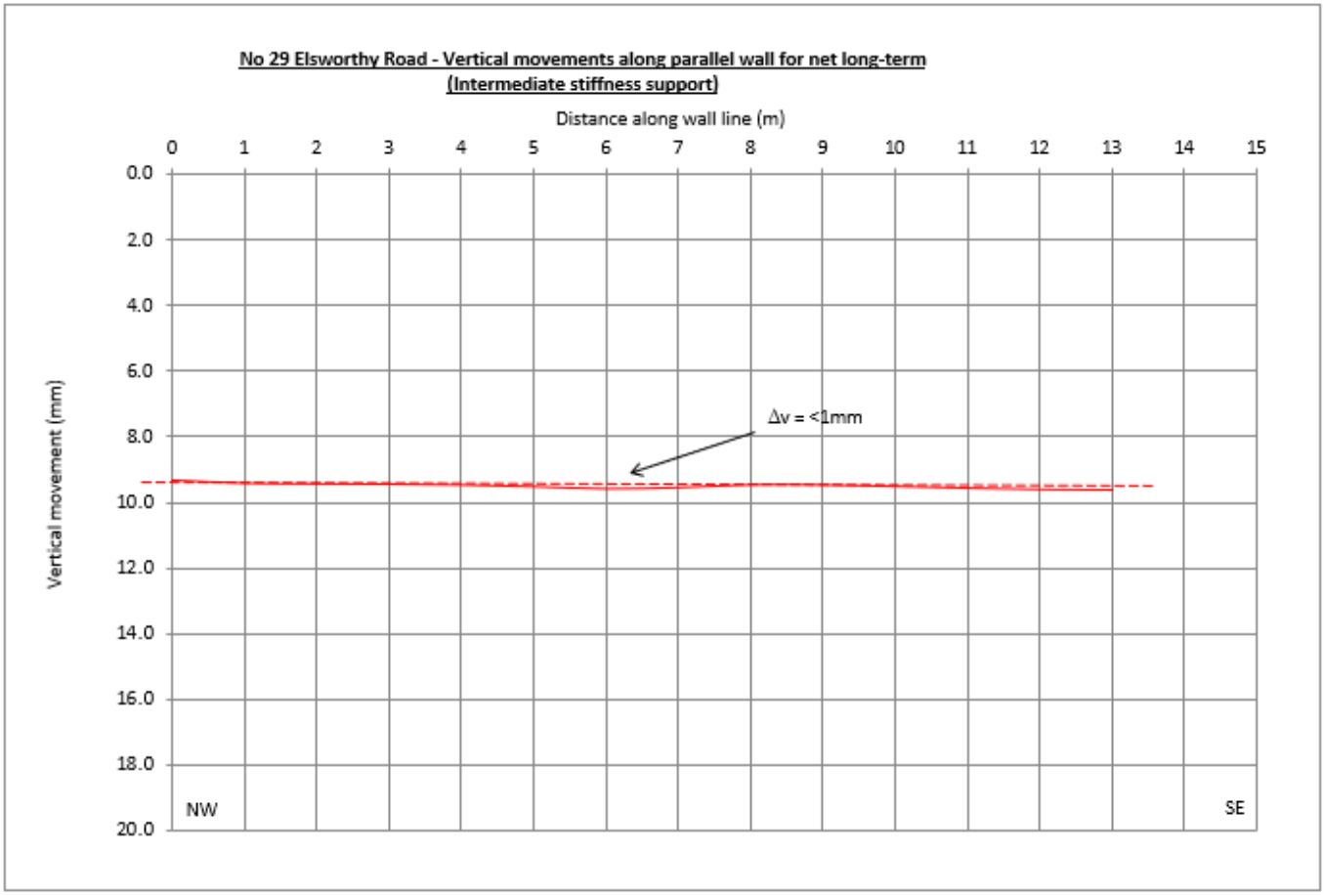
	Parallel wall - vertical movement at end of construction Intermediate			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	5.0	1.9	9.0	15.9
1.0	5.0	2.0	9.0	16.0
2.0	5.0	2.1	9.0	16.1
3.0	5.0	2.0	9.0	16.0
4.0	5.0	2.0	9.0	16.0
5.0	5.0	1.9	9.0	15.9
6.0	5.0	1.7	9.0	15.7
7.0	5.0	1.4	9.0	15.4
8.0	5.0	1.1	9.0	15.1
9.0	5.0	1.0	9.0	15.0
10.0	5.0	0.9	9.0	14.9
11.0	5.0	0.9	9.0	14.9
12.0	5.0	0.9	9.0	14.9
13.0	5.0	0.8	9.0	14.8

FIGURE 11

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 29 Elsworthy Road parallel wall (Intermediate stiffness)

Long term



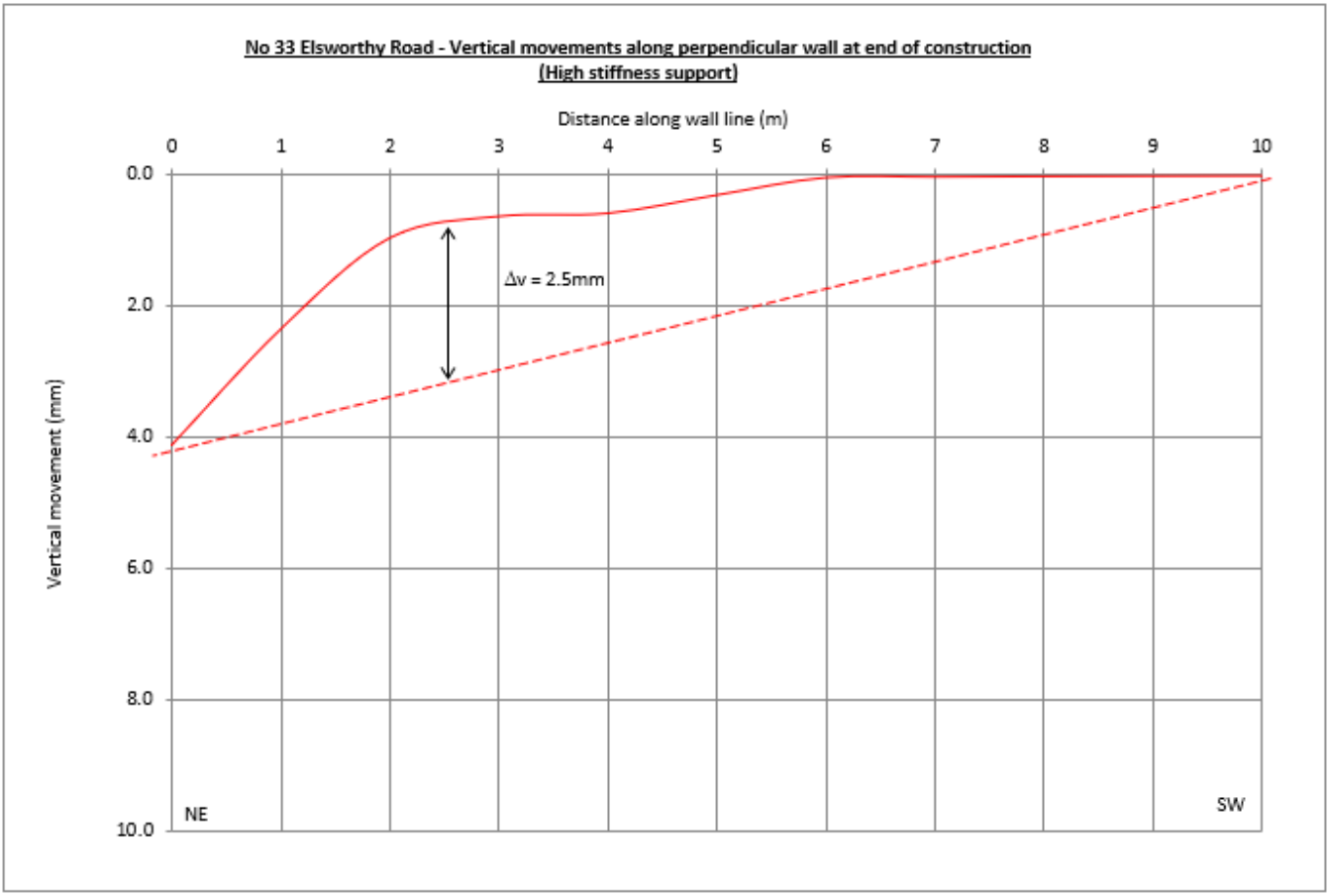
	Parallel wall - vertical movement long-term Intermediate		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	2.5	-6.6	9.3
1.0	2.7	-6.6	9.4
2.0	2.7	-6.6	9.4
3.0	2.7	-6.6	9.4
4.0	2.6	-6.5	9.4
5.0	2.5	-6.4	9.5
6.0	2.2	-6.1	9.6
7.0	1.8	-5.9	9.5
8.0	1.4	-5.7	9.4
9.0	1.3	-5.5	9.4
10.0	1.2	-5.4	9.5
11.0	1.2	-5.3	9.5
12.0	1.1	-5.3	9.6
13.0	1.1	-5.2	9.6

(Note: total long term net movement is determined using the end of construction movement and the post construction movements)

FIGURE 12

Settlement profile – No 33 Elsworthy Road perpendicular wall (High stiffness)

End of construction

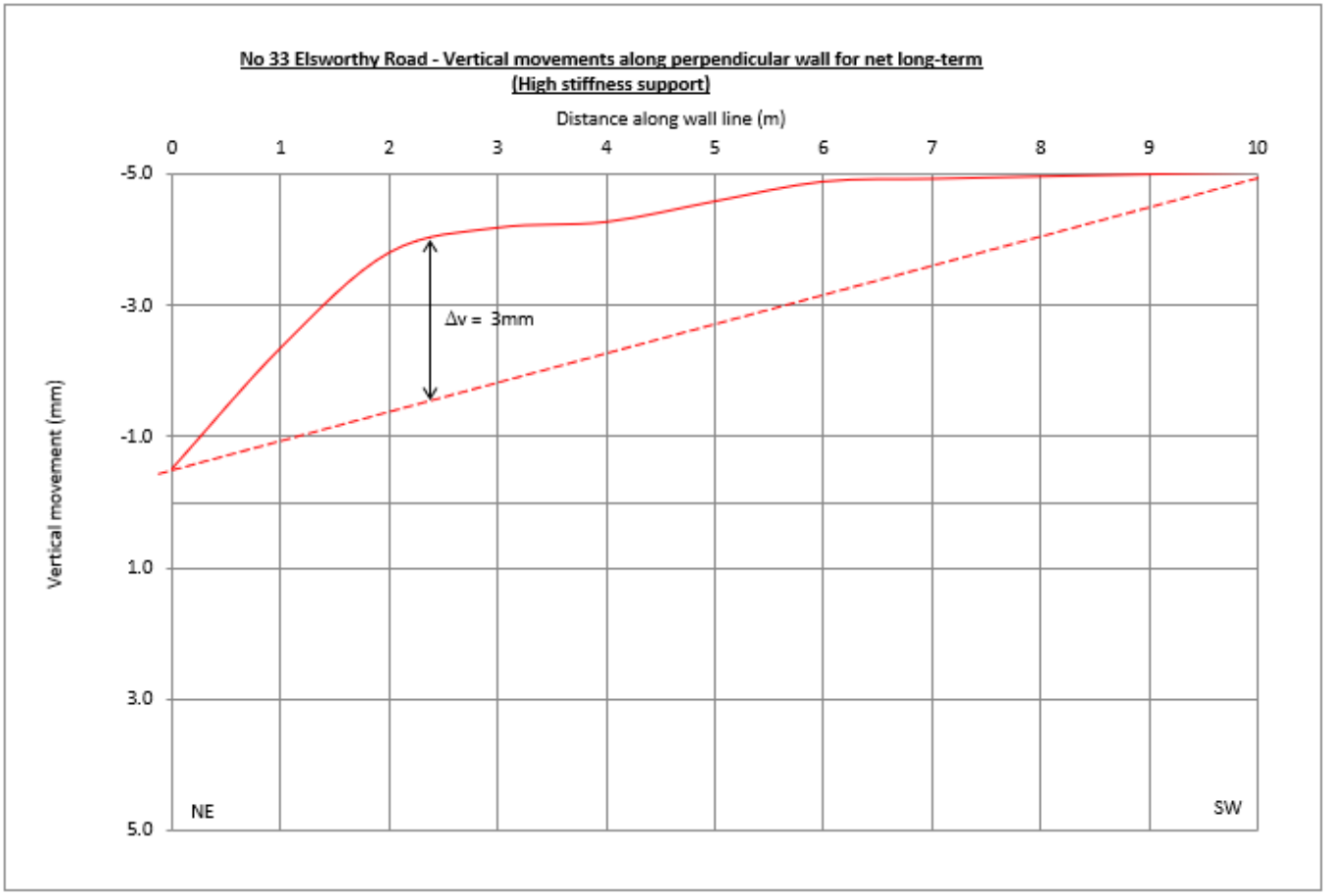


	Perpendicular wall - vertical movement at end of construction HIGH			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	2.0	0.6	1.5	4.1
1.0	1.0	0.4	1.0	2.4
2.0	0.0	0.2	0.8	1.0
3.0	0.0	0.1	0.5	0.6
4.0	0.0	0.1	0.5	0.6
5.0	0.0	0.1	0.3	0.3
6.0	0.0	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0
8.0	0.0	0.0	0.0	0.0
9.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	0.0	0.0

FIGURE 13

Settlement profile – No 33 Elsworthy Road perpendicular wall (High stiffness)

Long term



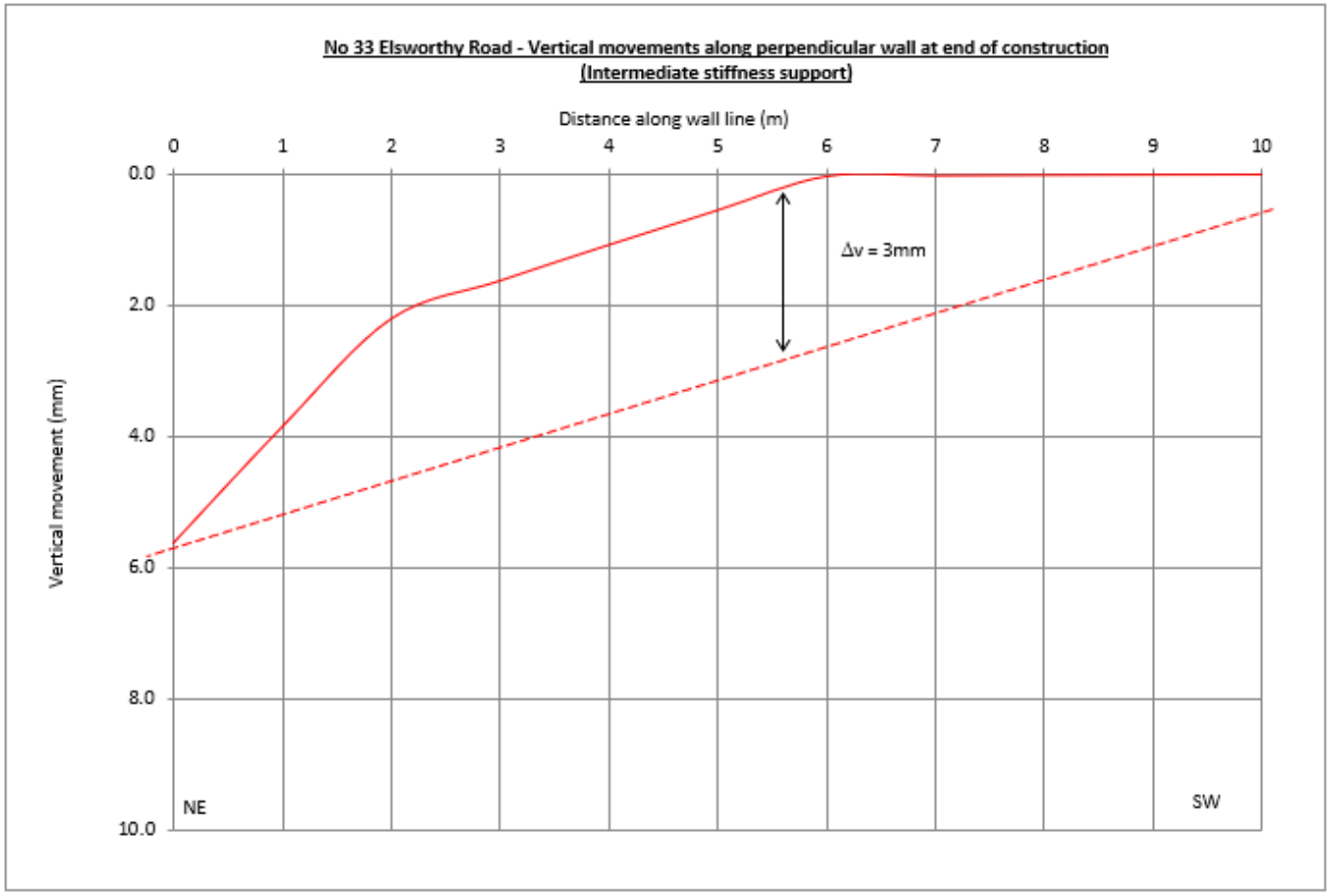
	Perpendicular wall - vertical movement long-term HIGH		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	0.8	-4.7	-0.5
1.0	0.5	-4.7	-2.4
2.0	0.3	-4.8	-3.8
3.0	0.2	-4.8	-4.2
4.0	0.1	-4.9	-4.3
5.0	0.1	-4.9	-4.6
6.0	0.1	-4.9	-4.9
7.0	0.0	-5.0	-4.9
8.0	0.0	-5.0	-5.0
9.0	0.0	-5.0	-5.0
10.0	0.0	-5.0	-5.0

(Note: total long term net is determined using the end of construction movement and the post construction movements)

FIGURE 14

Settlement profile – No 33 Elsworthy Road perpendicular wall (Intermediate stiffness)

End of construction

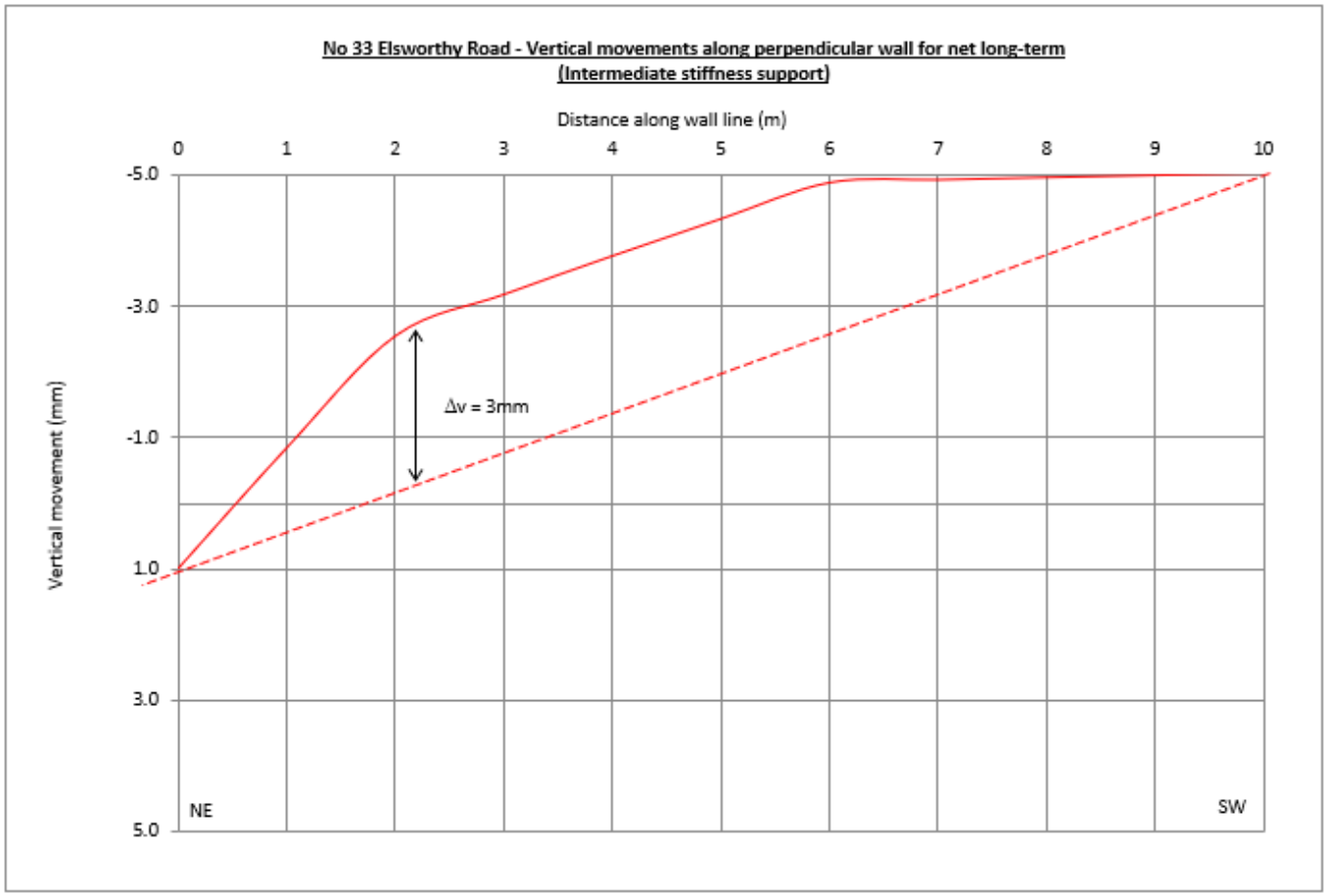


	Perpendicular wall - vertical movement at end of construction INTERMEDIATE			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	2.0	0.6	3.0	5.6
1.0	1.0	0.4	2.5	3.9
2.0	0.0	0.2	2.0	2.2
3.0	0.0	0.1	1.5	1.6
4.0	0.0	0.1	1.0	1.1
5.0	0.0	0.1	0.5	0.6
6.0	0.0	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0
8.0	0.0	0.0	0.0	0.0
9.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	0.0	0.0

FIGURE 15

Settlement profile – No 33 Elsworthy Road perpendicular wall (Intermediate stiffness)

Long term



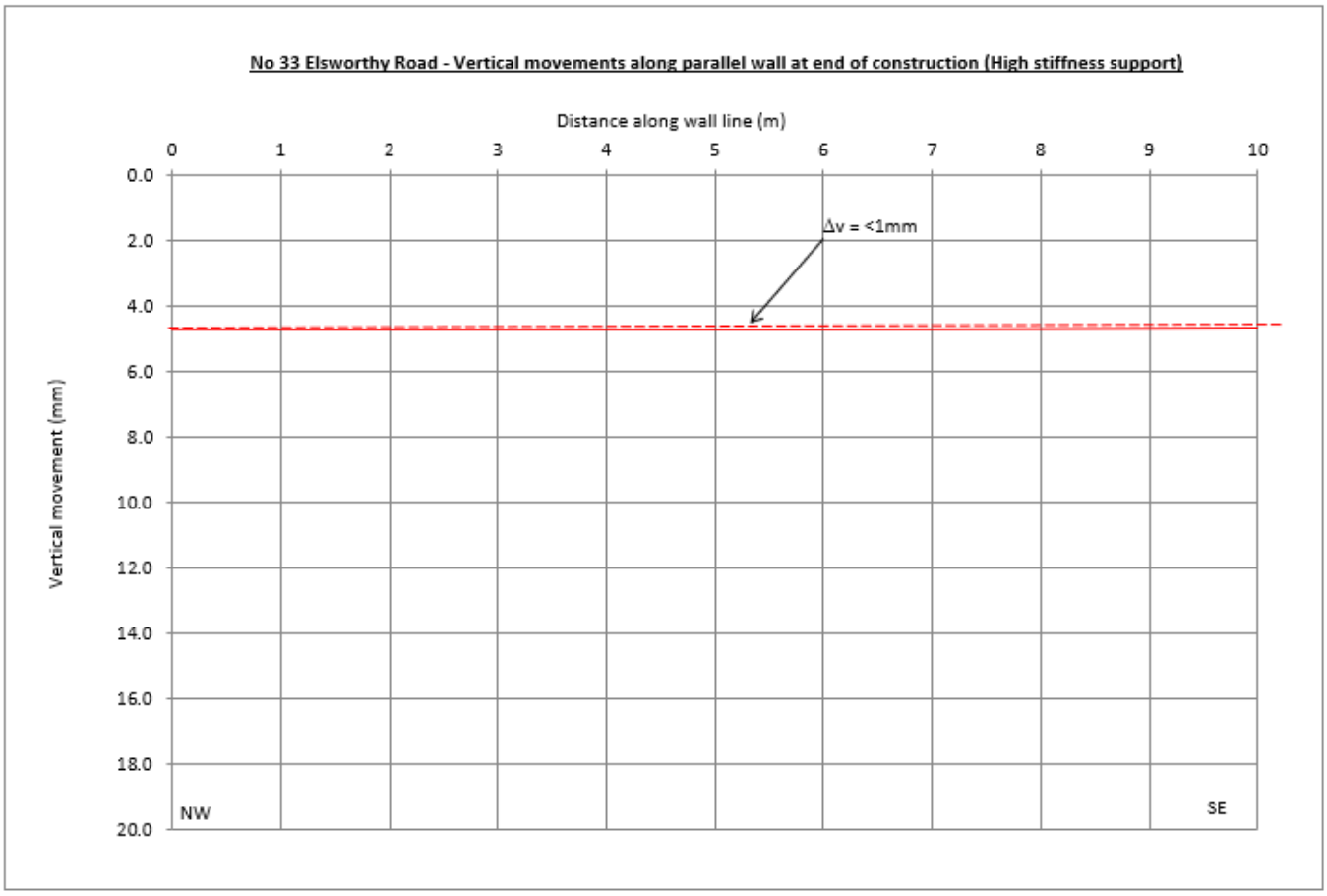
	Perpendicular wall - vertical movement long-term INT		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	0.9	-4.7	1.0
1.0	0.9	-4.7	-0.9
2.0	0.9	-4.8	-2.6
3.0	0.9	-4.8	-3.2
4.0	0.9	-4.9	-3.8
5.0	0.9	-4.9	-4.3
6.0	0.9	-4.9	-4.9
7.0	0.9	-5.0	-4.9
8.0	0.9	-5.0	-5.0
9.0	0.9	-5.0	-5.0
10.0	0.8	-5.0	-5.0

(Note: total long term net movement is determined using the end of construction movement and the post construction movements)

FIGURE 16

Settlement profile – No 33 Elsworthy Road parallel wall (High stiffness)

End of construction



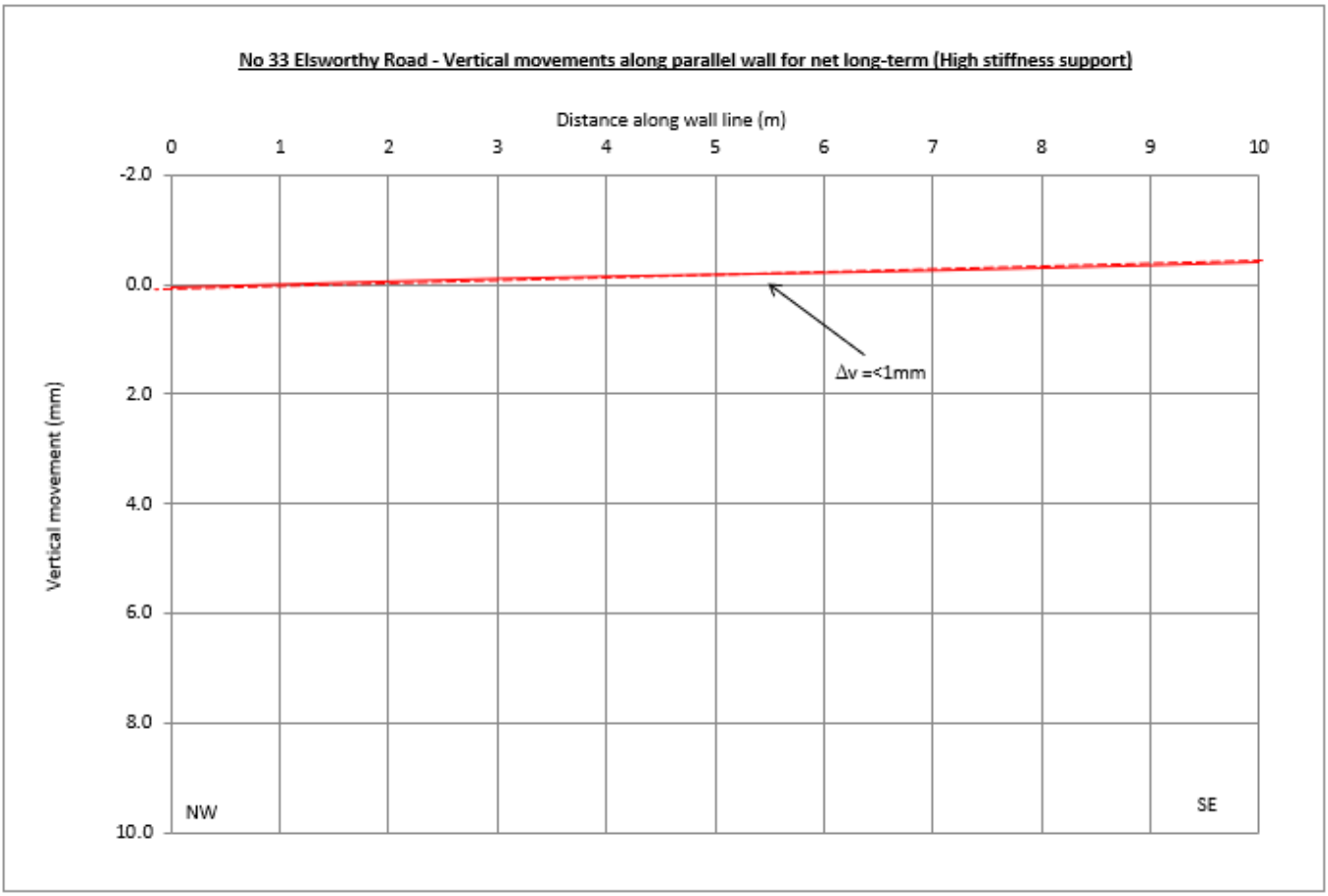
	parallel wall - vertical movement at end of construction HIGH			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	2.0	0.7	2.0	4.7
1.0	2.0	0.7	2.0	4.7
2.0	2.0	0.7	2.0	4.7
3.0	2.0	0.7	2.0	4.7
4.0	2.0	0.7	2.0	4.7
5.0	2.0	0.7	2.0	4.7
6.0	2.0	0.7	2.0	4.7
7.0	2.0	0.7	2.0	4.7
8.0	2.0	0.7	2.0	4.7
9.0	2.0	0.7	2.0	4.7
10.0	2.0	0.6	2.0	4.6

FIGURE 17

Site & Location	31 Elsworthy Road London SW10 9SJ	Report No: 10588A/JRCB

Settlement profile – No 33 Elsworthy Road parallel wall (High stiffness)

Long term



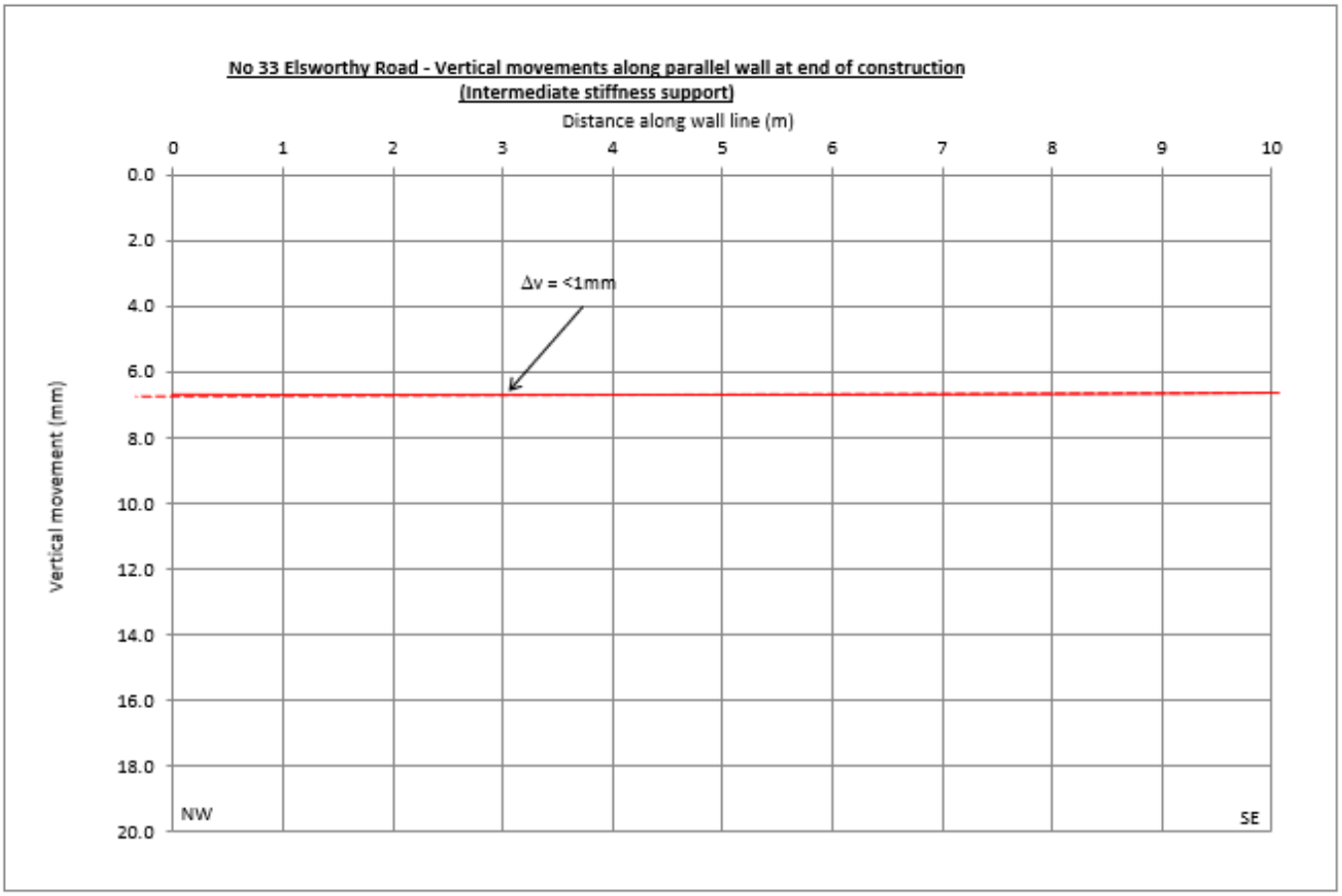
	parallel wall - vertical movement long-term HIGH		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	0.9	-4.7	0.0
1.0	0.9	-4.7	0.0
2.0	0.9	-4.8	-0.1
3.0	0.9	-4.8	-0.1
4.0	0.9	-4.9	-0.2
5.0	0.9	-4.9	-0.2
6.0	0.9	-4.9	-0.2
7.0	0.9	-5.0	-0.3
8.0	0.9	-5.0	-0.3
9.0	0.9	-5.0	-0.4
10.0	0.8	-5.0	-0.4

(Note: total long term net is determined using the end of construction movement and the post construction movements)

FIGURE 18

Settlement profile – No 33 Elsworthy Road parallel wall (Intermediate stiffness)

End of construction

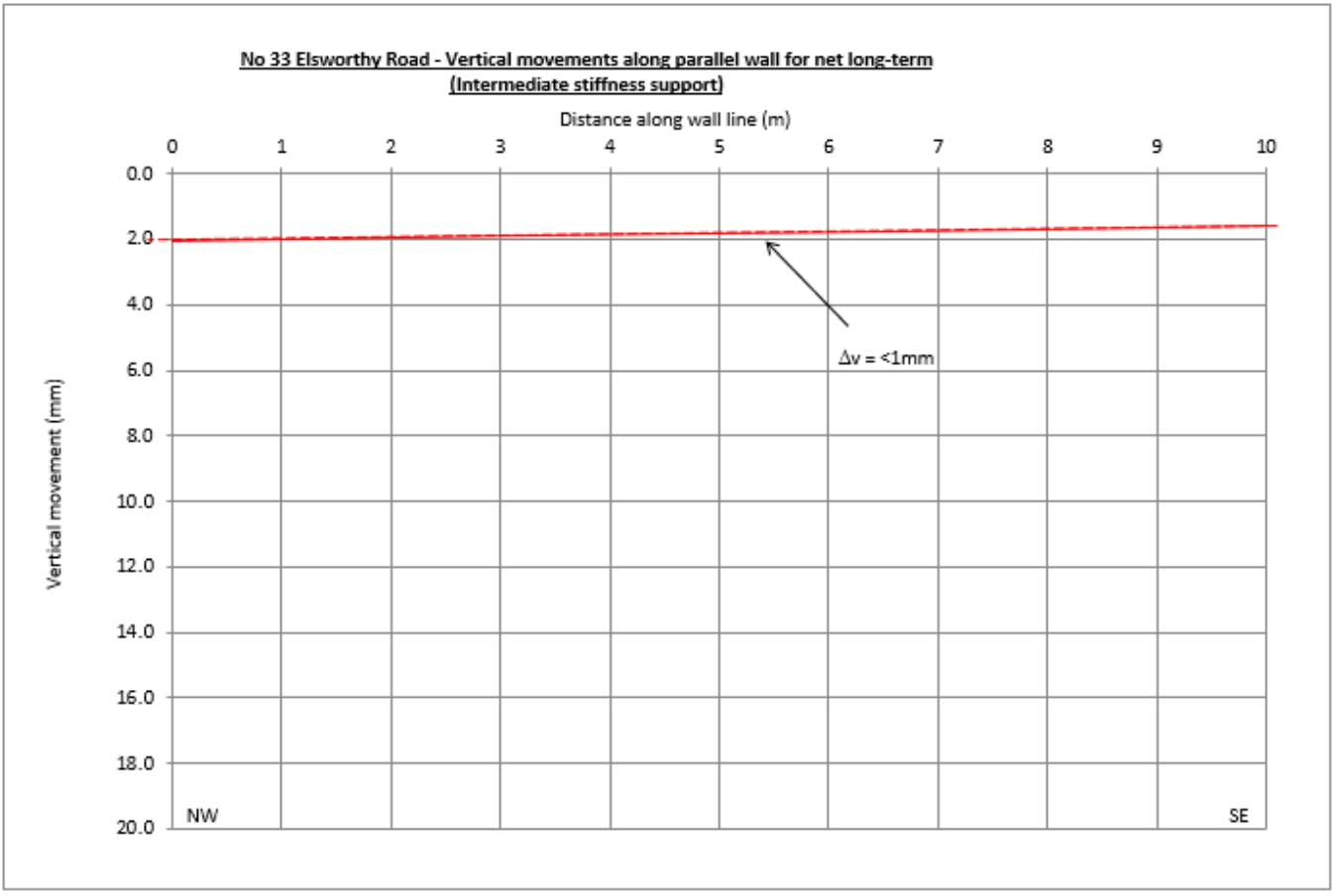


	Parallel wall - vertical movement at end of construction Intermediate			
Distance along wall line (m)	Installation Estimated from CIRIA chart	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Settlement (excavation) Settlement due to basement excavation - estimated from CIRIA chart	Net vertical movement at end of construction (mm)
0.0	2.0	0.7	4.0	6.7
1.0	2.0	0.7	4.0	6.7
2.0	2.0	0.7	4.0	6.7
3.0	2.0	0.7	4.0	6.7
4.0	2.0	0.7	4.0	6.7
5.0	2.0	0.7	4.0	6.7
6.0	2.0	0.7	4.0	6.7
7.0	2.0	0.7	4.0	6.7
8.0	2.0	0.7	4.0	6.7
9.0	2.0	0.7	4.0	6.7
10.0	2.0	0.6	4.0	6.6

FIGURE 19

Settlement profile – No 33 Elsworthy Road parallel wall (Intermediate stiffness)

Long term



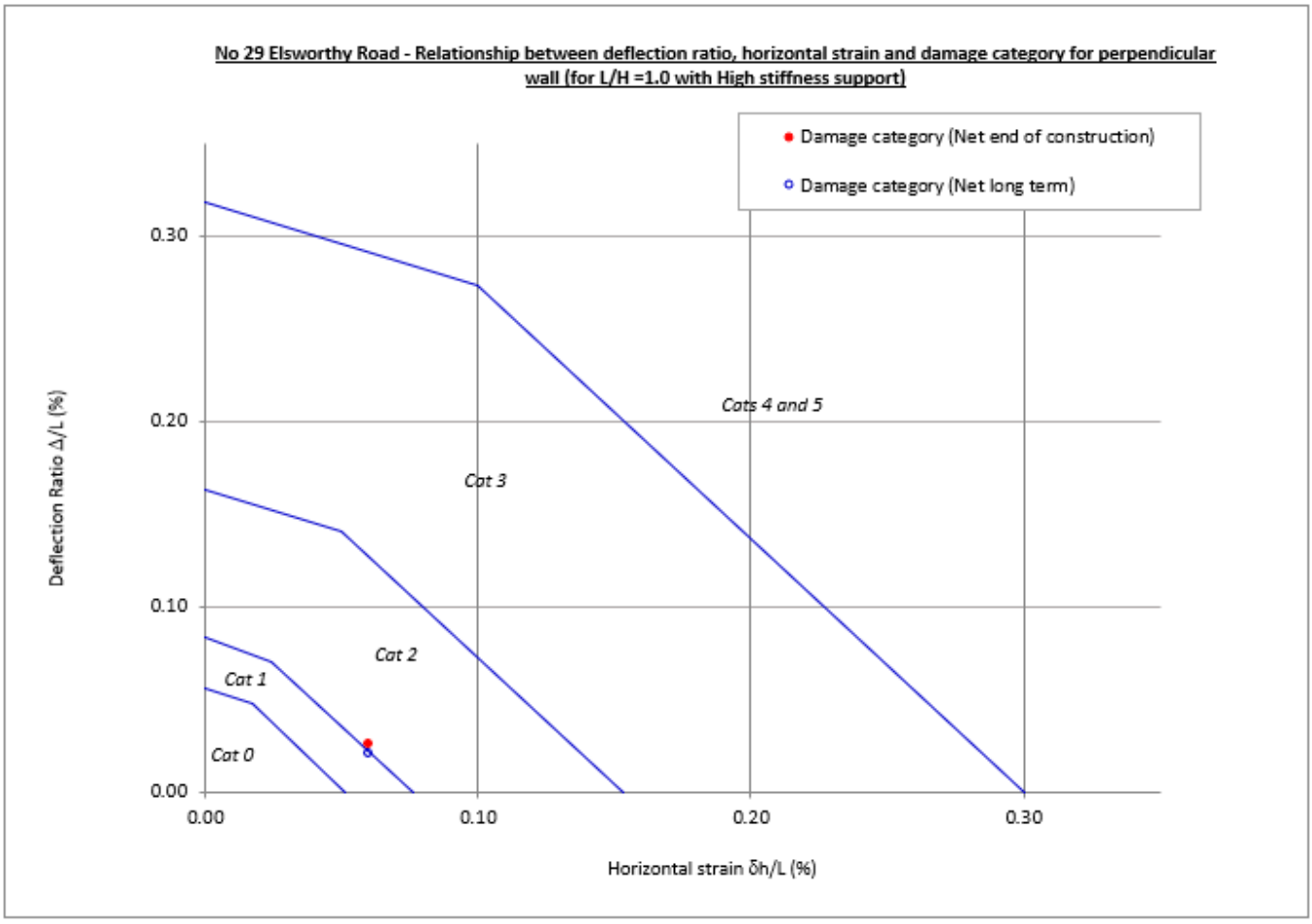
	Parallel wall - vertical movement long-term Intermediate		
Distance along wall line (m)	Settlement (loading) Due to foundations - from Bouss spreadsheet (mm)	Heave (unloading) Post-construction heave - from Bouss spreadsheet (mm)	Net total movement long-term (mm)
0.0	0.9	-4.7	2.0
1.0	0.9	-4.7	2.0
2.0	0.9	-4.8	1.9
3.0	0.9	-4.8	1.9
4.0	0.9	-4.9	1.8
5.0	0.9	-4.9	1.8
6.0	0.9	-4.9	1.8
7.0	0.9	-5.0	1.7
8.0	0.9	-5.0	1.7
9.0	0.9	-5.0	1.6
10.0	0.8	-5.0	1.6

(Note: total long term net movement is determined using the end of construction movement and the post construction movements)

FIGURE 20

Damage category assessment – No 29 Elsworthy Road perpendicular wall

High stiffness

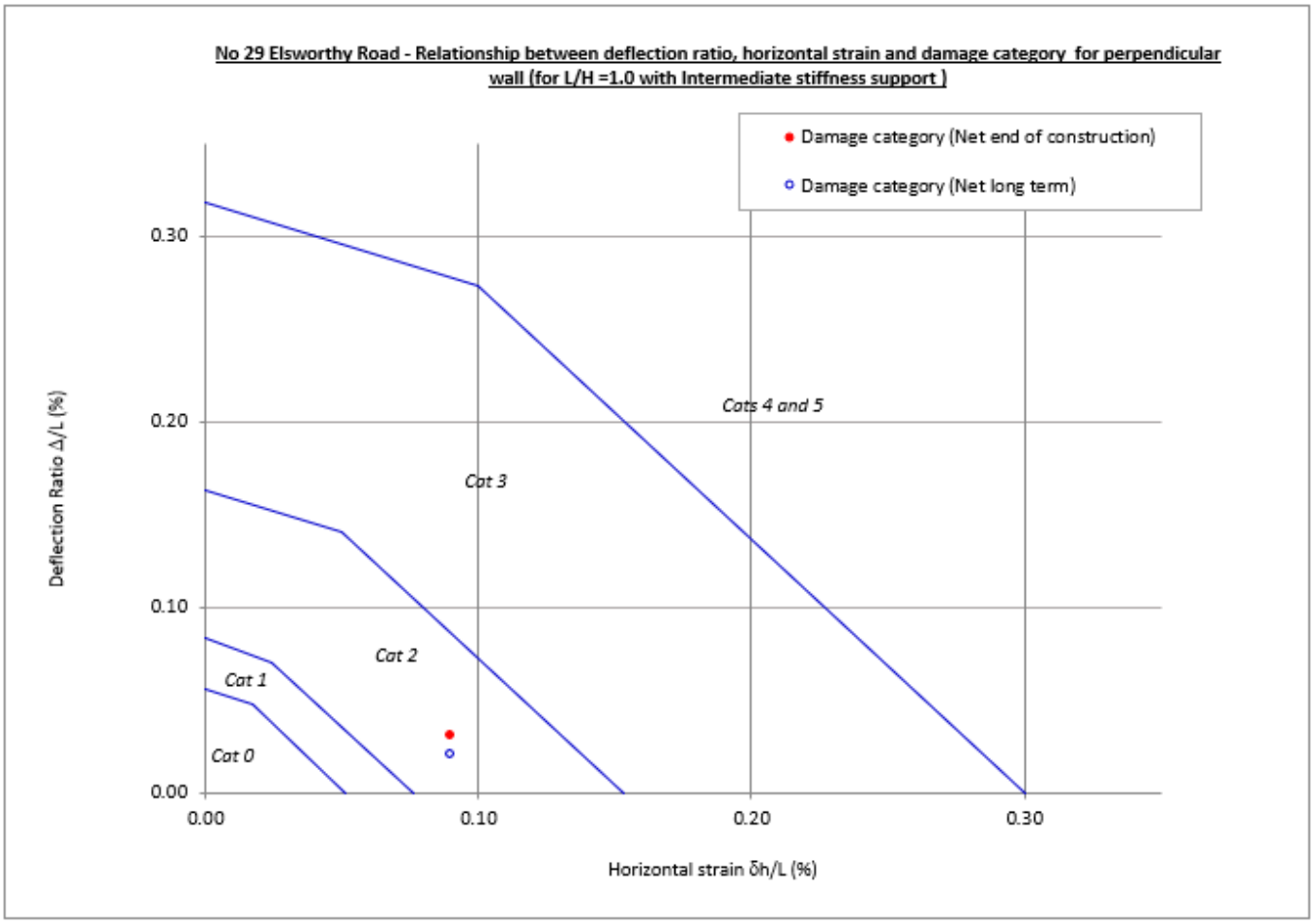


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	2.5	10.00	0.025
δh =	6.0	10.00	0.060
Long term			
Δv =	2.0	10.00	0.020
δh =	6.0	10.00	0.060

FIGURE 21

Damage category assessment – No 29 Elsworthy Road perpendicular wall

Intermediate stiffness

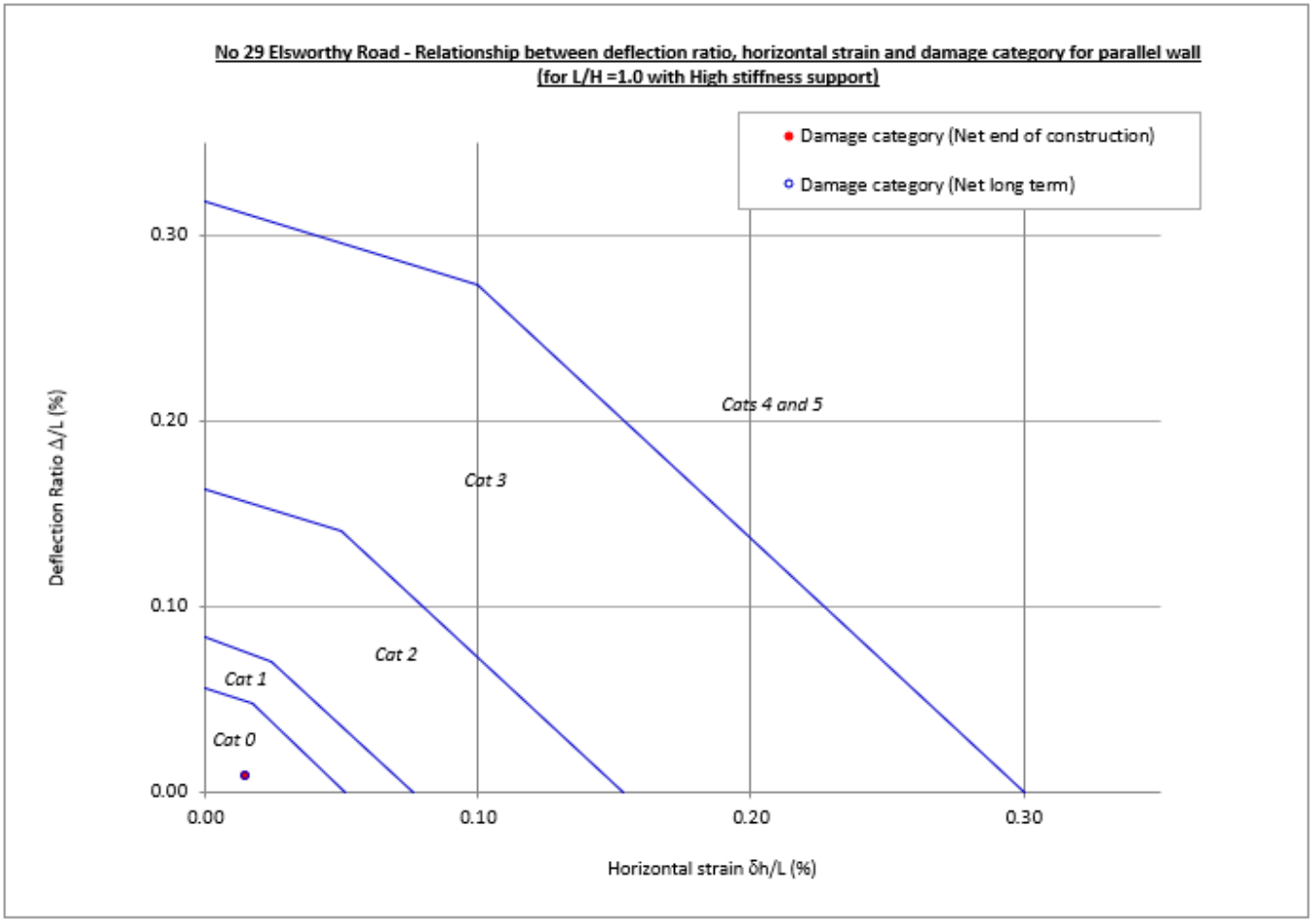


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	3.0	10.00	0.030
δh =	9.0	10.00	0.090
Long term			
Δv =	2.0	10.00	0.020
δh =	9.0	10.00	0.090

FIGURE 22

Damage category assessment – No 29 Elsworthy Road parallel wall

High stiffness

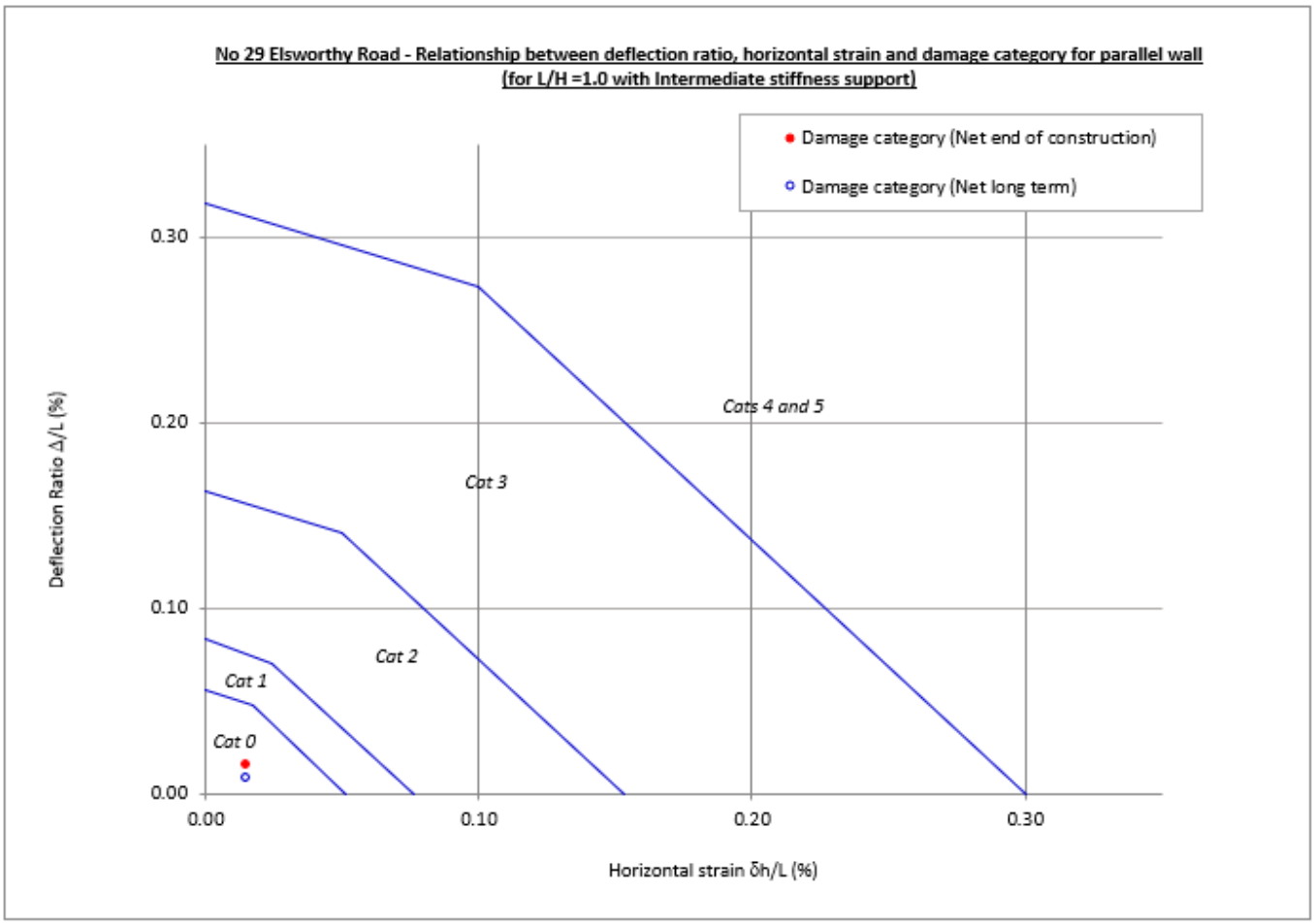


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	1.0	13.00	0.008
δh =	2.0	13.00	0.015
Long term			
Δv =	1.0	13.00	0.008
δh =	2.0	13.00	0.015

FIGURE 23

Damage category assessment – No 29 Elsworthy Road parallel wall

Intermediate stiffness

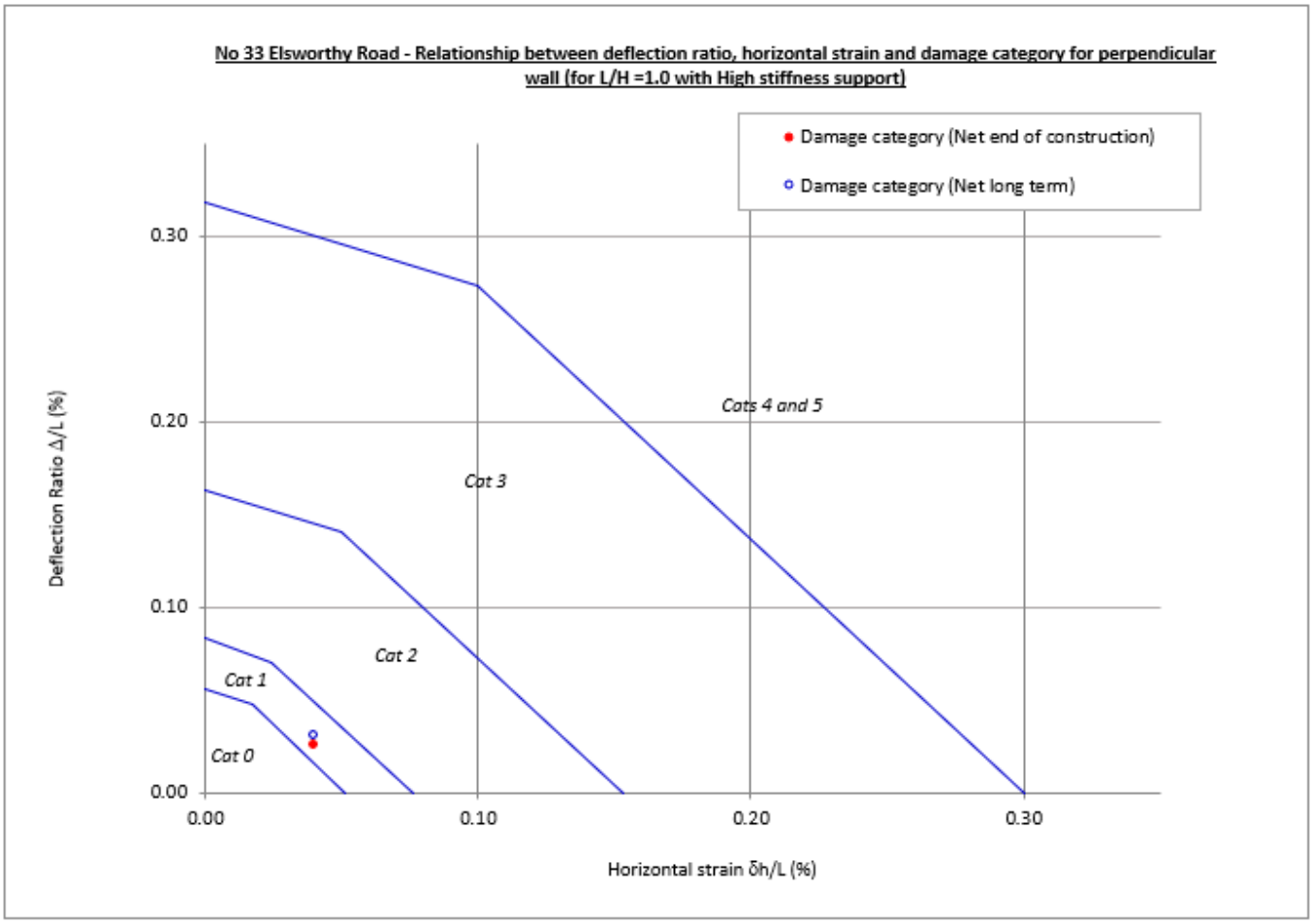


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	2.0	13.00	0.015
δh =	2.0	13.00	0.015
Long term			
Δv =	1.0	13.00	0.008
δh =	2.0	13.00	0.015

FIGURE 24

Damage category assessment – No 33 Elsworthy Road perpendicular wall

High stiffness

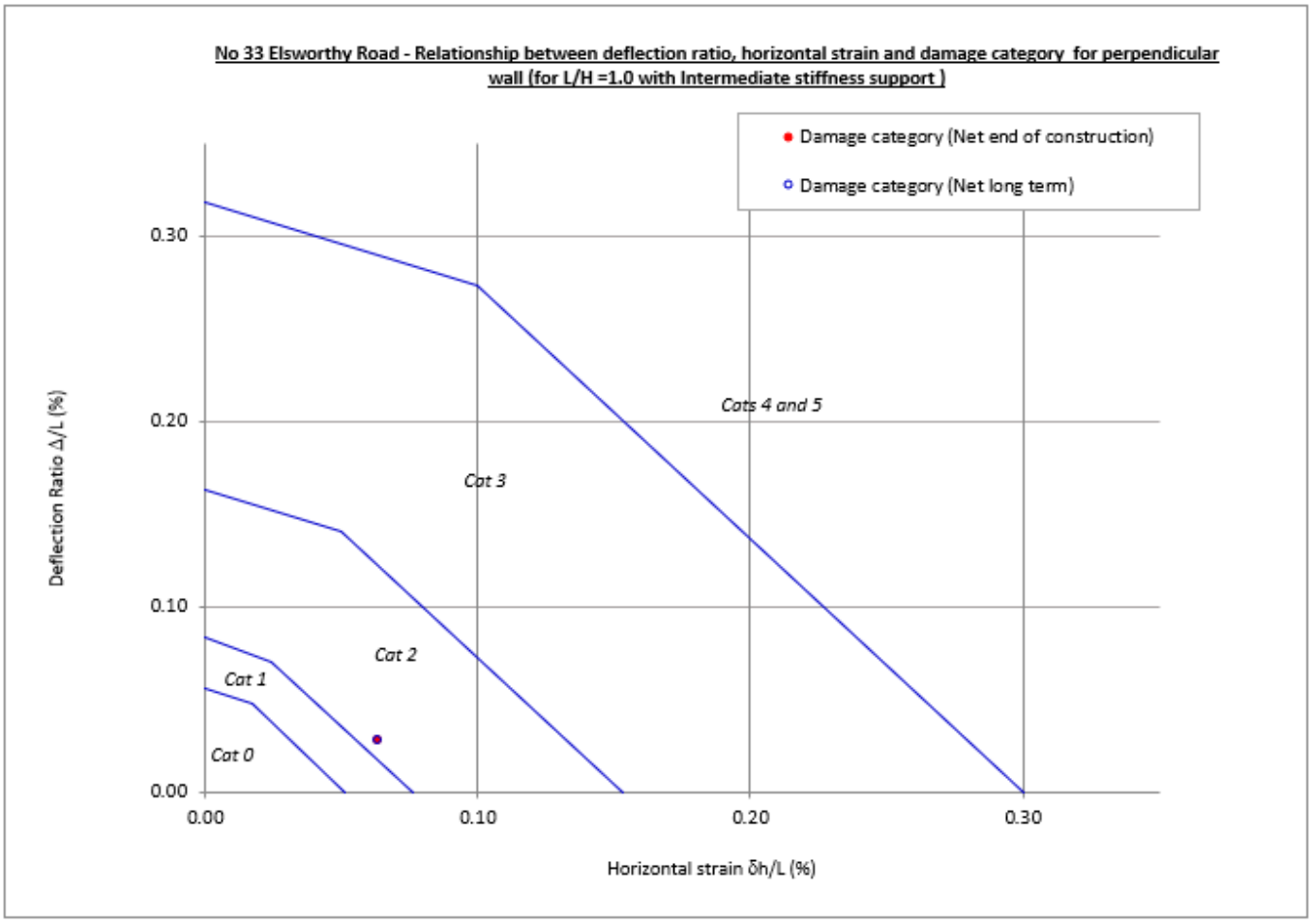


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	2.5	10.00	0.025
δh =	4.0	10.00	0.040
Long term			
Δv =	3.0	10.00	0.030
δh =	4.0	10.00	0.040

FIGURE 25

Damage category assessment – No 33 Elsworthy Road perpendicular wall

Intermediate stiffness

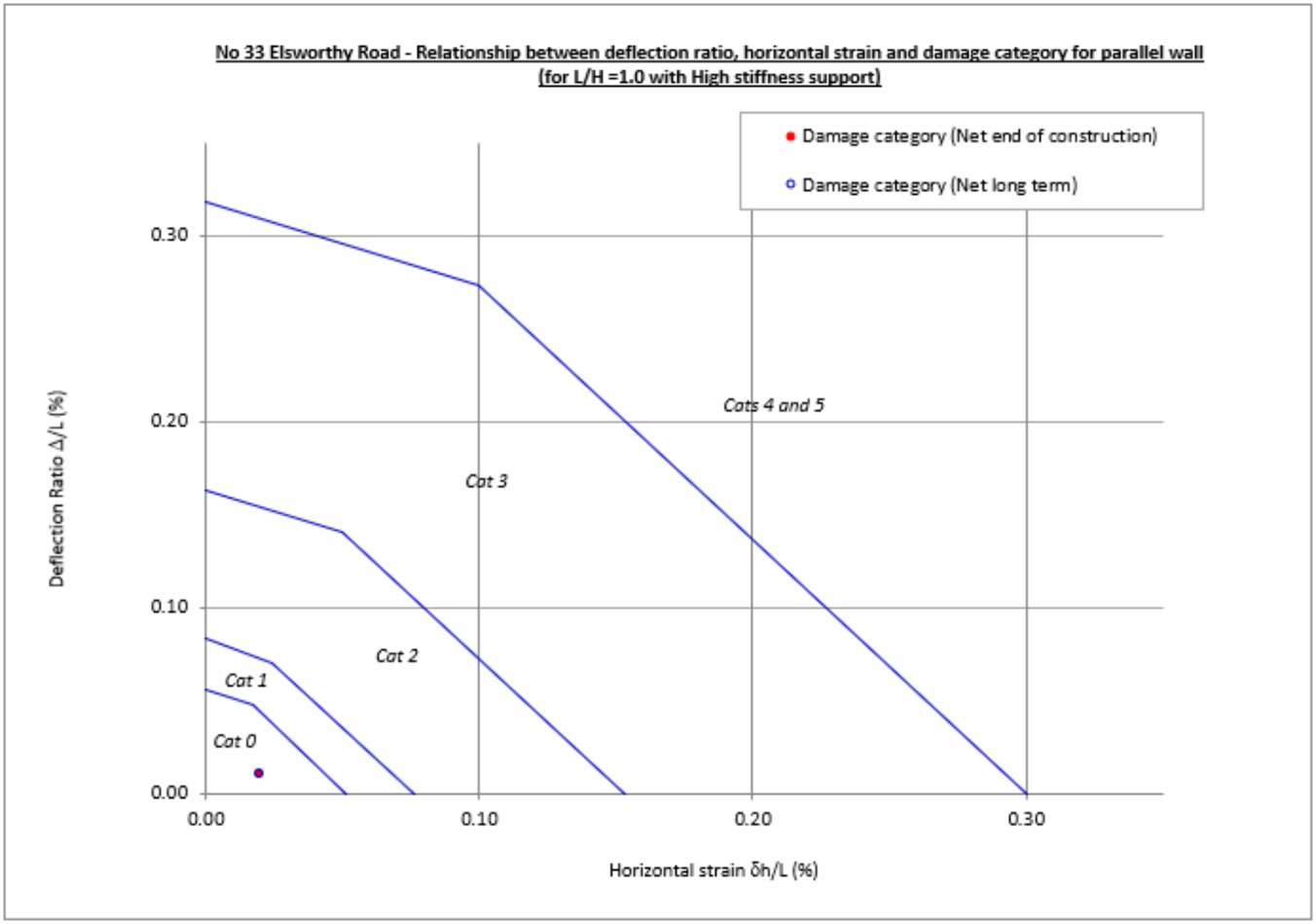


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	3.0	11.00	0.027
δh =	7.0	11.00	0.064
Long term			
Δv =	3.0	11.00	0.027
δh =	7.0	11.00	0.064

FIGURE 26

Damage category assessment – No 33 Elsworthy Road parallel wall

High stiffness

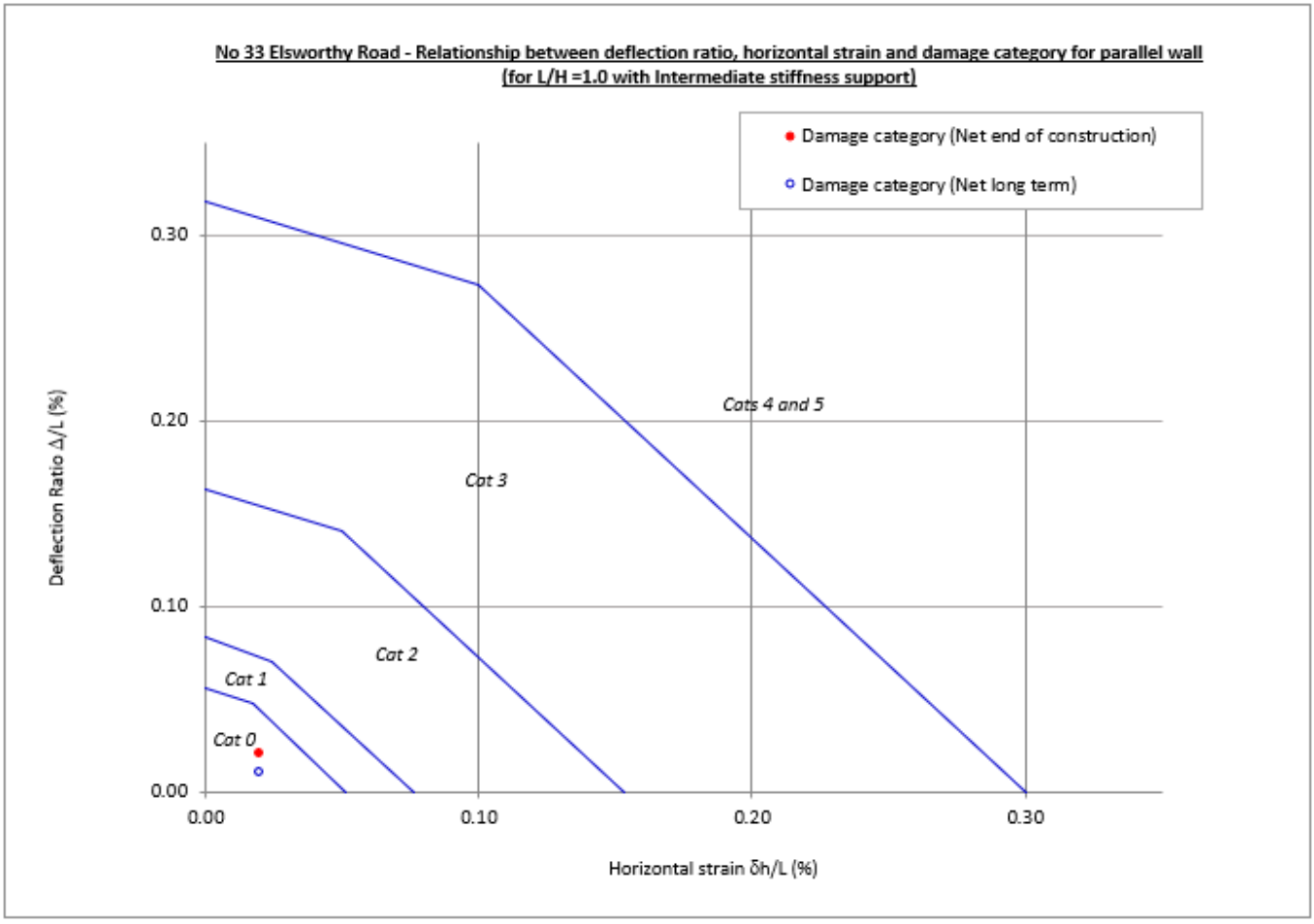


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	1.0	10.00	0.010
δh =	2.0	10.00	0.020
Long term			
Δv =	1.0	10.00	0.010
δh =	2.0	10.00	0.020

FIGURE 27

Damage category assessment – No 33 Elsworthy Road parallel wall

Intermediate stiffness

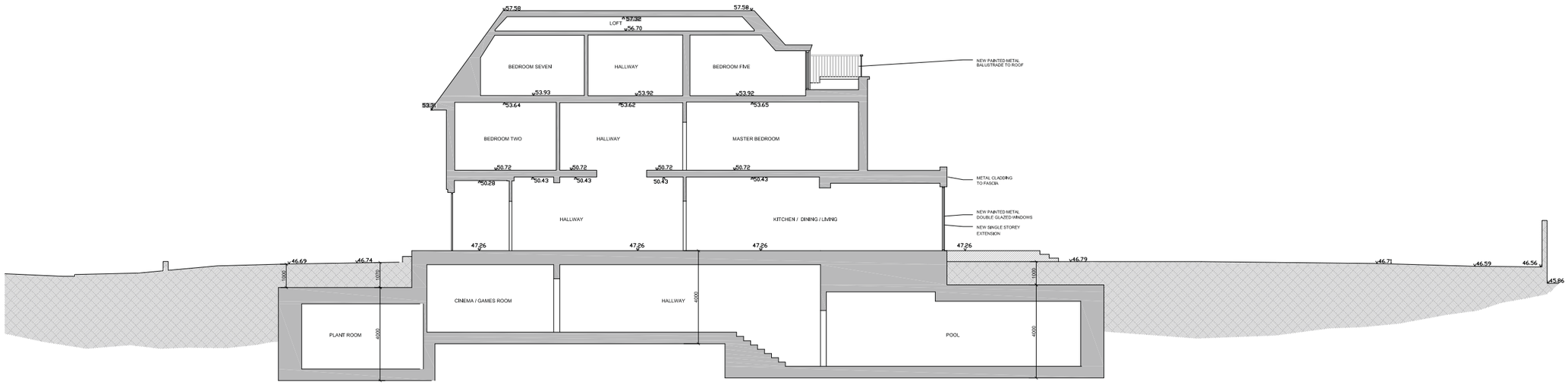


Vertical/horizontal movement (mm)		Wall length (m)	DR/HS
End of construction			
Δv =	2.0	10.00	0.020
δh =	2.0	10.00	0.020
Long term			
Δv =	1.0	10.00	0.010
δh =	2.0	10.00	0.020

FIGURE 28

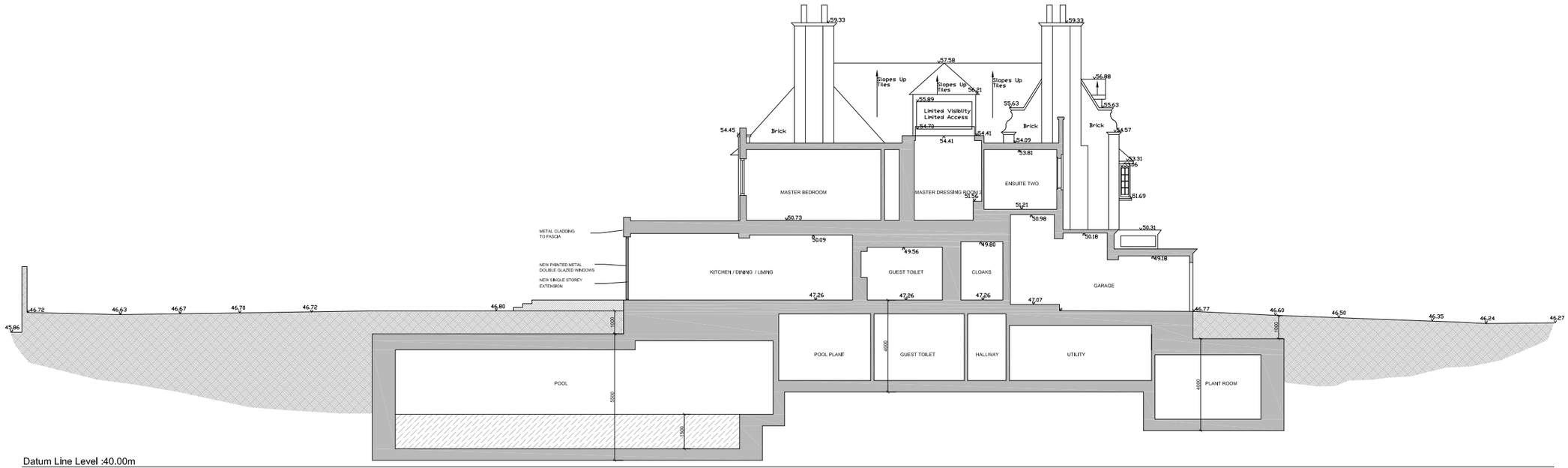
Note

This drawing is not to be scaled. Use figured dimensions only. All dimensions are to be checked on site and any discrepancies, errors or omissions are to be reported to the architect prior to commencement of works.



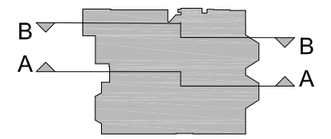
Datum Line Level :40.00m

PROPOSED SECTION AA



Datum Line Level :40.00m

PROPOSED SECTION BB



SCHEME DESIGN SUBJECT TO STRUCTURAL ENGINEER /SERVICES ENGINEER, & PLANNERS COMMENT

FOR PLANNING

*	dd/mm/yy	Description	By
		Description	
A	21.03.05	Plant room height updated	ISP

BB PARTNERSHIP LTD

CHARTERED ARCHITECTS

Studios 33-34, 10 Hornsey St, London, N7 8EL
Tel 020 7336 8555 - e-mail - architect@bbpartnership.co.uk

client
Elsworthy Road (Investments) Ltd

project
31 Elsworthy Road
London
NW3 3BT

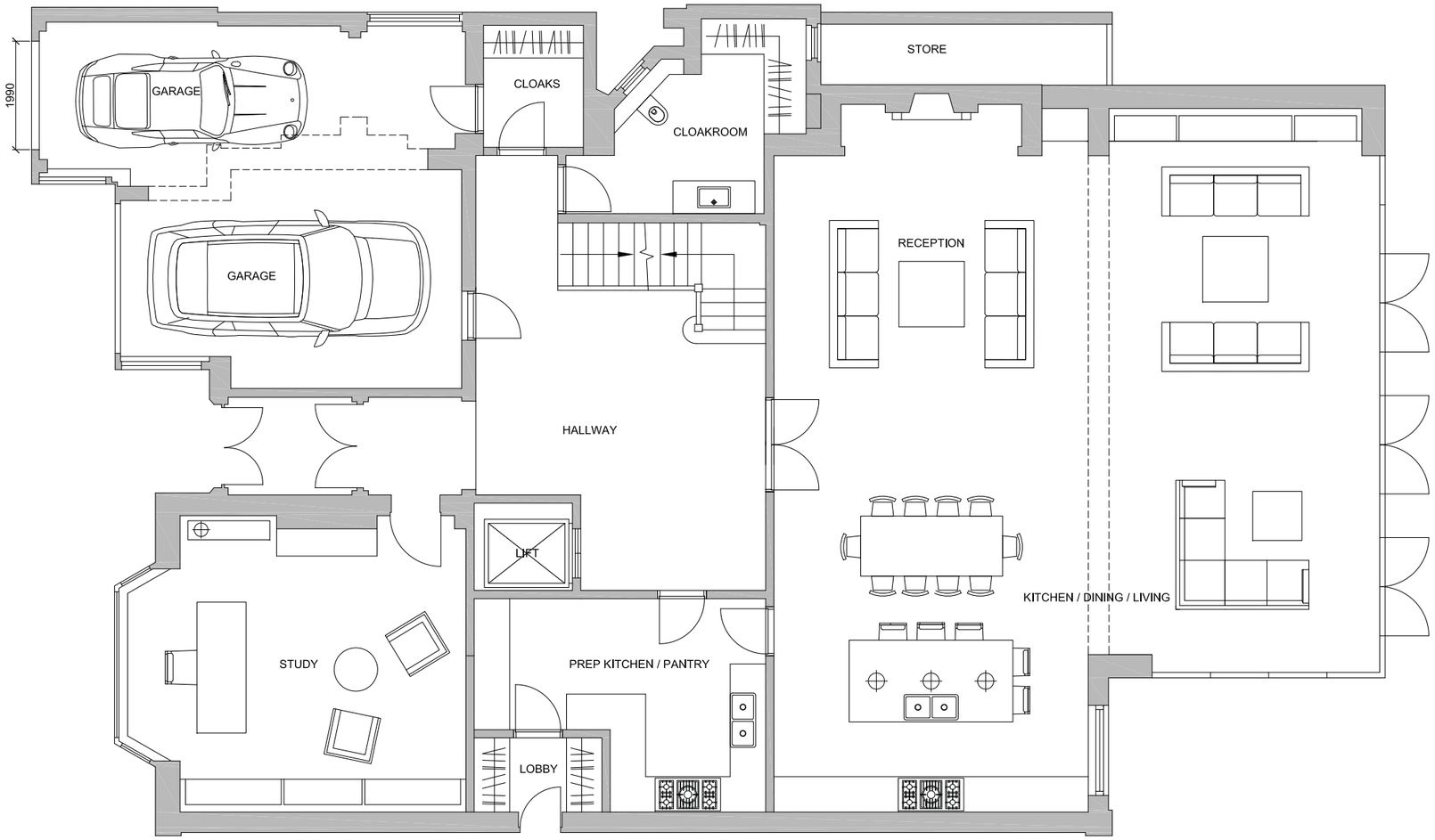
drawing
Proposed Section AA and Section BB

date	scale	drawn by
08/12/20	1:100 at A1	BC

drg.no.	revision
GEO_215	A

Note

This drawing is not to be scaled. Use figured dimensions only. All dimensions are to be checked on site and any discrepancies, errors or omissions are to be reported to the architect prior to commencement of works.



PROPOSED GROUND FLOORPLAN

0m 1m 2m 3m 4m 5m

1:50 scale

N

SCHEME DESIGN SUBJECT TO STRUCTURAL ENGINEER /SERVICES ENGINEER, & PLANNERS COMMENT

FOR PLANNING

*	dd/mm/yy	Description Description	By

BB PARTNERSHIP LTD

CHARTERED ARCHITECTS

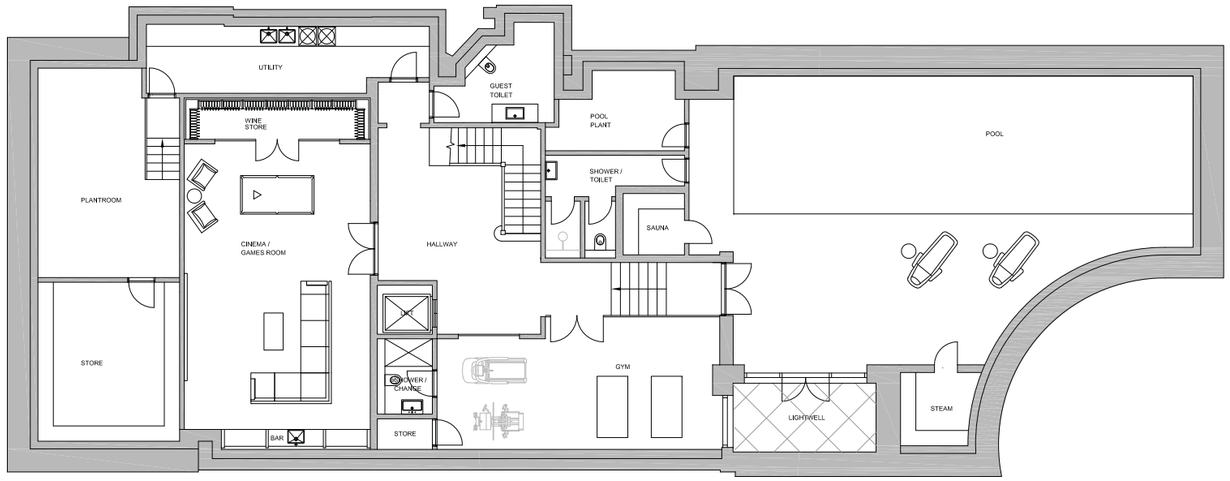
Studios 33-34, 10 Hornsey St, London. N7 8EL

Tel 020 7336 8555 - e-mail - architect@bbpartnership.co.uk

client Client		
project 31 Elsworthy Road London NW3 3BT		
drawing Proposed Ground Floor Plan		
date JAN 2021	scale 1:50 at A1	drawn by BC
drg.no. GEO_202		revision -

Note

This drawing is not to be scaled. Use figured dimensions only. All dimensions are to be checked on site and any discrepancies, errors or omissions are to be reported to the architect prior to commencement of works.



PROPOSED BASEMENT

0m 2m 4m 6m 8m 10m

1:100 scale

N

SCHEME DESIGN SUBJECT TO STRUCTURAL ENGINEER /SERVICES ENGINEER, & PLANNERS COMMENT

FOR PLANNING

*	dd/mm/yy	Description Description	By
A	01.02.21	Basement layout updated	SP

BB PARTNERSHIP LTD
CHARTERED ARCHITECTS
Studios 33-34, 10 Hornsey St, London. N7 8EL
Tel 020 7336 8555 - e-mail - architect@bbpartnership.co.uk

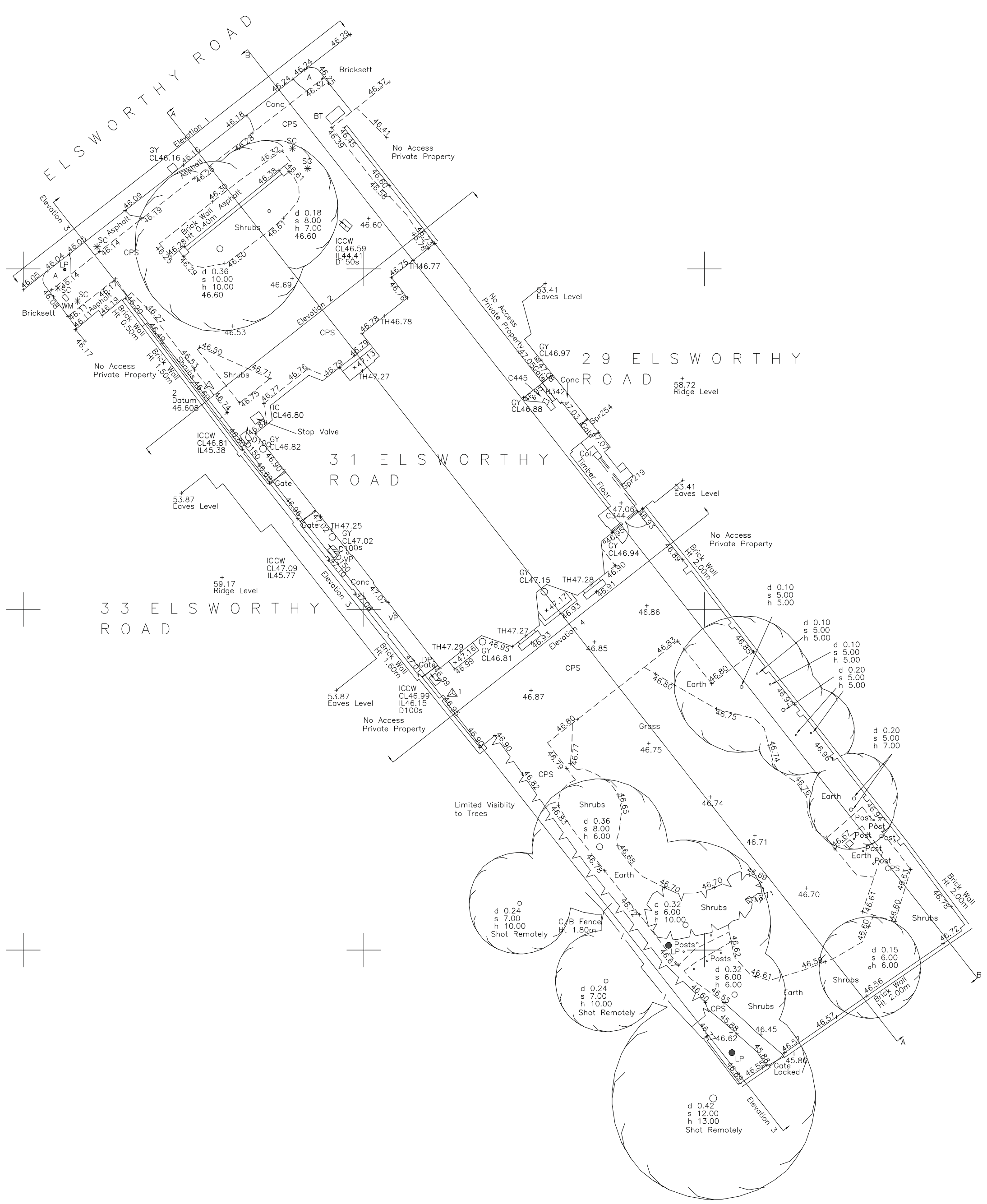
client
Client

project
31 Elsworthy Road
London
NW3 3BT

drawing
Proposed Basement

date	scale	drawn by
Jan 2021	1:100 at A1	BC

drg.no.	revision
GEO_201	A



N

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TEL 01277 821555 email: london@lasersurveys.com

DATUM NOTES

GRID ORIGIN IS BASED UPON SURVEY STATION 2 FIXED TO THE ORDNANCE SURVEY NATIONAL GRID BY LEICA SMARTNET GPS NETWORK. A SCALE FACTOR OF 1 APPLIES TO THIS DRAWING.

ie. MEASURED DISTANCES ON THE GROUND WITHOUT GPS WILL BE THE SAME AS THOSE MEASURED ON THIS DRAWING

LEVELS ARE RELATED TO :–
ORDNANCE SURVEY GPS ACTIVE NETWORK AND TRANSFORMED USING THE OSGM15 & OSTN15 MODEL

SITE BENCH MARK ESTABLISHED IS LOCATED AT :–
STATION 2

VALUE GIVEN AS 46.608m

SURVEY CONTROL STATIONS SHOWN △

ABBREVIATIONS (where applicable)

AV	Air Valve	MH	Manhole Cover
BK	Brick	MK	Marker
BL	Bollard	MS	Milestone
BS	Bus Stop	MT	Meter
BT	British Telecom	MY	Mercury
CB	Control Box	OH	Overhead
C/B	Close Boarded	PAV	Paving
CL	Cover Level	PB	Post Box
CLK	Chainlink	PE	Pipe
CO	Column	PM	Parking Meter
Conc	Concrete	P/R	Post and Rail
CP	Catch Pit	PT	Post
CPS	Concrete Paving Slabs	P/W	Post and Wire
CATV	Cable Television	RE	Rodding Eye
DC	Drainage Channel	RET	Retaining
DP	Drain Pipe	RS	Road Sign
EC	Electricity Cover	RSJ	Rolled Steel Joist
ER	Earthing Rod	SC	Stop Cock
FB	Flower Bed	SK	Soakaway
FE	Fence	SP	Signpost
FH	Fire Hydrant	ST	Silt Trap
FL	Floor Level	SV	Stop Valve
FP	Flag Pole	SVC	Security Video Camera
GP	Gate Post	TCB	Telephone Call Box
GV	Gas Valve	TK	Tank
GY, G	Gully	TL	Traffic Light
HT	Height	TP	Telegraph Pole
IC	Inspection Cover	UG	Underground
IL	Invert Level	UTF	Unable To Trace Further
IN	Interceptor	UTL	Unable To Lift
I/R	Iron Railings	VP	Vent Pipe
KO	Kerb Outlet	WL	Water Level
LB	Litter Bin	WM	Water Meter
LP	Lamp Post	WO	Wash Out

B	Floor to Beam Height in cms
C	Floor to Ceiling Height in cms
Cr.	Floor to Crown Height in cms
D	Floor to Door Head Height in cms
FC	Floor to False Ceiling Height in cms
FF	False Floor Level
H	Floor to Head Height in cms
S	Floor to Sill Height in cms
Spr.	Floor to Springer Height in cms

NOTES

* Drainage pipe sizes (where shown) have been gauged from the surface for safety reasons and should be regarded as approximate only.
* Tree species (where shown) should be treated with caution and expert identification is advised.
* Although this is a digital survey the accuracy and amount of detail shown is only commensurate with the graphical scale of mapping as specified. Care should be exercised when working to larger scales.
* Visible features in the vicinity of the boundaries as shown above, may not represent the extent of legally conveyed ownership.
* Whilst every effort has been made to achieve accuracy on this plan, CRUCIAL clearance dimensions, levels and invert levels should be checked prior to design and construction.
* Kerb levels have been taken in the bottom of the channel.
* Areas of dense undergrowth cannot be surveyed in detail, these areas will be shown in outline only and marked as 'dense undergrowth' on the plan.

SHEET LAYOUT
NOT TO SCALE

31 ELSWORTHY ROAD LONDON NW3 3BT

TOPOGRAPHICAL SURVEY

SURVEYED FOR ELSWORTHY ROAD (INVESTMENTS) LTD
CTV HOUSE, LA POUQUELAYE
ST HELIER
JERSEY
JE2 3TP

SURVEYOR G.W
DATE NOV/2020

NO	DATE	REVISION

DRAWING NO	L 10058/T	REV 0
SCALE	1 : 200 @ A1	
SEE ALSO DWG NOS		
SHEET	1 of 8	
REF NO	L 10058	