ground&water

GROUND MOVEMENT ANALYSIS REPORT

for the site at

38 GLENLOCH ROAD, CAMDEN LONDON NW3 4DN

on behalf of

NW3 PROPERTIES

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by NW3 Properties on the 11th July 2018 to undertake a Ground Movement Assessment at 38 Glenloch Road, London N1 8JQ. The scope of the investigation was detailed within the email between the client and Ground and Water Limited, dated 12th July 2018.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide the client with a **Ground Movement Analysis, as** a supplement to the Ground Investigation Report and Basement Impact Assessment prepared by Jomas Associates Ltd, referenced P1207J1245, dated in January 2018 and the Construction Methodology Statement in Support of Planning Application, December 2017 Rev. P1, prepared by Rob Markovits, Ref. 172904.

This Ground Movement Analysis report should be read in conjunction with the Ground Investigation Report, Basement Impact Assessment and Construction Methodology Statement (CMS).

A full scale Desk Study, intrusive ground investigation and full scale geotechnical or contamination assessment were not part of the remit of this report. The findings of the GI-BIA report, relevant to the Ground Movement Analysis are however discussed and assessed in this report.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

This report was based on the following documents. Total reliance has been placed on these reports and no liability can be taken for their short comings.

- Desk Study, Ground Investigation & Basement Impact Assessment Report, prepared by Jonas Associates Limited, January 2018, referenced P1207J1245.
- Construction Methodology Statement in Support of Planning Application, December 2017 Rev. P1, prepared by Rob Markovits, Ref. 172904.

This Ground Movement Analysis report should be read in conjunction with these documents.

2.0 SITE SETTING

2.1 Site Location

The site comprised a 0.01ha rectangular shaped plot of land, oriented in a north-west to south-east direction, located on the north-western side of Glenloch Road, ~15m north-east of its junction with Tudor Close. The site was located within the London Borough of Camden, north London.

The approximate National Grid Reference for the site was TQ 27173 84967. A site location plan is provided within Figure 1. A plan showing the site development area is given within Figure 2.

2.2 Site Description

The site currently consists of an unoccupied residential building, in terrace-arrangement, with a rear garden. The property contained an existing lower ground floor / basement beneath part of the building, to a depth of approximately ~3.00m bgl.

An aerial view of the site showing an approximate site boundary is given in Figure 3. An existing plan and section view of the site can be seen in Figures 4 and 5.

2.3 Proposed Development

At the time of reporting, August 2018, the proposed development was understood to comprise the extension of the lower ground floor, to form a single storey basement, demolition of the rear load bearing masonry, extension of the rear ground floor and some alterations to the existing interior design. The basement is going to be formed to an approximate total depth of 3.50m bgl (front and rear).

A plan and a section view of the proposed development are shown in Figures 6 and 7.

2.4 Geology

The BGS Geological Map for the area (North London Sheet No. 256 Solid and Drift 1:50,000) indicated that the site was underlain by bedrock deposits of the London Clay Formation. No areas of Made Ground were noted within 250m of the site.

A BGS borehole located ~228m north-west of the site revealed Made Ground to a depth of ~1.22m bgl, overlying clay for the remaining depth of the borehole, a depth of ~6.10m bgl.

London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required. The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

2.5 Slope Stability and Subterranean Developments

The building was situated within an area where slope instability problems were unlikely to be present. According to the report prepared by Jomas Associates Ltd, no special actions are required to avoid problems due to landslides. No special ground investigation are required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

The LUL Northern Line runs approximately 200m to the East of the site. As these were not within a close proximity the client was not required to advise London Underground asset protection department to check alignments and agreed works will not affect any existing tunnels or access shafts. No other underground structures, tunnels or vaults are expected near the proposed works.

2.6 Hydrogeology and Hydrology

A study of the aquifer maps on the DEFRA website and information within the report prepared by Jomas Associates Ltd revealed the site to be located on **Unproductive Strata**, associated with the bedrock deposits of the London Clay Formation. No designation was given for superficial deposits due to their likely absence.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels. The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

Examination within the DEFRA website showed that the site did **not** fall within a Groundwater Source Protection Zone as classified in the Policy and Practice for the Protection of Groundwater.

A culvert was recorded to be present 27m east of the site. This culvert channels surface waters draining from the Hampstead Ponds, located 1km north of the site, to the River Thames, located \sim 6km south of the site.

The nearest visible surface water feature comprised a pond, located within Hampstead Heath, $^{\sim}800m$ north of the site.

From analysis of hydrogeological and topographical maps, groundwater was anticipated to be encountered at depth (>6.00m below existing ground level (bgl)) and it was considered that the groundwater was flowing in a south / south easterly direction, in alignment with local topography. Isolated pockets of groundwater may be perched within any Made Ground, confined by the London Clay Formation, encountered beneath the site.

Examination of Environment Agency records demonstrates that the site was situated within a **Flood Zone 1**, i.e. an area with low probability of flooding from rivers and sea. In addition, the RoFRAS rate was Very Low, based on the report prepared by Jomas Associates Ltd.

2.7 Radon

BRE 211 (2015) Map 5 of the London, Sussex and west Kent area indicated that the site **was not** located within an area where mandatory protection measures against the ingress of radon were likely to be required. A risk assessment was not required.

2.8 Review of the Desk Study, Ground Investigation & Basement Impact Assessment Report prepared by Jomas Associates Limited, January 2018.

A brief review of the findings of the Desk Study, Ground Investigation & Basement Impact Assessment Report prepared by Jomas Associates Limited, January 2018 is carried out in this section, with a focus predominantly on the geotechnical parts of concern for the Ground Movement Analysis.

Summarising the historical mapping review in terms of features and development that have occurred suggested the site was undeveloped land, located within the Belsize Park area in 1871. By 1915, a residential building has been built on site and Glenloch Road has been constructed. No significant changes have occurred on site to the present day.

The surrounding area has been in use almost exclusively for residential properties, with the only significant industrial use being a garage 200m north of site, shown on maps dating 1951 - 1989.

<u>Summary of the important additional features within the Desk Study and Screening of the report</u> prepared by Jomas Associates Limited, relevant to this report

- The site was not within the catchment of the pond chains of Hampstead Heath.
- The proposed development is to extend an existing basement. The new basement will extend out under an existing rear external space which is covered entirely by hard surfacing (paving slabs).
- There is no reason to believe that more water than at present will be or could be discharged to the ground.
- No surface water features were present within 250m of site.
- A stepped slope will be constructed at the rear of the basement, stepping up to existing ground levels at the rear. However, it is assumed that the design of the stepped slope will take into account the risks of failure associated with the construction of the basement.
- No trees will be felled as part of this development and it is not considered likely that works will be undertaken in any root protection zones.
- The site is directly underlain by the London Clay Formation. The site is reported to be in area at moderate risk from shrink-swell clays. No evidence of structural stress caused by seasonal shrink swell was noted during the walkover.
- A culvert is present ~27m east of the site.
- The basement will extend into Unproductive strata, and it is therefore unlikely that a high groundwater table will be present. Some perched water might be encountered.
- It is likely that the basement foundations will increase the differential depth of foundations relative to neighbouring properties however this is dependent on the type and depth of foundations used at the neighbouring properties and this is currently unknown.

The site was attached to terraced three-storey housing to the east and west of the site. A site walkover was carried out by Ground and Water Ltd. Based on information gathered so far, it was considered that no basement (or at least basement covering the full footprint of the building) was present within 40 Glenloch Road. A lower ground floor was present within 36 Glenloch Road (Light well). Based on similar potential construction with the existing partial basement however, it was considered highly unlikely that this would cover the entire plot. In conclusion, a maximum differential depth of ~3.50m is expected to be created in most areas of the plots of concern.

In addition, based on the CMS, the party walls are to be underpinned in order to accommodate the full proposed basement. This also comprises the worst case scenario for the Ground Movement Analysis.

Results of the Intrusive Ground Investigation

The site works were undertaken on the 14^{th} November 2017 and comprised the drilling of 1No. Windowless Sampler Borehole to a depth of 5.45m bgl and 4No. hand excavated trial pits (TP1 – TP3, TP4a, TP4b) / foundation exposures to depths of between 0.74 - 1.65m bgl / bbl.

A combined ground gas / groundwater monitoring well was installed within WS2, to a depth of 5.00m bgl.

Foundation Exposures – Ground Conditions

TP1 was excavated in the west corner of the basement. The pit was extended to 0.85m bbl (metres below basement level), exposing four brick "steps" of 0.05m width each. The first step was measured to 0.43m depth; the remaining steps stepped down depths of between 0.07m and 0.09m. A fifth step of concrete stepped out 0.15m and was proven as the base of the foundation at 0.85mbbl. The footing was resting on soils of the London Clay Formation, described as soft to firm light brown clay.

TP2 was excavated inside the west corner of the rear room of the building an extended to 1.65mbgl. No step out was observed but the brick wall was followed down to the base of the pit. No natural ground was proved in this pit. The ground conditions comprised laminate floor boards to 0.05m bgl over Made Ground, described as soft to firm light brown sandy gravelly clay. The gravel was abundant, fine to coarse, sub-angular to angular flint, brick and concrete.

TP3 was formed in the rear hallway on the northern side of the house. The base of the foundation was found at 0.95mbgl, with the foundations found to be of brickwork to 0.80mbgl over a concrete base that stepped out by 0.14m. Concrete was recorded to 0.30m bgl, overlying Made Ground, which comprised a light brown gravelly clay. The gravel was abundant, fine to coarse, sub-angular to angular flint, brick and concrete.

TP4a was formed at the rear of the house along a garden wall and adjacent to the building. The exposed garden wall footing was recorded as a 1.30mbgl of brick over concrete. The concrete stepped out to at least 0.16m but the base was not proven. TP4b was formed at the rear of the house along a garden wall and adjacent to the building. The exposed building foundations were recorded as a 0.62mbgl of brick over concrete. The concrete stepped out by 0.02m but the base could not be proven. Laminate floors over concrete were recorded to 0.06m bgl, underlain by Made Ground to 0.60m bgl. The Made Ground comprised soft to firm light brown gravelly clay. The gravel was frequent, fine to coarse, sub-angular to angular brick, flint and concrete. Soils, most likely comprising Made Ground was recorded below, for the remaining depth of the pit, a depth of 1.25m bgl. The soils comprised a firm to stiff light brown clay with rootlets, over pink to brown clayey slightly gravelly sand. The sand was coarse grained with fine to medium angular clinker fragments.

Windowless Sampler Borehole – Ground Conditions

Made Ground

A paving slab over reinforced concrete were recorded in WS2, from ground level to a depth of 0.20m bgl. Soils described as Made Ground were recorded below, comprising light brown low strength gravelly clay. The gravel was frequent, fine to coarse, sub-angular to angular flint, brick and concrete.

London Clay Formation

Soils described as representative of the London Clay Formation were recorded from 1.30m bgl, for the remaining depth of the borehole, a depth of 5.45m bgl. The soils were described as a light brown with blue veins clay.

Groundwater

No groundwater was recorded during the ground investigation. Four return monitoring visits were carried out. Groundwater in WS2 was recorded, at depths of between 2.42 - 4.16m bgl during three of the visits and dry during one visit.

The report also mentioned that given the recorded geology and the lack of groundwater reported during drilling, it was likely that the water levels recorded during monitoring did not represent a true groundwater level, and it was more likely due to surface water ingress into the well.

Geotechnical In-Situ Testing

Standard Penetration Tests were carried out within WS2, at 1m intervals. An SPT N value of 6 was recorded within the Made Ground. SPT N values of between 6 - 12 were recorded within the soils of the London Clay Formation, resulting to low to medium equivalent undrained shear strengths (Cu), (30 - 60 kPa).

It should be noted that an SPT N value of 6 was recorded at 1.00 - 1.45m bgl, with the London Clay Formation encountered at 1.30m bgl, increasing to 10 from 2.00m bgl. Therefore, the low N value was considered to be representative for both the Made Ground and the shallower soils of the London Clay Formation until 2.00m bgl.

Geotechnical Laboratory Testing

Atterberg Limit Tests were carried out within samples of the Made Ground and the London Clay Formation. A modified Plasticity Index of 33.92%, indicating a medium volume change potential, was recorded within the sample of Made Ground tested.

Modified Plasticity Indices of between 37.20% – 59.00% were recorded within the samples of the London Clay Formation tested, indicating a Medium to High volume change potential in accordance with NHBC Chapter 4.2 and BRE240 Standards.

Consistency Index calculations carried out by Ground and Water Ltd, based on the geotechnical laboratory results of the ground investigation, indicated the soils to be stiff (Consistency Indices between 0.83 - 0.92).

Foundation Recommendations

The ground investigation report suggested a bearing capacity of \sim 90kPa at depths of \sim 3.00 – 3.50m bgl. It was not part of the remit of this report to comment additionally on ground conditions and foundation recommendations.

Geological Impact

At the depths that the basement would be constructed at the London Clay is unlikely to be prone to

seasonal shrinkage and swelling that arises due to changing water content in the soil. This is due to a lack of significant vegetation capable of removing water within the zone of influence; the extensive hard cover minimising the amount of water entering the ground and the lack of proven groundwater. Given the recorded geology and the lack of groundwater reported during drilling it is likely that the water levels recorded during monitoring does not represent a true groundwater level, and it likely due to surface water ingress into the well.

Hydrology and Hydrogeology Impact

The risk of flooding from groundwater was considered to be low. The proposed basement was unlikely to have a detectable impact on the local groundwater regime. Appropriate water proofing measures should be included within the whole of the proposed basement wall/floor design as a precaution.

The information available suggested that the site lies in an area that is not at risk of surface water flooding. Flooding via this source is therefore considered to be low.

Impact of Basement on adjacent Properties and Pavement

The report mentioned that unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground, any associated services and structures. It is recommended that the site is supported by suitably designed temporary support. This will ensure that the adjacent land is adequately supported in the temporary and permanent construction. Alternatively, the excavation should proceed in a manner that maintains the integrity of the ground on all sides.

The Basement Impact Assessment report stated that it would be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations.

A ground movement analysis is undertaken by Ground and Water Limited within the following sections, in order to supplement and further assess the basement impact on the neighbouring properties.

3.0 GROUND MOVEMENT ANALYSIS

3.1 Assessment of Ground Movement

At the time of reporting, August 2018, the proposed development was understood to comprise the extension of the lower ground floor, to form a single storey basement, demolition of the rear load bearing masonry, extension of the rear ground floor and some alterations to the existing interior design. The new basement is going to be formed to an approximate total depth of 3.50m bgl. (front and rear).

The basement will consist of reinforced concrete cantilevering retaining walls. These will be designed to resist the lateral loads around the perimeter of the basement. The basement floor structure will comprise a reinforced concrete slab. The retaining walls will also mainly transfer vertical loads to the ground.

According to CIRIA C760 estimating ground movements in the vicinity of excavations is very complex due to the variety of factors involved. It is also mentioned that ground movements around the excavation can be controlled and minimised by adopting specific measures, which are discussed at the end of this section.

Ground movements can be approximated using available monitoring data presented within CIRIA Report C760 in conjunction with engineering judgement.

CIRIA C760 states that it is not possible to distinguish between walls embedded in competent (stiff) ground retaining some soft and firm clays from those wholly embedded in soft to firm clays from research to date. However, the totality of the data provides an upper bound to observed experience which the vast majority of ground movements will fall into, including soft clays and alluvium. Therefore, using engineering judgement, we have produced design lines based on a conservative, moderate and actual case in firm clays.

The site was attached to terraced three-storey housing to the east and west of the site. A site walkover was carried out. Based on information gathered so far, it was considered that no basement (or at least basement covering the full footprint of the building) was present within 40 Glenloch Road. A lower ground floor was present within 36 Glenloch Road (Light well). Based on similar potential construction with the existing partial basement however, it was considered highly unlikely that this would cover the entire plot. In conclusion, a maximum differential depth of ~3.50m is expected to be created in most areas of the plots of concern.

Based on the maximum depth of excavation, structures within a ~12.2m (vertical movements) - ~14m (horizontal movements) radius of the proposed basement were considered likely to be influenced by the proposed development.

I	Parameters of Surroundir	ng Properties	
Property	Approximate Distance to Closest Wall (m)	Approximate Length (m)	Approximate Height (m) (Based on the excavation depth measurement points and ground level)
40 Glenloch Road	0.00	7.30	12.00
36 Glenloch Road	0.00	7.30	12.00
34 Glenloch Road	7.30	6.40	12.00

- The magnitude of ground movements has been assessed for the excavation of the underpinned retaining wall structure.
- It is important to note that CIRIA Reports C580/760 were written for embedded retaining walls. Therefore, movement calculations for the excavation of soil and installation of the underpinnings does not strictly apply to C580/760.

The following parameters have been used to inform this assessment:

- The maximum differential basement excavation depth is approximately ~3.50m bgl (front and rear)
- The method of basement construction will be underpinning;
- A high wall stiffness has been considered;
- In the permanent case the wall will always be propped at high level;
- The assessed buildings were estimated to be ~12.0m high based on ground level and the maximum excavation depth.
- Soils comprising Made Ground, over a firm clay has been proved.
- Analysis has been undertaken using soft to firm clays, for conservatism.

Based on reference to CIRIA Report C760 the following ground movements have been developed based on of the excavation of soils to form the basement.

		Ground Movement	Analysis (S	oft to Firm Clay)			
Property	Approx. Horizontal Ground Movement at Closest Wall (mm)	Approx. Horizontal Ground Movement at Furthest Wall (mm)	Horizontal Strain (%)	Approx. Vertical Ground Movement at Closest Wall (mm)	Approx. Vertical Ground Movement at Furthest Wall (mm)	Vertical Deflection Ratio (%)	Category of Damage
		Cons	ervative Lin	е			
40 Glenloch Road	5.25	2.51	0.03750	8.75	3.50	0.109589	Slight
36 Glenloch Road	5.25	2.51	0.03750	8.75	3.50	0.109589	Slight
34 Glenloch Road	2.51	0.11	0.03750	3.50	0.00	0.025	Negligible
		Mo	derate Line			-	
40 Glenloch Road	5.25	2.51	0.03750	5.60	3.50	0.054795	Very Slight
36 Glenloch Road	5.25	2.51	0.03750	5.60	3.50	0.054795	Very Slight
34 Glenloch Road	2.51	0.11	0.03750	3.50	0.00	0.023438	Negligible
		Re	alistic Line				
40 Glenloch Road	5.25	2.51	0.03750	3.50	1.75	0.041096	Very Slight
36 Glenloch Road	5.25	2.51	0.03750	3.50	1.75	0.041096	Very Slight
34 Glenloch Road	2.51	0.11	0.03750	1.75	0.00	0.015625	Negligible

The Ground Movement Spreadsheets and Calculations can be seen within Appendix B. Figures of the graphs used for the analysis can be seen in Figure 8.

In terms of building damage assessment and with reference to Table 2.5 of CIRIA Report C580 (after Burland et al, 1977), the 'Description of typical damage' given the calculated movements it is likely that the damage assessment will fall into Category 2, 'Slight' (for a conservative assessment, which is not likely to occur), to Category 0, 'Negligible'. For moderate and realistic situations, the damage assessment fell within Category 1 'Very Slight' to Category 0 'Negligible'. Calculations for the potential damage at each property can be seen within Appendix B.

Contour plots showing the horizontal and vertical ground movement due to the construction of the basement can be seen within Figures 9 - 10.

- The size of the developments used to provide the case histories for C580/760 are significantly greater than the scale of works proposed. In practice, the range of ground movements (relative to the excavation depth and the building dimensions) is therefore likely to be much smaller for this development.
- CIRIA Report C760 strongly advises that ground movements are influenced by the quality of workmanship. The party wall act will apply to this development and will reinforce good workmanship. The act provides an effective mechanism for ensuring that structural integrity of the neighbouring properties is maintained throughout the construction phase. Amongst other procedures, monitoring proposals will ensure that the actual wall movements are controlled and kept within acceptable limits.

Underpinning is understood to involve a 'hit and miss' approach in stages so each 'panel' is separated by 3-5 others from the next open one. It will be important that the building contractor is closely supervised and is experienced in this type of construction. It will be critical to prevent exposed faces from collapse or significant ground loss into the new excavation and temporary face support should be maintained where practicable. The nature and presence of basements/cellars in the adjoining properties is not known at this stage. Most ground movement should occur during excavation of the basement and construction so the adequacy of temporary support will be critical in limiting ground movements. A number of factors will assist in limiting ground movements:

- Most ground movement will occur during excavation and construction so the adequacy of temporary support will be critical in limiting ground movements;
- The speed of propping and support is key to limiting ground movements;
- Good workmanship will contribute to minimising ground movements
 - o Ensuring that adequate propping is in place at all times during construction;
 - Minimise deterioration of the central soil mass by the use of blinding/covering with a waterproof membrane;
 - Installation of the first (stiff) support quickly and early in the construction sequence for each underpin panel;
 - \circ $\;$ Control dewatering to minimise fines removal and drawdown;
 - Avoid overbreak.
 - Avoid leaving ground unsupported.

APPENDIX A Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to 38 Glenloch Road, Camden NW3 4DN.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

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Recipients are not permitted to publish this report outside of their organisation without our express written consent.















Max Excavation Depth

3.5

		8	Settlement /	Max Excavati	on Depth (%)	1								
		Distance/Max		Read off grap			Settlement (m)	(Settlement (mm		Horizontal Movem	ent	
Property	Distance	Excavation Depth	CONSERVICINE	Moderate	Realistic	Conservative	Moderate	Realistic	Concervative	Moderate	Realistic	Distance/Max Excavation Depth	%	(mm)
	0	0	0.25	0.1	6 0.:	0.0087	0.0056	0.0035	.8.7	5.6	3.5	0	0.15	5.2
	1.825	0.521428571	0.45	0.2	5 0.1	0.01575	0.00875	0.00595	15.7	8.75	5.95	0.521428571	0.130446	4.5656
	3.65	1.042857143	0.36	0.2	4 0.1	6 0.0128	0.0084	0.0056	42	8.4	5.6	1.042857143	0.110693	3.8812
	5.475	1.564285714	0.19	0.1	5 0.1	0.00665	0.00525	0.00385	5.6	5.25	3.85	1.564285714	0.091339	3.19680
40	7.3	2.085714286	0.1	0.	1 0.0	0.0035	0.0035	0.00175	3	5 3.5	1.75	2.085714286	0.071786	2.5125
	0	0	0.25	0.1	6 0.	0.00675	0.0056	0.0035	.8.7	5.6	3.5	0	0.15	5.25
	1.825	0.521428571	0.45	0.2	5 0.1	0.01575	0.00675	0.00595	15.7	8.75	5.95	0.521428571	0.130446	4.56563
	3.65	1.042857143	0.36	0.2	4 0.1	6 0.0128	0.0084	0.0056	12	8.4	5.6	1.042857143	0.110893	3.88125
	5.475	1.564285714	0.19	0.1	5 0.1	0.00665	0.00525	0.00385	5.6	5.25	3.85	1.564285714	0.091339	3.1968
36	7.3	2.085714286	0.1	0.	1 0.0	0.0035	0.0035	0.00175	3.	3.5	1.75	2.085714286	0.071786	2.512
	7.3	2.085714286	0.1	0.	1 0.0	0.0035	0.0035	0.00175	3	3.5	1.75	2.085714286	0.071786	2.512
	8.9	2.542857143	.0.1	0.0	5	0.0011	0.00175	0	3	1.75	0	2.542857143	0.054643	1.912
	10.5	3	-0		0	0	0) 0		0 0	0	3	0.0375	1.3125
	12.1	3.457142857	0		0	0	0) 0		0	0	3.457142857	0.020357	0.7125
34	13.7	3.914285714	0		0	D	0	0 0		0 0	0	3.914285714	0.003214	0.1125



Project: 38 Glenloch Road, Camden NW3 4D	DN	
Client: NW3 Properties	Date: August 2018	
Vertical and Horizontal Ground Movements due to excavation in Soft – Firm Clay	Ref: GWPR2718	

Figure 8

3

ground&water



APPENDIX B Ground Movement Assessment Calculations

Max Excavation Depth 3.5

			Settlement	: / Max Excavatio	on Depth (%)									
		Distance/Max		Read off graph			Settlement (m)			Settlement (mm)	Horizontal Movem	ent	
Property	Distance	Excavation Depth	Conservative	Moderate	Realistic	Conservative	Moderate	Realistic	Conservative	Moderate	Realistic	Distance/Max Excavation Depth	%	(mm)
	0	0	0.25	0.16	0.1	0.00875	0.0056	0.0035	8.75	5.6	3.5	0	0.15	5.25
	1.825	0.521428571	0.45	0.25	0.17	0.01575	0.00875	0.00595	15.75	8.75	5.95	0.521428571	0.130446	4.56563
	3.65	1.042857143	0.36	0.24	0.16	0.0126	0.0084	0.0056	12.6	8.4	5.6	1.042857143	0.110893	3.88125
	5.475	1.564285714	0.19	0.15	0.11	0.00665	0.00525	0.00385	6.65	5.25	3.85	1.564285714	0.091339	3.19688
40	7.3	2.085714286	0.1	0.1	0.05	0.0035	0.0035	0.00175	3.5	3.5	1.75	2.085714286	0.071786	2.5125
	0	0	0.25	0.16	0.1	0.00875	0.0056	0.0035	8.75	5.6	3.5	0	0.15	5.25
	1.825	0.521428571	0.45	0.25	0.17	0.01575	0.00875	0.00595	15.75	8.75	5.95	0.521428571	0.130446	4.56563
	3.65	1.042857143	0.36	0.24	0.16	0.0126	0.0084	0.0056	12.6	8.4	5.6	1.042857143	0.110893	3.88125
	5.475	1.564285714	0.19	0.15	0.11	0.00665	0.00525	0.00385	6.65	5.25	3.85	1.564285714	0.091339	3.19688
36	7.3	2.085714286	0.1	0.1	0.05	0.0035	0.0035	0.00175	3.5	3.5	1.75	2.085714286	0.071786	2.5125
	7.3	2.085714286	0.1	0.1	0.05	0.0035	0.0035	0.00175	3.5	3.5	1.75	2.085714286	0.071786	2.5125
	8.9	2.542857143	0.1	0.05	0	0.0035	0.00175	0	3.5	1.75	0	2.542857143	0.054643	1.9125
	10.5	3	0	(0	0	0	0	C	0	0	3	0.0375	1.3125
	12.1	3.457142857	0	(0	0	0	0	0	0	0	3.457142857	0.020357	0.7125
34	13.7	3.914285714	0	(0	0	0	0	C	0	0	3.914285714	0.003214	0.1125

Distance from excavation / max. excavation depth

CIRIA C760 does not cover Horizontal Movements for soft - firm clays. Therefore, these were derived from stiff clay results.

Potential Damage to Building

Soft to firm clays - Conservative

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 40		Neighbouring Property 2	No. 36	
	m	mm		m	mm
L	7.30	7300	L	7.30	7300
н	12.00	12000	Н	12.00	12000
L/H	0.61		L/H	0.61	
Verticle Deflection (Δ)	<mark>8</mark> mm	from graph (max difference	Verticle Deflection (Δ)	<mark>8</mark> mm	from graph (max difference
Defelction Ratio (Δ /L)	0.109589 %	between blue and orange line)	Defelction Ratio (Δ /L)	0.109589 %	between blue and orange line)
Horizontal Movement (δh)	2.74 mm	difference between horizontal	Horizontal Movement (δh)	2.74	difference between horizontal
Horzontal Strain (٤h) = δh/L	0.03750 %	farthest walls	Horzontal Strain (٤h) = δh/L	0.03750 %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

	L/H 0.61						L/H	1	0.61			
Negligible damage limit (E	lim) 0.05	;			Negligible da	mage limit (Elim)	0.05	5				
(Δ/L)/(Elim) (Eh)/(Elim)	2.191780822 0.75	Plot this point on fig2.18 below the appropriate L/ into 'negligible' category	(b) if the plotted point is H line then damage falls - no need to plot points		(Δ/L)/(Elim) (Eh)/(Elim)		2.191780822 0.75	2 Plot thi 5 the appr	s point on fig ropriate L/H category - r	g2.18 (b) if line then c no need to	the plotted lamage falls plot points	l point is below into 'negligible' below
Very Slight damage limit (Elim) 0.075	i			Very Slight da	amage limit (Elim)	0.075	5				
(Δ/L)/(Elim) (Eh)/(Elim)	1.461187215 0.5	Plot this point on fig2.18 below the appropriate L/ into 'very slight' category	(b) if the plotted point is H line then damage falls - no need to plot points		(Δ/L)/(Elim) (Eh)/(Elim)		1.461187215 0.5	5 Plot thi 5 the appr	s point on fig opriate L/H category - r	g2.18 (b) if line then d no need to	the plotted amage falls plot points	l point is below into 'very slight' below
Slight damage limit (Elim)	0.15	i			Slight damag	e limit (Elim)	0.15	5				
(Δ/L)/(Elim) (Eh)/(Elim)	0.730593607 0.25	Plot this point on fig2.18 below the appropriate L/ into 'slight' category - no r	(b) if the plotted point is H line then damage falls need to plot points below		(Δ/L)/(Elim) (Eh)/(Elim)		0.730593607 0.25	7 Plot thi 5 the ap	s point on fig propriate L/ category - r	g2.18 (b) if /H line the no need to	the plotted damage fa plot points	l point is below alls into 'slight' below
Moderate damage limit (8	ilim) 0.3				Moderate da	mage limit (Elim)	0.3	3				
(Δ/L)/(Elim) (Eh)/(Elim)	0.365296804 0.125	Plot this point on fig2.18 below the appropriate L/ into 'moderate' category - damage is	(b) if the plotted point is 'H line then damage falls if the point is not below, s 'severe'		(Δ/L)/(Elim) (Eh)/(Elim)		0.365296804 0.125	Plot thi the appr catego	s point on fig ropriate L/H ory - if the po	g2.18 (b) if line then c oint is not	the plotted lamage falls below, dam	l point is below into 'moderate' age is 'severe'
Calculated Category of Da	mage	Slight			Calculated Ca	ategory of Damage			Slight			
Fig 2.18 (b)					Table 2.5							
Fig 2.18 (b)					Table 2.5 Table 2.5 Cla	assification of visible damage to v rding, 1989; and Burland, 2001)	valls (after Burland (et al, 1977, Bos	scardin and			
Fig 2.18 (b)	10	(1/4) = 1.0			Table 2.5 Table 2.5 Category of damage	assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined)	valls (after Burland (ge	et al, 1977, Bos Approximate crack width (mm)	scardin and E Limiting tensile strain E _{tim} (per cent)			
Fig 2.18 (b)	- 1.2 –	<i>(L/H</i>) = 1.0)		Table 2.5 Table 2.5 Category of damage 0 Negligible	assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible.	valls (after Burland o ge xout 0.1 mm are	et al, 1977, Bos Approximate crack width (mm) < 0.1	scardin and E Limiting tensile strain \mathbf{z}_{lim} (per cent) 0.0–0.05			
Fig 2.18 (b)	- 1.2 -	(<i>L/H</i>) = 1.0	- (<i>L/H</i>) = 1.5		Category of damage 0 Negligible 1 Very slight	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio	valls (after Burland of ge pout 0.1 mm are <u>treated during</u> plated slight external m.	Approximate crack width (mm) < 0.1 < 1	scardin and E Limiting tensile strain E _{lim} (per cent) 0.0–0.05 0.05–0.075			
Fig 2.18 (b)	- 1.2 - -1 - - 0.8 - K 3	(<i>L/H</i>) = 1.0	- (<i>L/H</i>) = 1.5	(H) = 0 5	Table 2.5 Cla Color Col	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio <u>Cracks easily filled. Redecorar</u> required. Several slight fractur of building. Cracks are visible some repointing may be require ensure weathertightness. Door	valls (after Burland of ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside e externally and red externally to s and windows	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5	scardin and E Limiting tensile strain Elim (per cent) 0.0–0.05 0.05–0.075 0.075–0.15			
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - K K	(<i>L/H</i>) = 1.0	- (<i>L/H</i>) = 1.5	(H) = 0.5	Table 2.5 Cla Col Category of damage 0 Negligible 1 Very slight 2 Slight 5 3 3 Moderate	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration, Perhaps iso fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open	valls (after Burland of ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside externally and red externally to rs and windows	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a	scardin and E Limiting tensile strain Elim (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3			
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 -	(L/H) = 1.0	- (<i>L/H</i>) = 1.5	(H) = 0.8	Table 2.5 Cla Col Category of damage 0 Negligible 1 Very slight 2 Slight 5 3	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be require ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair	valls (after Burland of ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside externally and red externally to rs and windows ing up and can be treacks can be expointing of. ly a small amount Doors and es may fracture. ed.	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3	scardin and E Limiting tensile strain \mathbf{z}_{tim} (per cent) 0.0–0.05 0.05–0.075 0.05–0.15 0.15–0.3			
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0	-(<i>L/H</i>) = 1.5	(H) = 0.8	Table 2.5 Cla Col Col Category of damage 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration, Perhaps iso fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticeer or bulging noticeably, some lo beams. Service pipes disrupted	valls (after Burland of ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside externally and red externally and red externally to rs and windows ing up and can be treacks can be epointing of ly a small amount Doors and es may fracture. ed. ng breaking-out s. especially over and frames ably. Walls leaning boss of bearing in d.	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks	scardin and E Limiting tensile strain Etim (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3			
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0	-(L/H) = 1.5	(H) = 0.8	Table 2.5 Cla Col Cole Category of damage Cole 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe 5 Very severe	Assification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticear or bulging noticeably, some lo beams. Service pipes disrupted This requires a major repair in complete rebuilding. Beams lo lean badly and require shoring with distortion. Danger of inst	valls (after Burland of ge bout 0.1 mm are treated during olated slight external m. tion probably res showing inside externally and red externally to rs and windows ing up and can be t cracks can be epointing of. ily a small amount Doors and es may fracture. ed. ing breaking-out s, especially over and frames ably. Walls leaning iss of bearing in d. ivolving partial or ose bearings, walls g. Windows broken iability.	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks usually > 25 but depends on number of cracks.	scardin and e Limiting tensile strain sim (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			

Potential Damage to Building

Soft to firm clays - Moderate

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 40		Neighbouring Property 2	No. 36	
	m	mm		m	mm
L	7.30	7300	L	7.30	7300
н	12.00	12000	н	12.00	12000
L/H	0.61		L/H	0.61	
Verticle Deflection (Δ)	<mark>4</mark> mm	from graph (max difference	Verticle Deflection (Δ)	<mark>4</mark> mm	from graph (max difference
Defelction Ratio (Δ/L)	0.054795 %	between blue and orange line)	Defelction Ratio (Δ/L)	0.054795 %	between blue and orange line)
Horizontal Movement (δh)	2.74 mm	difference between horizontal	Horizontal Movement (δh)	2.74	difference between horizontal movement at nearest and
Horzontal Strain (Eh) = δ h/L	0.03750 %	farthest walls	Horzontal Strain (Eh) = δ h/L	0.03750 %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

	L/H 0.61					L/H	l	0.61				
Negligible damage limit (El	lim) 0.05			Negligible dar	mage limit (Elim)	0.05	;					
(Δ/L)/(Elim) (Eh)/(Elim)	1.095890411 0.75	Plot this point on fig2.18 (b) if the plotted point below the appropriate L/H line then damage fa into 'negligible' category - no need to plot poin	t is Ils ts	(Δ/L)/(Elim) (Eh)/(Elim)		1.095890411 0.75	Plot thi the appr	s point on fig ropriate L/H category - r	g2.18 (b) i line then o no need to	f the plotte damage fall plot point	d point is below Is into 'negligible' Is below	
Very Slight damage limit (8	Elim) 0.075			Very Slight da	amage limit (Elim)	0.075	;					
(Δ/L)/(Elim) (Eh)/(Elim)	0.730593607 0.5	Plot this point on fig2.18 (b) if the plotted point below the appropriate L/H line then damage fa into 'very slight' category - no need to plot poin	t is Ils nts	(Δ/L)/(Elim) (Eh)/(Elim)		0.730593607 0.5	Plot thi the appr	s point on fig opriate L/H category - r	g2.18 (b) it line then c no need to	f the plotte lamage falls plot point	d point is below s into 'very slight' s below	
Slight damage limit (Elim)	0.15			Slight damage	e limit (Elim)	0.15	;					
(Δ/L)/(Elim) (Eh)/(Elim)	0.365296804 0.25	Plot this point on fig2.18 (b) if the plotted point below the appropriate L/H line then damage fa into 'slight' category - no need to plot points bel	t is Ils ow	(Δ/L)/(Elim) (Eh)/(Elim)		0.365296804 0.25	Plot thi	s point on fig propriate L/ category - r	g2.18 (b) ii 'H line the no need to	f the plotte n damage f p plot point	d point is below alls into 'slight' s below	
Moderate damage limit (El	lim) 0.3			Moderate dar	mage limit (Elim)	0.3	8					
(Δ/L)/(Elim) (Eh)/(Elim)	0.182648402 0.125	Plot this point on fig2.18 (b) if the plotted point below the appropriate L/H line then damage fa into 'moderate' category - if the point is not belo damage is 'severe'	t is IIs ow,	(Δ/L)/(Elim) (Eh)/(Elim)		0.182648402 0.125	Plot thi the appr catego	s point on fig opriate L/H ory - if the po	g2.18 (b) if line then c pint is not	f the plotte Jamage fall below, dan	d point is below s into 'moderate' nage is 'severe'	
Calculated Category of Dar	nage	Very Slight		Calculated Ca	tegory of Damage		١	<mark>/ery Slight</mark>				
Fig 2.18 (b)				Table 2.5								
Fig 2.18 (b)	1			Table 2.5 Table 2.5 Clas	ssification of visible damage to w rding, 1989; and Burland, 2001)	valls (after Burland e	et al, 1977, Box	scardin and				
Fig 2.18 (b)	- 12	-(1/H) = 1.0		Table 2.5 Table 2.5 Category of damage	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined)	valls (after Burland e ge	et al, 1977, Box Approximate crack width (mm)	e Limiting tensile strain s _{lim} (per cent)				
Fig 2.18 (b)	- 1.2 –	— (<i>L/H</i>) = 1.0		Table 2.5 Class Control Table 2.5 Class Control Category of damage 0 0 Negligible	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible.	valls (after Burland e ge pout 0.1 mm are	Approximate crack width (mm) < 0.1	e Limiting tensile strain z _{lim} (per cent) 0.0–0.05				
Fig 2.18 (b)	- 1.2 -	(L/H) = 1.0 (L/H) = 1.5		Table 2.5 Class Control Table 2.5 Class Control Category of damage 0 0 Negligible 1 Very slight	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. <u>Fine cracks that can easily be f</u> normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection	valls (after Burland e ge pout 0.1 mm are <u>treated during</u> plated slight external m.	Approximate crack width (mm) < 0.1 < 1	scardin and E Limiting tensile strain s _{lim} (per cent) 0.0–0.05 0.05–0.075				
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - Kity	(L/H) = 1.0 (L/H) = 1.5	(1 /H) = 0 4	Table 2.5 Class Content of the content of	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be f normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection <u>Cracks easily filled. Redecorat</u> required. Several slight fractur of building. Cracks are visible <u>some repointing may be required</u>	valis (after Burland e ge bout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to	Approximate crack width (mm) < 0.1 < 1 < 5	scardin and Limiting tensile strain ϵ_{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15				
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - Kity - 0.6 -	(L/H) = 1.0 (L/H) = 1.5	(<i>L/H</i>) = 0.8	Table 2.5 Class Content of the Content of	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than abo classed as negligible. Fine cracks that can easily be f normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Doors may stick slightly.	valis (after Burland e ge bout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to rs and windows	Approximate crack width (mm) < 0.1 < 1 < 5	e Limiting tensile strain s _{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15				
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 -	(L/H) = 1.0 (L/H) = 1.5 (L/H) = 1.5 (L/H) = 1.5	(<i>L/H</i>) = 0.5	Table 2.5 Class Content of the Content of	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab- classed as negligible. Fine cracks that can easily be f normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Doors may stick slightly. The cracks require some openi patched by a mason. Recurrent masked by suitable linings. Re external brickwork and possibl of brickwork to be replaced. D windows sticking. Service pipe Weathertightness often impair	valls (after Burland e ge pout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to as and windows <u>ing up and can be</u> <u>treacks can be</u> <u>epointing of</u> <u>ly a small amount</u> Doors and es may fracture. ed.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3	scardin and Limiting tensile strain s _{tim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3				
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0 (L/H) = 1.5 (L/H) = 1.5 (L/H) = 4.0	(<i>L/H</i>) = 0.4	Table 2.5 Class Condition Category of damage Category of damage 0 Negligible 1 Very slight 2 Slight 5	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be f normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Doors may stick slightly. The cracks require some openi patched by a mason. Recurrent masked by suitable linings. Re external brickwork to be replaced. D windows sticking. Service pipe Weathertightness often impaire Extensive repair work involvir and replacing sections of walls doors and windows. Windows distorted, floor sloping noticea or bulging noticeably, some low beams. Service pipes disrupted	valls (after Burland e ge pout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to is and windows <u>ing up and can be</u> <u>t cracks can be</u> epointing of. <u>aly a small amount</u> Doors and es may fracture. ed. <u>ing breaking-out</u> <u>s especially over</u> and frames ably. Walls leaning biss of bearing in d.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks	scardin and 2 Limiting tensile strain sim (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3				
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0 (L/H) = 1.5 20 U/H = 1.5 20 U/H = 1.5 0.2 0.4 0.6 0.8 1	(<i>L/H</i>) = 0.8	Table 2.5 Class Content of the content of	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than abo classed as negligible. Fine cracks that can easily be to normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fracture of building. Cracks are visible some repointing may be requir ensure weathertightness. Doors may stick slightly. The cracks require some openin patched by a mason. Recurrent masked by suitable linings. Re external brickwork and possibl of brickwork to be replaced. D windows sticking. Service pipe Weathertightness often impaire Extensive repair work involvin and replacing sections of walls doors and windows. Windows distorted, floor sloping noticea or bulging noticeably, some lo beams. Service pipes disrupted This requires a major repair im complete rebuilding. Beams lo lean badly and require shoring with distortion. Danger of insta	valls (after Burland e ge pout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside externally and <u>red externally</u> to a and windows <u>ing up and can be</u> <u>the cracks can be</u> <u>epointing of</u> . <u>and rames</u> ably assault <u>amount</u> Doors and es may fracture. ed. <u>ing breaking-out</u> <u>s especially over</u> and frames ably. Walls leaning iss of bearing in d. <u>twolving partial or</u> ose bearings, walls g. Windows broken tability.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks usually > 25 but depends on number of cracks.	scardin and Limiting tensile strain sim (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3 > 0.3				

Soft to firm clays - Realistic

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 40		Neighbouring Property 2	No. 36	
	m	mm		m	mm
L	7.30	7300	L	7.30	7300
н	12.00	12000	н	12.00	12000
L/H	0.61		L/H	0.61	
Verticle Deflection (Δ)	<mark>3</mark> mm	from graph (max difference	Verticle Deflection (Δ)	<mark>3</mark> mm	from graph (max difference
Defelction Ratio (Δ/L)	0.041096 %	between blue and orange line)	Defelction Ratio (Δ/L)	0.041096 %	between blue and orange line)
Horizontal Movement (δh)	2.74 mm	difference between horizontal	Horizontal Movement (δh)	2.74	difference between horizontal
Horzontal Strain (Eh) = δ h/L	0.03750 %	farthest walls	Horzontal Strain (Eh) = δ h/L	0.03750 %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

	L/H 0.61					L/H	0.61		
Negligible damage limit (El	lim) 0.05			Negligible dan	nage limit (Elim)	0.05			
(Δ/L)/(Elim) (Eh)/(Elim)	0.821917808 0.75	Plot this point on fig2.18 (b) if below the appropriate L/H lin into 'negligible' category - no	the plotted point is then damage falls need to plot points	(Δ/L)/(Elim) (Eh)/(Elim)	0.821	917808 Plo 0.75 the	ot this point on fi appropriate L/H category -	g2.18 (b) if the plo line then damage no need to plot po	otted point is below falls into 'negligible' pints below
Very Slight damage limit (8	Elim) 0.075			Very Slight da	mage limit (Elim)	0.075			
(Δ/L)/(Elim) (Eh)/(Elim)	0.547945205 0.5	Plot this point on fig2.18 (b) if below the appropriate L/H lin into 'very slight' category - no	the plotted point is e then damage falls need to plot points	(Δ/L)/(Elim) (Eh)/(Elim)	0.547	945205 Plo 0.5 the	ot this point on fi appropriate L/H category -	g2.18 (b) if the plo line then damage no need to plot po	otted point is below falls into 'very slight' pints below
Slight damage limit (Elim)	0.15			Slight damage	limit (Elim)	0.15			
(Δ/L)/(Elim) (Eh)/(Elim)	0.273972603 0.25	Plot this point on fig2.18 (b) if below the appropriate L/H lin into 'slight' category - no need	the plotted point is e then damage falls to plot points below	(Δ/L)/(Elim) (Eh)/(Elim)	0.273	972603 Plo 0.25 th	ot this point on fine appropriate L, category -	g2.18 (b) if the plo /H line then dama no need to plot po	otted point is below ge falls into 'slight' oints below
Moderate damage limit (El	lim) 0.3			Moderate dar	nage limit (Elim)	0.3			
(Δ/L)/(Elim) (Eh)/(Elim)	0.136986301 0.125	Plot this point on fig2.18 (b) if below the appropriate L/H lin into 'moderate' category - if th damage is 'sev	the plotted point is then damage falls point is not below, vere'	(Δ/L)/(Elim) (Eh)/(Elim)	0.136	986301 Plo 0.125 the ca	ot this point on fi appropriate L/H ategory - if the p	g2.18 (b) if the plo line then damage oint is not below,	otted point is below falls into 'moderate' damage is 'severe'
Calculated Category of Dar	nage	Very Slight		Calculated Cat	egory of Damage		Very Slight		
Fig 2.18 (b)				Table 2.5					
Fig 2.18 (b)	1			Table 2.5 Table 2.5 Clas	sification of visible damage to walls (after ling, 1989; and Burland, 2001)	r Burland et al, 19	77, Boscardin and		
Fig 2.18 (b)	- 1 2 -			Table 2.5 Table 2.5 Category of damage	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined)	r Burland et al, 197 Appro: crack v (mm)	77, Boscardin and simate Limiting vidth tensile strain s _{lim} (per cent)		
Fig 2.18 (b)	- 1.2 –	<i>(L/H</i>) = 1.0		Table 2.5 Class Cord Table 2.5 Class Cord Category of damage 0 0 Negligible	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible.	Approx crack v (mm) m are < 0.1	77, Boscardin and simate Limiting vidth tensile strain ϵ_{lim} (per cent) 0.0–0.05		
Fig 2.18 (b)	- 1.2 -	(<i>L/H</i>) = 1.0	<i>JH</i>) = 1.5	Table 2.5 Clas Cord Category of damage 0 Negligible 1 Very slight	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible. Fine cracks that can easily be treated du normal decoration. Perhaps isolated slig fracture in building. Cracks in external brickwork visible on inspection.	Approx crack v (mm) m are < 0.1 <u>ming</u> < 1 ght	77, Boscardin and ximate Limiting vidth tensile strain ϵ_{lim} (per cent) 0.0–0.05 0.05–0.075		
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - Kity	(L/H) = 1.0 (L	JH) = 1.5 → (L/H) =	Table 2.5 Clas Cord Category of damage 0 Negligible 1 Very slight 2 Slight = 0.5	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible. Fine cracks that can easily be treated du normal decoration. Perhaps isolated slig fracture in building. Cracks in external brickwork visible on inspection. <u>Cracks easily filled. Redecoration proba</u> required. Several slight fractures showin of building. Cracks are visible external some repointing may be required extern ensure weathertightness. Doors and win	Image: state stat	77, Boscardin and simate Limiting tensile strain ϵ_{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15		
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - K-35 - 0.6 - - 0.4 -	(L/H) = 1.0 (L 2.0 (L 2.0)	JH) = 1.5 (L/H) =	Table 2.5 Clas Cord Category of damage 0 Negligible 1 Very slight 2 Slight = 0.5 3 Moderate	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible. Fine cracks that can easily be treated du normal decoration. Perhaps isolated slig fracture in building. Cracks in external brickwork visible on inspection. Cracks easily filled. Redecoration proba required. Several slight fractures showi of building. Cracks are visible externall some repointing may be required extern ensure weathertightness. Doors and win may stick slightly. The cracks require some opening up an patched by a mason. Recurrent cracks c masked by suitable linings. Repointing external brickwork and possibly a small of brickwork to be replaced. Doors and	aburland et al, 193 Approx crack v (mm) um are < 0.1	77, Boscardin and ximate Limiting tensile strain ϵ_{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 r a 0.15–0.3 of > 3		
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0 (L 2.0 (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) $(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L)(L$	JH) = 1.5 (L/H) =	Table 2.5 Class Cord Table 2.5 Class Cord Category of damage Cord 0 Negligible 1 1 Very slight 2 2 Slight 3 3 Moderate 4 4 Severe 3	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible. Fine cracks that can easily be treated du normal decoration. Perhaps isolated slig fracture in building. Cracks in external brickwork visible on inspection. Cracks easily filled. Redecoration proba- required. Several slight fractures showin of building. Cracks are visible externall some repointing may be required extern ensure weathertightness. Doors and win may stick slightly. The cracks require some opening up an patched by a mason. Recurrent cracks co masked by suitable linings. Repointing external brickwork and possibly a small of brickwork to be replaced. Doors and windows sticking. Service pipes may fr Weathertightness often impaired. Extensive repair work involving breakin and replacing sections of walls, especia doors and windows. Windows and fram distorted, floor sloping noticeably. Wall or bulging noticeably, some loss of bear beams. Service pipes disrupted.	ably < 5	T7, Boscardin and simate width Limiting tensile strain ϵ_{im} (per cent) 0.0-0.05 0.05-0.075 0.05-0.075 0.075-0.15 ra 0.15-0.3 out > 0.3 pends > 0.3		
Fig 2.18 (b)	- 1.2 - -1 - 0.8 - - 0.6 - - 0.4 - - 0.2 -	(L/H) = 1.0 (L 20 (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L	JH) = 1.5 (L/H) =	Table 2.5 Clas Cord Table 2.5 Clas Cord Category of damage Cord 0 Negligible 1 1 Very slight 2 2 Slight 3 3 Moderate 4 5 Very severe 5	sification of visible damage to walls (after ling, 1989; and Burland, 2001) Description of typical damage (ease of repair is underlined) Hairline cracks of less than about 0.1 m classed as negligible. Fine cracks that can easily be treated du normal decoration, Perhaps isolated slig fracture in building. Cracks in external brickwork visible on inspection. Cracks easily filled. Redecoration probs required. Several slight fractures showin of building. Cracks are visible external some repointing may be required extern ensure weathertightness. Doors and win may stick slightly. The cracks require some opening up an patched by a mason. Recurrent cracks c masked by suitable linings. Repointing external brickwork and possibly a small of brickwork to be replaced. Doors and windows sticking. Service pipes may fr Weathertightness often impaired. Extensive repair work involving breakir and replacing sections of walls, especia doors and windows. Windows and fram distorted, floor sloping noticeably. Wall or bulging noticeably, some loss of bear beams. Service pipes disrupted. This requires a major repair involving p complete rebuilding. Beams lose bearin lean badly and require shoring. Window with distortion. Danger of instability.	Approximation of the second	77, Boscardin and ximate vidth Limiting tensile strain ε_{lim} (per cent) 0.0-0.05 0.05-0.075 0.05-0.075 0.075-0.15 i of > 3 out > 25 ends ber of		

Potential Damage to Building

Soft to firm clays - Conservative

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 34		Neighbouring Property 2	No. 0	
	m r	nm		m	mm
L	6.40 64	100	L	0.00	0
н	12.00 120	000	н	0.00	0
L/H	0.53		L/H	#DIV/0!	
Verticle Deflection (Δ)	1.6 mm	from graph (max difference	Verticle Deflection (Δ)	<mark>8</mark> mm	from graph (max difference
Defelction Ratio (Δ /L)	0.025000 %	between blue and orange line)	Defelction Ratio (Δ /L)	#DIV/0! %	between blue and orange inter
Horizontal Movement (δh)	2.40 mm	difference between horizontal movement at nearest and	Horizontal Movement (δh)	0.00	difference between horizontal movement at nearest and
Horzontal Strain (εh) = δh/L	0.03750 %	farthest walls	Horzontal Strain (٤h) = δh/L	#DIV/0! %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

L/1	H 0.53						L/H	I #DIV	/0!			
Negligible damage limit (Elim)	0.05			Ν	Negligible da	mage limit (Elim)	0.05	i				
(Δ/L)/(Elim) (Eh)/(Elim)	0.5 0.75	Plot this point on fig2.13 below the appropriate into 'negligible' categor	8 (b) if the plotted point is L/H line then damage falls ry - no need to plot points	(, (,	Δ/L)/(Elim) Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H I category - r	2.18 (b) if the ine then dam to need to plo	plotted point i age falls into 'ne t points below	s below egligible'
Very Slight damage limit (Elim	n) 0.075			N	/ery Slight da	amage limit (Elim)	0.075	i				
(Δ/L)/(Elim) (Eh)/(Elim)	0.333333333 0.5	Plot this point on fig2.13 below the appropriate into 'very slight' catego	8 (b) if the plotted point is L/H line then damage falls ry - no need to plot points	() (1	∆/L)/(Elim) Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H I category - r	2.18 (b) if the ine then dam to need to plo	plotted point i age falls into 've t points below	s below ery slight'
Slight damage limit (Elim)	0.15			S	blight damage	e limit (Elim)	0.15	;				
(Δ/L)/(Elim) (Eh)/(Elim)	0.1666666667 0.25	Plot this point on fig2.13 below the appropriate l into 'slight' category - no	8 (b) if the plotted point is L/H line then damage falls need to plot points below	(, (,	Δ/L)/(Elim) Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the ap	s point on fig propriate L/I category - r	2.18 (b) if the H line then da to need to plo	plotted point i mage falls into t points below	s below 'slight'
Moderate damage limit (Elim)) 0.3			Γ	Moderate da	mage limit (Elim)	0.3	}				
(Δ/L)/(Elim) (Eh)/(Elim)	0.083333333 0.125	Plot this point on fig2.13 below the appropriate l into 'moderate' category damage	8 (b) if the plotted point is L/H line then damage falls - if the point is not below, is 'severe'	(, (,	Δ/L)/(Elim) Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr catego	s point on fig opriate L/H I ory - if the po	2.18 (b) if the ine then dam int is not belo	plotted point i age falls into 'm ow, damage is 's	s below oderate' evere'
Calculated Category of Damag	ge	Negligible		c	Calculated Ca	itegory of Damage						
Fig 2.18 (b)				т	Table 2.5	ssification of visible damage to	walls (after Buriand e	et al, 1977, Bos	scardin and			
Fig 2.18 (b)	I			т	Table 2.5 Table 2.5 Cla Category of	ssification of visible damage to rding, 1989; and Burland, 2001) Description of typical dama	walls (after Burland e ge	et al, 1977, Bos Approximate	scardin and			
Fig 2.18 (b)	1.2 -	, <i>→ (L/H)</i> = 1.	0	т	Table 2.5 Table 2.5 Cla Cor Category of damage	ssification of visible damage to rding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined)	walls (after Burland e ge	et al, 1977, Bos Approximate crack width (mm)	scardin and e Limiting tensile strain e _{lim} (per cent)			
Fig 2.18 (b) –	1.2 -	<i>(L/H)</i> = 1.	0	Т	Cable 2.5 Cla Table 2.5 Cla Category of damage 0 Negligible 1	ssification of visible damage to ording, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible.	walls (after Burland e ge bout 0.1 mm are	Approximate crack width (mm) < 0.1	Example Limiting tensile strain stim (per cent) 0.0-0.05			
Fig 2.18 (b)	-1.2 -	(<i>L/H</i>) = 1.	0 — (<i>L/H</i>) = 1.5	Т	Cable 2.5 Clack Table 2.5 Clack Category of damage 0 0 Negligible 1 Very slight	ssification of visible damage to rding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible. <u>Fine cracks that can easily be</u> <u>normal decoration</u> . Perhaps is fracture in building. Cracks in brickwork visible on inspectio	walls (after Burland e ge bout 0.1 mm are <u>treated during</u> solated slight n external on.	Approximate crack width (mm) < 0.1 < 1	scardin and E Limiting tensile strain s _{lim} (per cent) 0.0–0.05 0.05–0.075			
Fig 2.18 (b)	-1- -1- 0.8- Kay	(<i>L/H</i>) = 1.	0 — (<i>L/H</i>) = 1.5	т H) = 0.5	Cable 2.5 Clacol Category of damage 0 0 Negligible 1 Very slight 2 Slight	ssification of visible damage to r rding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspectio <u>Cracks easily filled. Redecora</u> required. Several slight fractu of building. Cracks are visible <u>some repointing may be requi</u> ensure weathertightness. Doo may stick slightly	walls (after Burland e ge bout 0.1 mm are treated during solated slight a external on. <u>ation probably</u> res showing inside e externally and <u>ired externally</u> to rs and windows	Approximate crack width (mm) < 0.1 < 1 < 5	scardin and Limiting tensile strain s _{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15			
Fig 2.18 (b)	-1 -1 -0.8 - 1 -0.6 -0.4	(L/H) = 1.	0 	т H) = 0.5	Cable 2.5 Clacol Category of damage 0 0 Negligible 1 Very slight 2 Slight 3 Moderate	ssification of visible damage to r rding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecors required. Several slight fractu of building. Cracks are visible some repointing may be requi ensure weathertightness. Doo may stick slightly. The cracks require some oper patched by a mason. Recurrer masked by suitable linings. R external brickwork and possil of brickwork to be replaced. I windows sticking. Service pij Weathertightness often inmai	walls (after Burland e ge bout 0.1 mm are <u>treated during</u> solated slight n external on. <u>ation probably</u> wres showing inside e externally and <u>ired externally</u> to rs and windows <u>hing up and can be</u> epointing of. <u>bly a small amount</u> Doors and pes may fracture. red.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3	scardin and Limiting tensile strain E _{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3			
Fig 2.18 (b)	-1 -1 -0.8 - 1 -0.6 - 0.4 - 0.2	(L/H) = 1.	0 - (L/H) = 1.5	т H) = 0.5	Cable 2.5 Cla Correct Control Co	ssification of visible damage to trding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible. Fine cracks that can easily be normal decoration, Perhaps is fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecora required. Several slight fractu of building. Cracks are visible some repointing may be requi ensure weathertightness. Doo may stick slightly. The cracks require some oper patched by a mason. Recurrer masked by suitable linings. R external brickwork to be replaced. I windows sticking. Service pi Weathertightness often impair Extensive repair work involvi and replacing sections of wall doors and windows. Windows distorted, floor sloping notice or bulging noticeably, some le beams. Service pipes disrupte	walls (after Burland e ge bout 0.1 mm are treated during solated slight a external on. ation probably tres showing inside e externally and irred externally to rs and windows and windows and can be epointing of bly a small amount Doors and pes may fracture. red. ing breaking-out ls, especially over s and frames ably. Walls leaning oss of bearing in rd.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks	scardin and E Limiting tensile strain \mathbf{z}_{lim} (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			
Fig 2.18 (b)	-1 -1 -0.8 -0.6 -0.4 -0.2 -0.2	(L/H) = 1.	0 -(L/H) = 1.5 (L/H) = 1.5	н) = 0.5	Cable 2.5 Cla Col Table 2.5 Cla Col Category of damage 0 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe 5 Very severe	ssification of visible damage to (rding, 1989; and Burland, 2001) Description of typical dama (ease of repair is underlined) Hairline cracks of less than al classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspection Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be required. Several slight fractur of building. Cracks are visible some repointing may be required. The cracks require some oper patched by a mason. Recurrent masked by suitable linings. R external brickwork to be replaced. I windows sticking. Service pit Weathertightness often impair Extensive repair work involvit and replacing sections of wall doors and windows. Windows distorted, floor sloping notice or bulging noticeably, some Ib beams. Service pipes disrupte This requires a major repair in complete rebuilding. Beams I lean badly and require shoring with distortion. Danger of ins	walls (after Burland e ge bout 0.1 mm are treated during solated slight a external on. ation probably res showing inside e externally and ired externally to rs and windows and windows and can be at cracks can be epointing of bly a small amount Doors and pes may fracture. red. ing breaking-out ls. especially over s and frames ably. Walls leaning oss of bearing in ed. nvolving partial or ose bearings, walls g. Windows broken tability.	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks usually > 25 but depends on number of cracks.	scardin and • Limiting tensile strain \mathbf{s}_{tim} (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			

Potential Damage to Building

Soft to firm clays - Moderate

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 34		Neighbouring Property 2	No. 0	
	m	mm		m	mm
L	6.40	6400	L	0.00	0
н	12.00 1	12000	н	0.00	0
L/H	0.53		L/H	#DIV/0!	
Verticle Deflection (Δ)	1.5 mm	from graph (max difference	Verticle Deflection (Δ)	<mark>8</mark> mm	from graph (max difference
Defelction Ratio (Δ /L)	0.023438 %	between blue and orange line)	Defelction Ratio (Δ/L)	#DIV/0! %	between blue and orange line)
Horizontal Movement (δh)	2.40 mm	difference between horizontal movement at nearest and	Horizontal Movement (δh)	0.00	difference between horizontal movement at nearest and
Horzontal Strain (εh) = δh/L	0.03750 %	farthest walls	Horzontal Strain (ᢄh) = δh/L	#DIV/0! %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

L/H	0.53						L/H	H #DIV	/0!			
Negligible damage limit (Elim)	0.05			I	Negligible daı	mage limit (Elim)	0.0	5				
(Δ/L)/(Elim) (Eh)/(Elim)	0.46875 0.75	Plot this point on fig2.18 below the appropriate L/ into 'negligible' category	 (b) if the plotted point is (H line then damage falls - no need to plot points 		(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H li category - n	2.18 (b) if the ne then dama o need to plo	plotted point i ge falls into 'ne points below	s below egligible'
Very Slight damage limit (Elim)	0.075			,	Very Slight da	amage limit (Elim)	0.07	5				
(Δ/L)/(Elim) (Eh)/(Elim)	0.3125 0.5	Plot this point on fig2.18 below the appropriate L/ into 'very slight' category	(b) if the plotted point is 'H line then damage falls y - no need to plot points		(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H li category - n	2.18 (b) if the ne then dama o need to plo	plotted point i ge falls into 've points below	s below ery slight'
Slight damage limit (Elim)	0.15			5	Slight damage	e limit (Elim)	0.1	5				
(Δ/L)/(Elim) (Eh)/(Elim)	0.15625 0.25	Plot this point on fig2.18 below the appropriate L/ into 'slight' category - no r	(b) if the plotted point is 'H line then damage falls need to plot points below	,	(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the ap	s point on fig propriate L/F category - n	2.18 (b) if the I line then da o need to plo	plotted point i nage falls into points below	s below 'slight'
Moderate damage limit (Elim)	0.3			I	Moderate da	mage limit (Elim)	0.3	3				
(Δ/L)/(Elim) (Eh)/(Elim)	0.078125 0.125	Plot this point on fig2.18 below the appropriate L/ into 'moderate' category - damage i	(b) if the plotted point is 'H line then damage falls · if the point is not below, s 'severe'		(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr catego	s point on fig opriate L/H li ory - if the po	2.18 (b) if the ne then dama nt is not belo	plotted point i ge falls into 'm w, damage is 's	s below oderate' severe'
Calculated Category of Damage		Negligible		(Calculated Ca	itegory of Damage						
Fig 2.18 (b)				-	Table 2.5	scification of visible domage to u	valls (affar Purland	ot al 1077 Par	cordin and			
Fig 2.18 (b)	1			-	Table 2.5	ssification of visible damage to v ding, 1989; and Burland, 2001)	valls (after Burland	et al, 1977, Bos	scardin and			
Fig 2.18 (b) - 1.2		<i>(L/H</i>) = 1.0)	-	Table 2.5 Table 2.5 Category of damage	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined)	valls (after Burland ge	et al, 1977, Bos Approximate crack width (mm)	scardin and Limiting tensile strain ε _{lim} (per cent)			
Fig 2.18 (b) - 1.2	-	<i>(L/H</i>) = 1.0)	-	Table 2.5 Table 2.5 Category of damage 0 Negligible	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible.	valls (after Burland ge pout 0.1 mm are	et al, 1977, Bos Approximate crack width (mm) < 0.1	scardin and Limiting tensile strain ε _{lim} (per cent) 0.0–0.05			
Fig 2.18 (b) - 1.2 -1 —		(<i>L/H</i>) = 1.0) - (<i>L/H</i>) = 1.5		Table 2.5 Cla. Cor Table 2.5 Cla. Cor Category of damage 0 0 Negligible 1 Very slight	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. <u>Fine cracks that can easily be</u> normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspectio	valls (after Burland ge pout 0.1 mm are <u>treated during</u> plated slight external m.	et al, 1977, Bos Approximate crack width (mm) < 0.1 < 1	scardin and Limiting tensile strain ε _{lim} (per cent) 0.0–0.05 0.05–0.075			
Fig 2.18 (b) - 1.2 -1 - -1 - -0.8 -		(<i>L/H</i>) = 1.0) - (<i>L/H</i>) = 1.5	/H) = 0.5	Cable 2.5 Cla. Cor Category of damage Cor 0 Negligible 1 Very slight 2 Slight	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration, Perhaps iso fracture in building. Cracks in brickwork visible on inspectio <u>Cracks easily filled. Redecorar required</u> . Several slight fractur of building. Cracks are visible <u>some repointing may be requir</u> ensure weathertightness. Door may stick slightly.	valls (after Burland ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside e externally and red externally to is and windows	et al, 1977, Bos Approximate crack width (mm) < 0.1 < 1 < 5	Limiting tensile strain $\mathbf{\epsilon}_{lim}$ (per cent) 0.0–0.05 0.05–0.075 0.075–0.15			
Fig 2.18 (b) - 1.2 - 1.2 - 1 - 0.8 - 0.6 - 0.4		(L/H) = 1.0	-(L/H) = 1.5	/H) = 0.5	Table 2.5 Clarcor Table 2.5 Clarcor Category of damage 0 0 Negligible 1 Very slight 2 Slight 3 Moderate	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair	valls (after Burland ge pout 0.1 mm are <u>treated during</u> olated slight external m. <u>tion probably</u> res showing inside externally and <u>red externally</u> to a and windows <u>ing up and can be</u> <u>treacks can be</u> <u>epointing of.</u> <u>ly a small amount</u> Doors and es may fracture. ed.	et al, 1977, Bos Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3	Scardin and Limiting tensile strain ϵ_{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3			
Fig 2.18 (b) - 1.2 - 1.2 1 - 0.8 - 0.8 - 0.4 - 0.4 - 0.2		(L/H) = 1.0) - (<i>L/H</i>) = 1.5	/H) = 0.5	Table 2.5 Cla. Cor Category of damage 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iss fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticee or bulging noticeably, some lo beams. Service pipes disrupted	valls (after Burland ge pout 0.1 mm are <u>treated during</u> olated slight external on. <u>tion probably</u> res showing inside externally and <u>red externally</u> to rs and windows <u>ing up and can be</u> <u>tracks can be</u> <u>epointing of</u> . <u>ily a small amount</u> Doors and es may fracture. ed. <u>ing breaking-out</u> <u>s, especially over</u> and frames ably. Walls leaning poss of bearing in d.	et al, 1977, Bos Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks	scardin and Limiting tensile strain ϵ_{lim} (per cent) 0.0-0.05 0.05-0.075 0.05-0.15 0.15-0.3 > 0.3			
Fig 2.18 (b) - 1.2 - -1 -1 -0.8 - - 0.4 - - 0.2 - 0		(L/H) = 1.0	-(L/H) = 1.5	/H) = 0.5	Table 2.5 Cla. Cor Table 2.5 Cla. Cor Category of damage 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe 5 Very severe	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps isa fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticer or bulging noticeably, some lo beams. Service pipes disrupted This requires a major repair in complete rebuilding. Beams lo lean badly and require shoring with distortion. Danger of inst	valls (after Burland ge pout 0.1 mm are treated during olated slight external m. tion probably res showing inside externally and red externally to rs and windows ing up and can be treacks can be externally and red externally to rs and windows ing up and can be treacks can be epointing of ly a small amount Doors and es may fracture. ed. ing breaking-out s, especially over and frames ably. Walls leaning iss of bearing in d. involving partial or ose bearings, walls g. Windows broken iability.	et al, 1977, Box Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks usually > 25 but depends on number of cracks.	scardin and Limiting tensile strain ϵ_{lim} (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			

Soft to firm clays - Realsitic

(a) Definition of deflection ratio.

Neighbouring Property 1	No. 34		Neighbouring Property 2	No. 0	
	m r	nm		m	mm
L	6.40 64	400	L	0.00	0
н	12.00 120	000	н	0.00	0
L/H	0.53		L/H	#DIV/0!	
Verticle Deflection (Δ)	1 mm	from graph (max difference	Verticle Deflection (Δ)	mm	from graph (max difference
		between blue and orange line)			between blue and orange line)
Defelction Ratio (Δ /L)	0.015625 %		Defelction Ratio (Δ /L)	#DIV/0! %	
Horizontal Movement (δh)	2.40 mm	difference between horizontal	Horizontal Movement (δh)	0.00	difference between horizontal
Horzontal Strain (Eh) = δ h/L	0.03750 %	farthest walls	Horzontal Strain (٤h) = δh/L	#DIV/0! %	farthest walls

CATEGORY OF DAMAGE

Damage category limits are given in Table 2.5 (below) you will also need Fig 2.18 (also shown below).

L/H	0.53						L/H	I #DIV	/0!			
Negligible damage limit (Elim)	0.05			I	Negligible daı	mage limit (Elim)	0.05	i				
(Δ/L)/(Elim) (Eh)/(Elim)	0.3125 0.75	Plot this point on fig2. below the appropriate into 'negligible' catego	18 (b) if the plotted point is e L/H line then damage falls ory - no need to plot points	5 ((Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H I category - n	2.18 (b) if th ine then dan o need to pl	e plotted po nage falls inte ot points bel	int is below o 'negligible' ow
Very Slight damage limit (Elim)	0.075			N	Very Slight da	amage limit (Elim)	0.075	i				
(Δ/L)/(Elim) (Eh)/(Elim)	0.208333333 0.5	Plot this point on fig2. below the appropriate into 'very slight' categ	18 (b) if the plotted point is e L/H line then damage falls ory - no need to plot points		(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr	s point on fig opriate L/H li category - n	2.18 (b) if th ine then dan o need to pl	e plotted po hage falls into ot points bel	int is below o 'very slight' ow
Slight damage limit (Elim)	0.15			9	Slight damage	e limit (Elim)	0.15	i				
(Δ/L)/(Elim) (Eh)/(Elim)	0.104166667 0.25	Plot this point on fig2. below the appropriate into 'slight' category - r	18 (b) if the plotted point is e L/H line then damage falls no need to plot points below	5 () () ()	(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the ap	s point on fig propriate L/H category - n	2.18 (b) if th I line then d o need to pl	e plotted po amage falls in ot points bel	int is below nto 'slight' ow
Moderate damage limit (Elim)	0.3			I	Moderate da	mage limit (Elim)	0.3	5				
(Δ/L)/(Elim) (Eh)/(Elim)	0.052083333 0.125	Plot this point on fig2. below the appropriate into 'moderate' catego damag	18 (b) if the plotted point is e L/H line then damage falls ry - if the point is not below ge is 'severe'	5 () , ,	(Δ/L)/(Elim) (Eh)/(Elim)		#DIV/0! #DIV/0!	Plot thi the appr catego	s point on fig opriate L/H I ory - if the po	2.18 (b) if th ine then dan int is not be	e plotted po hage falls into ow, damage	int is below o 'moderate' is 'severe'
Calculated Category of Damage		Negligible		(Calculated Ca	itegory of Damage						
Fig 2.18 (b)				T	Table 2.5							
Fig 2.18 (b)	1			٦	Table 2.5 Table 2.5 Cla Cor	ssification of visible damage to v rding, 1989; and Burland, 2001)	valls (after Buriand e	et al, 1977, Bos	scardin and			
Fig 2.18 (b)	2	(17H) = 1	0	T	Table 2.5 Table 2.5 Cla Cor Category of damage	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined)	valls (after Burland e ge	et al, 1977, Bos Approximate crack width (mm)	scardin and • Limiting tensile strain ɛ _{lim} (per cent)			
Fig 2.18 (b) - 1	.2 –	<i>(L/H</i>) = 1	.0	T	Table 2.5 Clarcon Table 2.5 Clarcon Category of damage 0 0 Negligible	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible.	valls (after Burland e ge vout 0.1 mm are	et al, 1977, Bos Approximate crack width (mm) < 0.1	e Limiting tensile strain s _{lim} (per cent) 0.0–0.05			
Fig 2.18 (b) - 1 -1	.2 -	(<i>L/H</i>) = 1	.0 — (<i>L/H</i>) = 1.5	7	Table 2.5 Clarcon Table 2.5 Clarcon Category of damage O 0 Negligible 1 Very slight	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. <u>Fine cracks that can easily be</u> normal decoration, Perhaps iso fracture in building. Cracks in brickwork visible on inspectio	yalls (after Burland e ge wout 0.1 mm are <u>treated during</u> plated slight external n.	Approximate crack width (mm) < 0.1 < 1	scardin and E Limiting tensile strain E _{lim} (per cent) 0.0–0.05 0.05–0.075			
Fig 2.18 (b) - 1 - 1 - 1	.2 -	(<i>L/H</i>) = 1	0 — (<i>L/H</i>) = 1.5	/H) = 0.5	Table 2.5 Clarcon Table 2.5 Clarcon Category of damage 0 0 Negligible 1 Very slight 2 Slight	ssification of visible damage to w rding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio <u>Cracks easily filled. Redecorat required.</u> Several slight fractur of building. Cracks are visible <u>some repointing may be required</u> .	valls (after Burland e ge yout 0.1 mm are treated during olated slight external n. tion probably res showing inside externally and red externally to a and windows	Approximate crack width (mm) < 0.1 < 1	scardin and Limiting tensile strain s _{lim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15			
Fig 2.18 (b) - 1 - 1 - 1 - 1 - 0	.2 -	(L/H) = 1	-(L/H) = 1.5	JH) = 0.5	Table 2.5 Clarcon Table 2.5 Clarcon Category of damage 0 0 Negligible 1 Very slight 2 Slight 3 Moderate	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be require ensure weathertightness. Door may stick slightly.	valls (after Burland e ge oout 0.1 mm are <u>treated during</u> olated slight external n. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to s and windows	Approximate crack width (mm) < 0.1 < 1 < 5	scardin and • Limiting tensile strain \mathbf{z}_{iim} (per cent) 0.0–0.05 0.05–0.075 0.075–0.15			
Fig 2.18 (b) - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	.2 - .8 - K,	(L/H) = 1	-(L/H) = 1.5	JH) = 0.5	Table 2.5 Cla. Cor Table 2.5 Cla Category of damage 0 0 Negligible 1 Very slight 2 Slight 3 Moderate	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair	valls (after Burland e ge out 0.1 mm are <u>treated during</u> olated slight external n. <u>tion probably</u> res showing inside e externally and <u>red externally</u> to is and windows <u>ing up and can be</u> <u>t cracks can be</u> <u>epointing of</u> <u>ly a small amount</u> Doors and es may fracture. ed.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3	 Limiting tensile strain sim (per cent) 0.0–0.05 0.05–0.075 0.075–0.15 0.15–0.3 			
Fig 2.18 (b) - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	.2 - .8 - K,y, .6	$(L/H) = 1$ 3.0 $U_{H}y = 4.0$	-(L/H) = 1.5	/H) = 0.5	Table 2.5 Cla. Cor Category of damage 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps is fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorat required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork and possib of brickwork to be replaced. I windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticea or bulging noticeably, some lo beams. Service pipes disrupted	valls (after Burland e ge out 0.1 mm are <u>treated during</u> olated slight external n. <u>tion probably</u> res showing inside externally and <u>red externally</u> to s and windows <u>ing up and can be</u> <u>t cracks can be</u> epointing of. <u>ly a small amount</u> oors and es may fracture. ed. <u>ng breaking-out</u> <u>s especially over</u> and frames ably. Walls leaning iss of bearing in d.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks	scardin and E Limiting tensile strain \mathbf{z}_{lim} (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			
Fig 2.18 (b) -1 -1 -1 -1 -1 -0 -0 -0 -0 -0 -0	.2 - .8 - K,	(L/H) = 1	(L/H) = 1.5	JH) = 0.5	Table 2.5 Cla. Cor Table 2.5 Cla. Cor Category of damage 0 Negligible 1 Very slight 2 Slight 3 Moderate 4 Severe 5 Very severe	ssification of visible damage to w ding, 1989; and Burland, 2001) Description of typical damag (ease of repair is underlined) Hairline cracks of less than ab classed as negligible. Fine cracks that can easily be normal decoration. Perhaps iso fracture in building. Cracks in brickwork visible on inspectio Cracks easily filled. Redecorar required. Several slight fractur of building. Cracks are visible some repointing may be requir ensure weathertightness. Door may stick slightly. The cracks require some open patched by a mason. Recurren masked by suitable linings. Re external brickwork to be replaced. D windows sticking. Service pip Weathertightness often impair Extensive repair work involvir and replacing sections of wall doors and windows. Windows distorted, floor sloping noticee or bulging noticeably, some lo beams. Service pipes disrupted This requires a major repair in complete rebuilding. Beams lo lean badly and require shoring with distortion. Danger of inst	valls (after Burland e ge out 0.1 mm are <u>treated during</u> olated slight external n. <u>tion probably</u> res showing inside externally and <u>red externally</u> to s and windows <u>ing up and can be</u> <u>t cracks can be</u> <u>epointing of.</u> <u>ly a small amount</u> oors and es may fracture. ed. <u>ing breaking-out</u> <u>s especially over</u> and frames ably. Walls leaning uss of bearing in <u>d.</u> <u>wolving partial or</u> ose bearings, walls p. Windows broken iability.	Approximate crack width (mm) < 0.1 < 1 < 5 5–15 or a number of cracks > 3 15–25 but also depends on number of cracks usually > 25 but depends on number of cracks.	scardin and • Limiting tensile strain sim (per cent) 0.0-0.05 0.05-0.075 0.075-0.15 0.15-0.3			

