Appendix D: Building Damage Ground Movement Assessment

Saville Theatre

Building Damage Ground Movement Assessment

April 2025

3722-A2S-XX-XX-RP-Y-0002-03

Project Name	Saville Theatre
Project Number	3722
Client	Yoo Capital Limited
Document Name	Building Damage Ground Movement Assessment

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Document Reference	Status	Notes	Revision	Issued by	Date
3722-A2S-XX-XX-RP-Y-0002-00	First Issue	-	00	JT	24.01.2025
3722-A2S-XX-XX-RP-Y-0002-01	Second Issue	Minor revision to proposed development detail	01	JT	30.01.2025
3722-A2S-XX-XX-RP-Y-0002-02	Third Issue	Secant pile wall	02	JT	04.04.2025
3722-A2S-XX-XX-RP-Y-0002-03	Fourth Issue	Updated scheme drawings	03	JT	07.04.2025

Contents

1. Introduction

A-squared Studio Engineers Ltd (A-squared) has been engaged by Yoo Capital Ltd (Yoo Capital) to prepare a ground movement assessment (GMA) for the proposed development at Saville Theatre, 135 Shaftesbury Avenue, London, WC2H 8AH (herein called the 'site').

The scope of this report comprises an assessment of the potential impact of ground movements associated with demolition, excavation and construction works on the existing retained building facades and on the neighbouring properties in proximity to the proposed development.

1.1. Study Aims and Objectives

A ground movement and impact assessment has been undertaken to estimate the potential damage induced by the proposed development works on the existing retained building facades and on the neighbouring properties.

The proposed commercial redevelopment comprises the extension of the existing two-storey basement to a five-storey basement while maintaining the existing basement footprint. The works will involve the partial demolition of the existing structure with partial retention of the building facades, followed by the construction of a five-storey vertical extension plus plant level on top of the existing building. The basement will extend to a depth of approximately 22.21m bgl. The facades on the southeast, southwest and northeast elevations will be fully retained, while the northwest elevation will be partially preserved.

The assessment encompasses the neighbouring buildings located within the *zone of influence* of the proposed scheme. The GMA is based on *greenfield* ground movements which are unlikely to be exceeded. The adopted assessment methodology provides a robust and conservative assessment, representative of current industry best practice, as detailed in Section 4.

The assessment carried out and described herein aims to:

- Assess the impact on ground movements induced by the proposed works on adjacent properties.
- Provide performance criteria and inform aspects of substructure construction and design.

This report provides a detailed description of the:

- Site and proposed development.
- Modelling parameters and input.
- Analyses and results.

1.2. Information Sources

The principal sources of information which have informed the assessment include the following:

- *Desk Study & Ground Investigation Report* prepared by Geotechnical & Environmental Associated Limited, dated 15 December 2017 (doc. ref. J17183 Issue 1).
- *Land Contamination Risk Management Preliminary Risk Assessment* prepared by Pell Frischmann Consultants Limited, dated 24 January 2024 (doc. ref. 105465-PEF-ZZ-XX-RP-GG-600001 rev P02).
- *Pile Loads* Mark-Up prepared by Elliott Wood Partnership Limited, dated 8 January 2025.
- *Existing loads (Based on assumptions)* prepared by Elliott Wood Partnership Limited, received 07 January 2025.
- Proposed scheme drawings prepared by Elliott Wood Partnership Limited, dated February 2018 to May 2024 (doc. refs. 2111-EWP-ST-B4-DR-S-060000 WIP, B3-DR-S-070000 WIP, B2-DR-S-080000 WIP, B1-DR-S-090000 WIP, B1-DR-S-095000 WIP, B1-DR-S-097000 P01, 00-DR-S-100000 WIP, XX-DR-S-200000 P01, XX-DR-S-200001 P01).

- Proposed scheme drawings prepared by Elliott Wood Partnership Limited, dated June 2024 (doc. refs. 2240073-EWP-ZZ-B4-SK-S-0030 P2, B3-SK-S-0031 P1, B2-SK-S-0032 P1, B1-SK-S-0033 P1, 0G-SK-S-0034 to 0035 P1, 01-SK-S-0036 P1, 02-SK-S-0037 P1, 03-SK-S-0038 P1, 04-SK-S-0039 P1, 05-SK-S-0040 P1, 06-SK-S-0041 P1, 07-SK-S-0042 P1, 08-SK-S-0043 P1, 09-SK-S-0044 P1, 10-SK-S-0045 P1, 11-SK-S-0046 P1, ZZ-SK-S-0047 P1, XX-SK-S-0048 P1, XX-SK-S-0049 P1).
- *Proposed Sequence Sketches* prepared by Elliott Wood Partnership Limited, dated January 2025 (doc. ref. 2240073-EWP-ZZ-XX-S2-S-XXX P1).
- *Site Section – Existing Building* prepared by Elliott Wood Partnership Limited, dated January 2025 (doc. refs. 2240073-EWP-ZZ-XX-SK-S-0077 to 0078 P1).
- Existing building drawings prepared by Buckley Gray Yeoman Limited, dated May 2024 (doc. refs. 1232-PL-ES-01 to 02 P1).
- Existing building drawings prepared by DSDHA Limited, dated November 2024 (doc. refs. 125SA-DSD-ZZ-ZZ-DR-A-23001 to 23003 P01).
- Existing building drawings prepared by SPPARC Architecture LLP, dated May 2024 (doc. refs. 2111-SPP-ST-B2-DR-A-02-1001 P0.02, B1-DR-A-02-1002 P0.02, 0G-DR-A-02-1003 P0.02, 01-DR-A-02-1004 P0.02, 02-DR-A-02-1005 P0.02, 03-DR-A-02-1006 P0.02, 04-DR-A-02-1007 P0.02, 05-DR-A-02-1008 P0.02, RF-DR-A-02-1009 P0.02,ZZ-DR-A-02-0001 to 3004 P0.02).
- Archive drawings prepared by T.P. Bennett & Son, dated February 1930 (drawing nos. 20 to 52)

2. Site Setting

2.1. Site Location

The proposed development is located at Saville Theatre, 135 Shaftesbury Avenue, London, WC2H 8AH, as shown in Figure 2.1. The approximate National Grid reference is 529977E, 181149N. The site is relatively flat across the entire footprint, with an approximate ground level between +22.50mOD and +23.00mOD. The development falls within the administrative boundaries of the London Borough of Camden and is currently occupied by a Grade II listed six- and seven-storey commercial building with a double-storey basement.

The island site is bound by Shaftesbury Avenue to the southeast, Stacey Street to the southwest, New Compton Street to the northwest and St Giles Passage to the northeast.

Figure 2.1 Location of the proposed development outlined in red

2.2. Proposed Development

The proposed commercial redevelopment comprises the extension of the existing two-storey basement to a five-storey basement while maintaining the existing basement footprint. The works will involve the partial demolition of the existing structure with partial retention of the building facades, followed by the construction of a five-storey vertical extension plus plant level on top of the existing building. The basement will extend to a depth of approximately 22.21m bgl. The facades on the southeast, southwest and northeast elevations will be fully retained, while the northwest elevation will be partially preserved.

The proposed building loads will be supported by a suspended slab on pile foundations with steel plunge columns to support the top-down construction methodology.

The proposed basement plan is presented in Figure 2.2 and Figure 2.3.

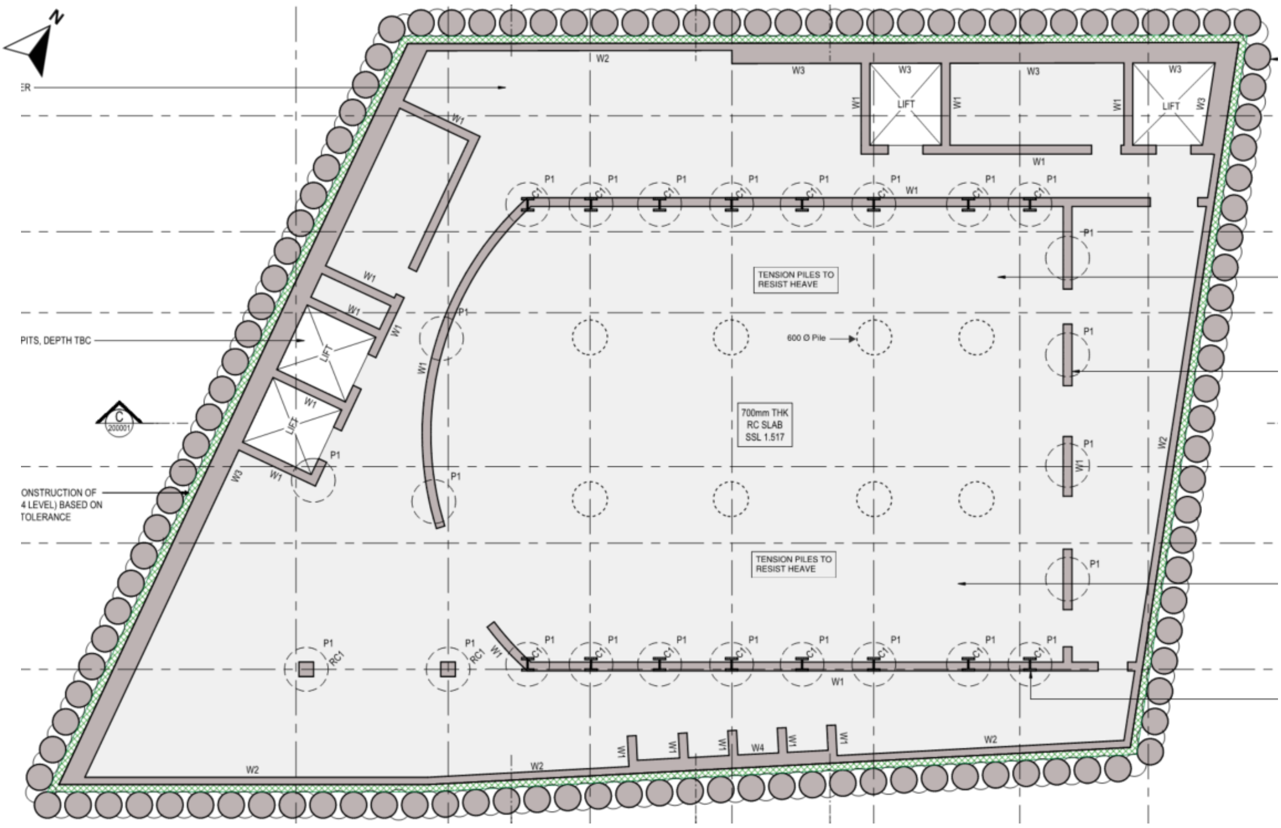

Figure 2.2 Proposed B4 level plan (source: *2111-EWP-ST-B4-DR-S-060000 WIP 21/05/2025*)

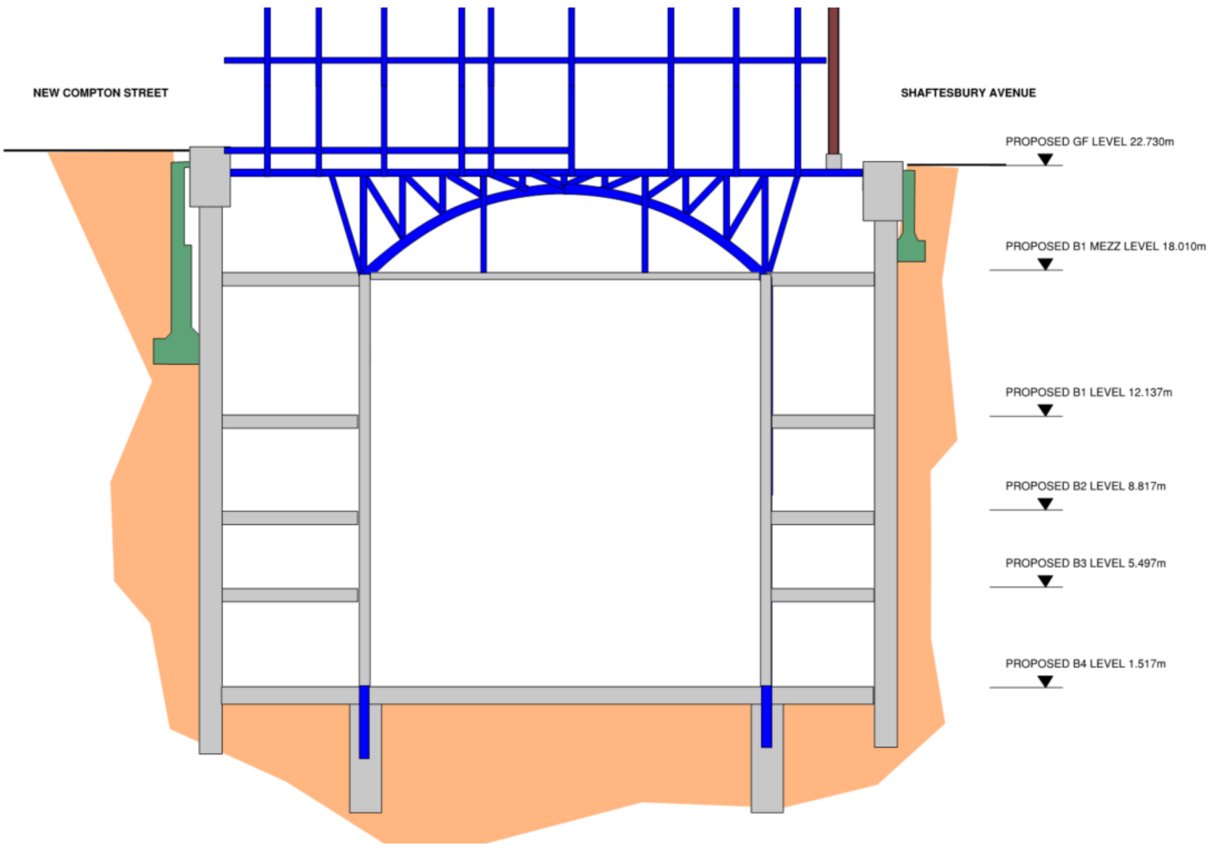

Figure 2.3 Proposed Basement Section (source: *Proposed Sequence Sketches prepared by Elliott Wood Partnership Limited, dated January 2025 (doc. ref. 2240073-EWP-ZZ-XX-S2-S-XXX P1)*)

3. Ground Conditions

The ground model and geotechnical parameters adopted for the GMA have been determined based on a review of the site-specific ground investigation, undertaken by Geotechnical & Environmental Associated Limited from October to November 2017, and nearby historical BGS boreholes.

The ground conditions were found to comprise of the following strata (in order of succession):

- **Made Ground:** Dark brown silty sandy very gravelly CLAY with brick and concrete fragments.
- **Lynch Hill Gravel Member:** Medium dense orange-brown coarse gravelly SAND.
- **London Clay Formation:** Firm becoming very stiff dark brownish grey silty slightly sandy becoming very sandy CLAY.
- **Lambeth Group:** Very stiff greenish grey mottled brown very silty, slightly sandy CLAY interbedded with very dense SAND.
- **Thanet Formation:** Very dense dark grey silty SAND.
- **Chalk Group:** Extremely weak low density white CHALK.

The above includes the strata of engineering interest and significance, taking cognizance of the scale of the proposed development and zone of influence. The ground model adopted for this assessment is presented Table 3.1.

Table 3.1 Ground model and geotechnical parameters adopted for the assessment

Stratum	Top of Stratum (mOD)	Thickness (m)	Bulk Unit Weight (kN/m^3)	Undrained Young's Modulus, $E_{u,v}$ [2] (MPa)	Drained Young's Modulus, E_v' [2] (MPa)
Made Ground	+22.73	3.50	18		10
Lynch Hill Gravel Member	+19.23	1.23	19	-	34
London Clay Formation	+18.00	30.00	20	25 + 2.8z [4]	20 + 2.2z
Lambeth Group	-12.00	15.50	20	125	100
Thanet Formation	-27.50	4.20	20	-	150
Chalk Group	-31.70	33.30 (to rigid boundary) [3]	20	-	175 + 2z [5]

[1] The ground model and geotechnical parameters have been derived solely for the purposes of this assessment.

[2] The stiffness data (E and E') has been evaluated empirically taking into consideration the nature of the geotechnical/soil-structure interaction mechanisms and level of anticipated strain within the soil mass.

[3] Rigid boundary assumed at -65.00mOD for analytical purposes as this is within the Chalk bedrock which is significantly stiff.

[4] z = depth below top of stratum

[5] 2MPa/m increase with depth derived from nearby publicly available deep boreholes.

4. Impact Assessment Methodology

4.1. Overview

A series of three-dimensional models of the proposed scheme have been developed in Oasys PDisp / XDisp software and combined by means of superposition to enable ground movement assessments to be carried out representing the various construction stages. The ground movement displacement fields have been separated into two groups (A and B) based on the approach followed, detailed below:

Group A – Unloading / Loading ground movements

A1. Building demolition and basement excavation (short-term).

A2. Building demolition, basement excavation and application of the proposed building loading (long-term).

Group B – CIRIA-based ground movements

B1. Secant pile wall installation and basement excavation.

B2. Secant pile wall installation, basement excavation and application of the building loading (long-term).

The Group A assessments are based on *greenfield* ground movements evaluated from linear half space (PDisp) analyses and focus on vertical ground movements induced by the overburden removal unloading and re-loading processes. The modelled loading is summarised in Section 4.2.

The Group B assessments adopt the normalised ground displacement curves reported in CIRIA C760. In addition to the effects arising from the excavation, the ground movements effects associated with the installation of the secant pile wall have been considered. The following CIRIA C760 normalised ground movement curves have been adopted to assess ground movements due to retention system installation and excavation works:

- *Secant pile wall installation:* Installation of contiguous bored pile wall in stiff clay.
- *Excavation to formation:* Excavation in front of a high stiffness wall in stiff clay.

The “Installation of contiguous bored pile wall in stiff clay” CIRIA C760 curve has been adopted as it provides a more representative ground movement field for this assessment. It is widely accepted in the industry that the “Installation of secant bored pile wall in stiff clay” dataset is an upper bound for the movements induced by embedded pile wall installations – based on data measured in the field – and the contiguous curve presents a better fit to the empirical data set. For this reason, the contiguous pile wall curve has been adopted for the analysis presented herein.

In the B2 assessment, the CIRIA ground movements are combined with the long-term settlements induced by the proposed building loading (evaluated in PDisp).

The two sets of analyses enable the production of an *envelope* of damage classification results, with the worst-case results presented herein. A representative geometry has been adopted for defining the excavation/installation geometry implemented in the 3D modelling efforts. Figure 4.1 shows the XDisp model geometry used to determine the impact of the proposed development works on the existing retained building facades and on the surrounding buildings.

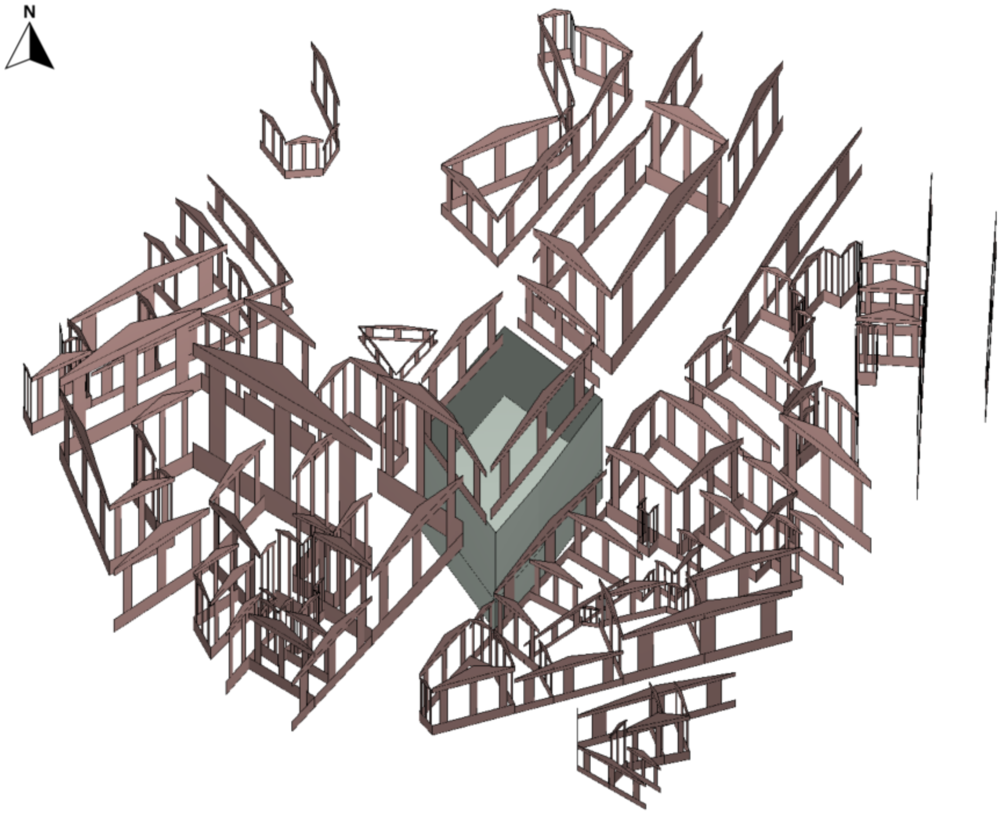

Figure 4.1 XDisp model geometry

4.2. Loading

Demolition loads have been provided by Elliott Wood Partnership Ltd (Elliott Wood) and excavation loads have been determined by the amount of soil that is required to be removed to reach formation level; these have both been modelled as an upward vertical surcharge. The following surcharges considered in this stage are shown below:

- Demolition of existing structure, applied at the existing B2 assumed formation level (+14.25mOD) = -111kPa.
- Basement excavation applied at the proposed B4 formation level, +0.617mOD = -285kPa.

The permanent building load has been modelled as a vertical surcharge in conjunction with the unloading pressures listed above. The loading applied to the bearing piles and the secant wall piles has been summed into groups, and the settlements have been analysed using the equivalent raft concept. This concept assumes that the load is applied at a depth of 2L/3, where L is the expected length of the piles from the proposed B4 formation level. Pile lengths are based on a preliminary axial capacity analysis for the pile loads provided by Elliott Wood. Pile lengths assumed for the assessment are as follows:

- Secant wall piles, 900mm diameter at 1500mm c.c. spacing, toe level = -9.00mOD.
- Bearing piles, 1500mm diameter, average toe level = -21.30mOD.

Following the revision of the contiguous pile wall to a secant pile wall, the required toe level for axial stability has deepened from -9.00mOD to -12.00mOD due to the increased spacing between the load bearing piles. The longer secant piles will transfer the load to deeper, stiffer soil layers, however for a more conservative analysis, the load spread level assuming the shorter contiguous piles is retained.

The load is assumed to spread from the perimeter of the group at a slope of 1 horizontal to 4 vertical to allow for that part of the load to be transferred by skin friction to the surrounding soil.

These induced ground movements will extend over a given zone of influence surrounding the building footprint. The pressure to represent the building load is as follows:

- Secant pile wall loading applied 2L/3 from B4 formation level (-5.79mOD) = 255kPa.
- Bearing pile loading applied 2L/3 from B4 formation level (-13.99mOD) = 206kPa.

The locations of the applied loads are shown in Figure 4.2 and Figure 4.3.

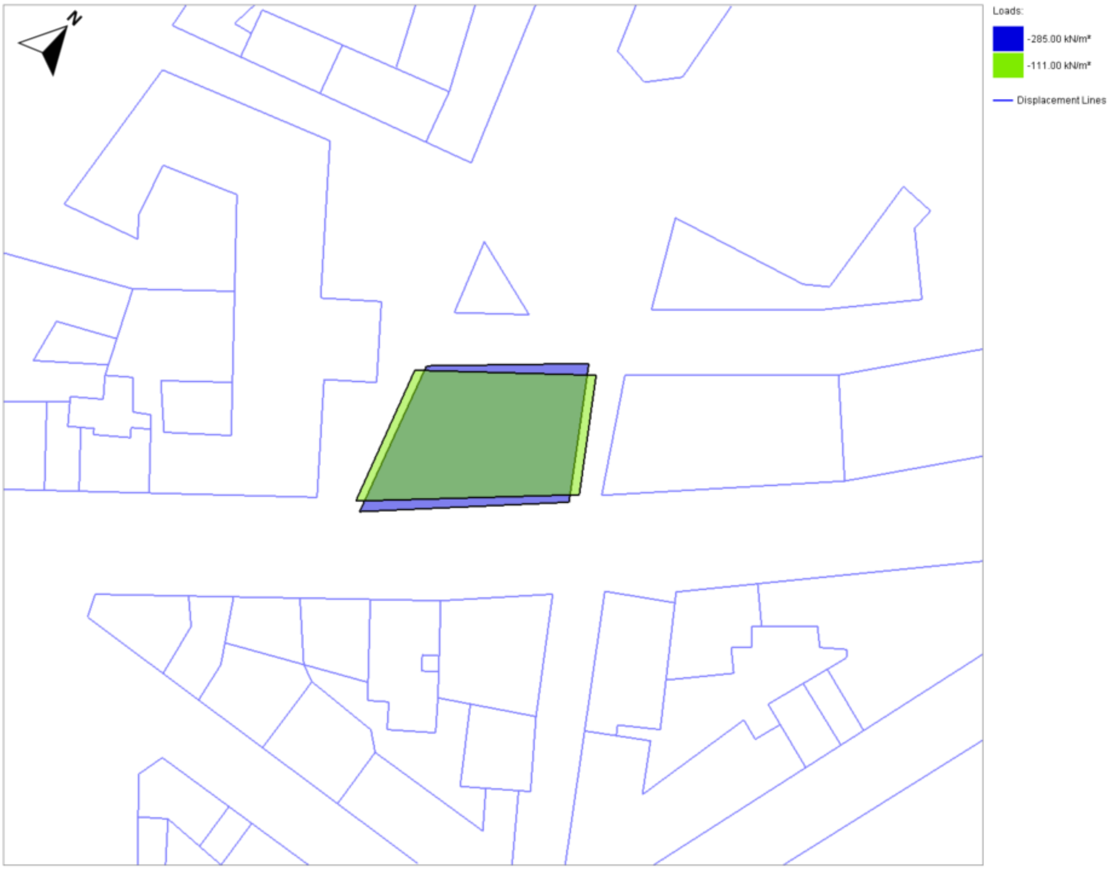

Figure 4.2 PDisp demolition and basement excavation unloading pressures

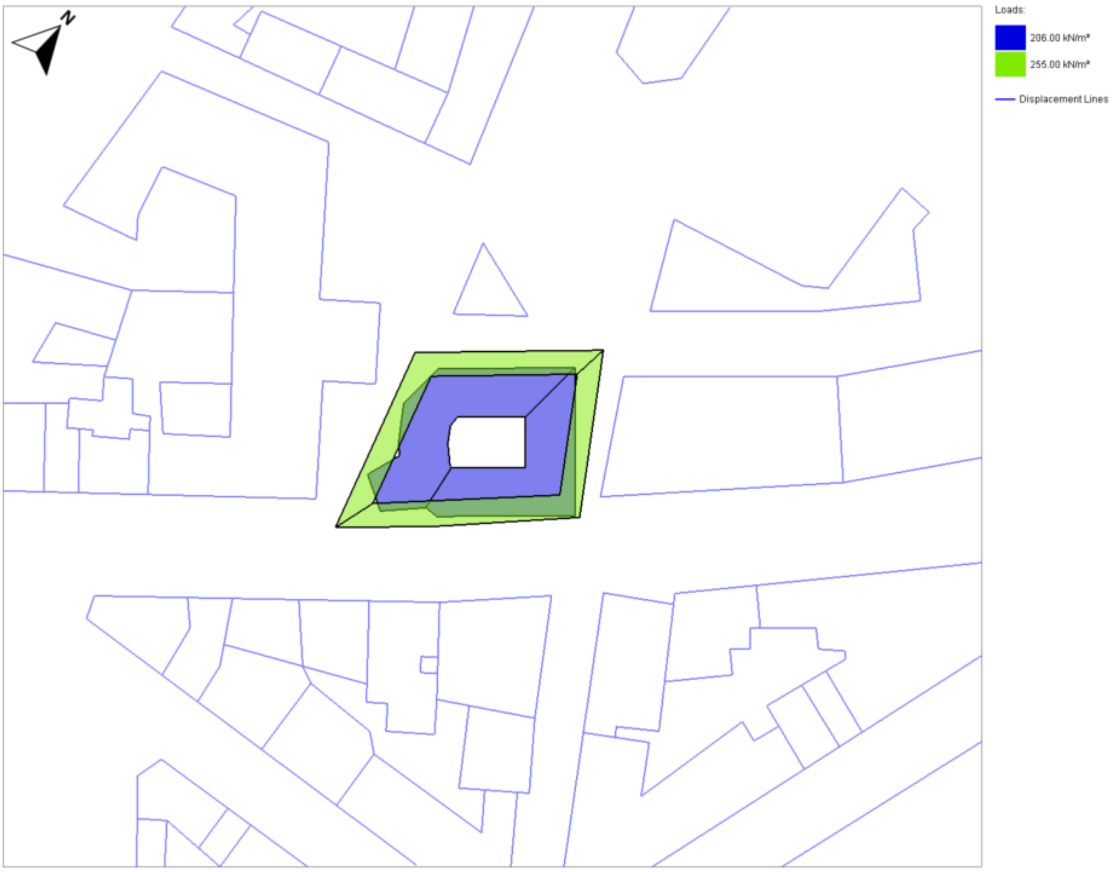

Figure 4.3 PDisp long-term building loading pressures

4.3. Impact Assessment

The potential impact/damage induced on primary façade/wall elements of the buildings surrounding the proposed scheme have been evaluated based on the calculated ground movement fields. The arrangement presents an array of façades running both perpendicular and parallel to the proposed basement (covering the key deformation mechanisms). In total, 150No. façades of the existing retained building and of the neighbouring buildings were considered for the current study. The nomenclature of the building façades is shown in Figure 4.4.

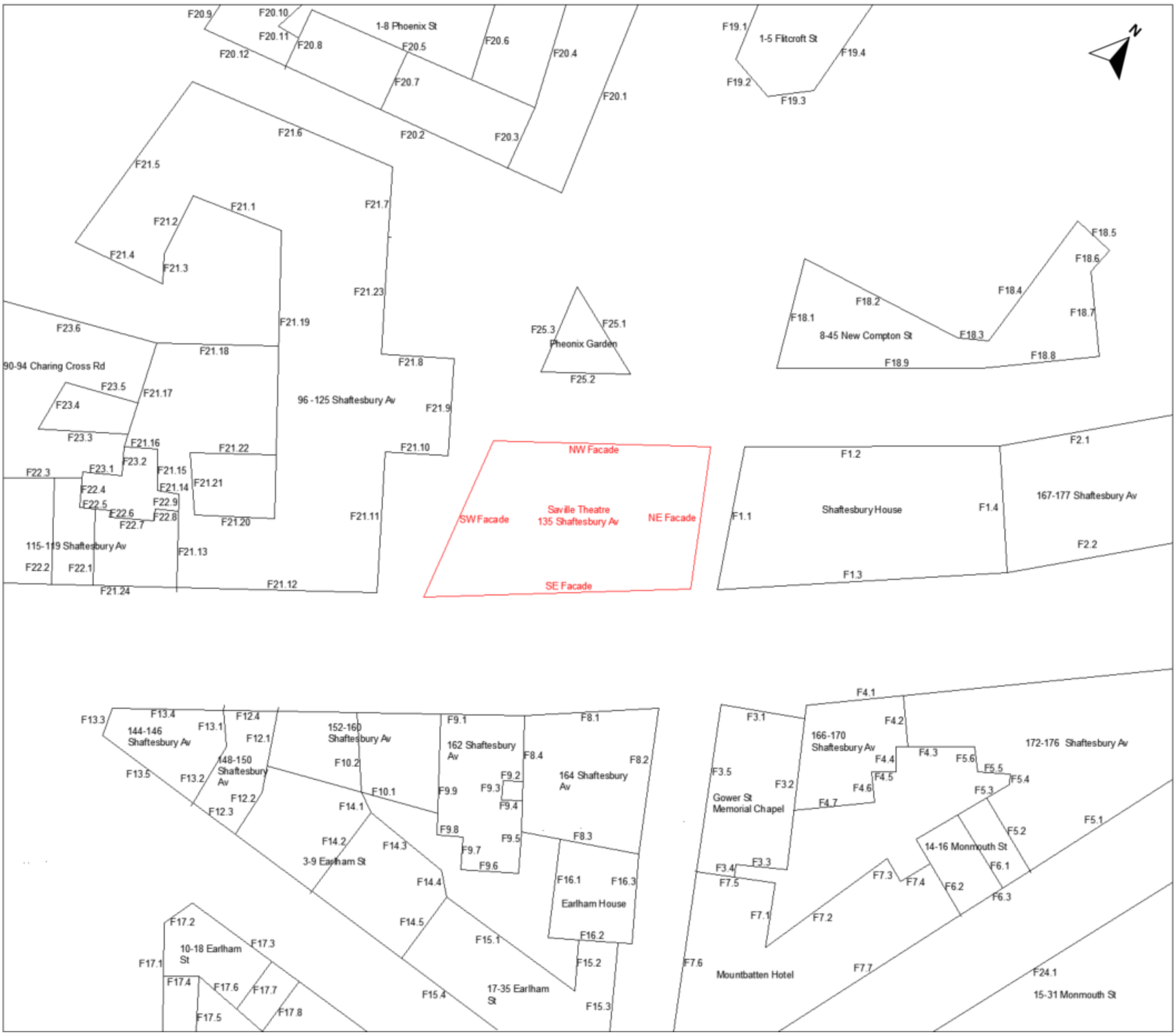

Figure 4.4 Summary of façade nomenclature location

Each wall has been assumed to behave as an equivalent beam subject to a bending and extension/compression deformation mechanism, based on the evaluated greenfield ground movement, as outlined previously.

Tensile strains induced within the building masonry walls have been evaluated based on the deflection ratios Δ/L and horizontal extension mechanisms estimated from the analyses. The assessment considers the well-established Burland (1997) damage classification method, as presented and summarised in Figure 4.5 and Figure 4.6. This method involves a relatively simple but robust means of assessment, which is widely adopted and is considered to comprise an industry standard/best practice basis for impact assessments of this typology.

Potential damage categories are directly related to the tensile strains induced by the proposed construction stages, arising from a combination of direct tension and bending induced tension mechanisms. The evaluated damage categories correspond to an unlikely to be exceeded scenario (on the basis of the data sets adopted and greenfield assumptions).

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Figure 4.5 Building damage classification, after Burland et al. 1977, Boscardin and Cording 1989 and Burland 2001 - relationship between category of damage and limiting strain ε_{lim}

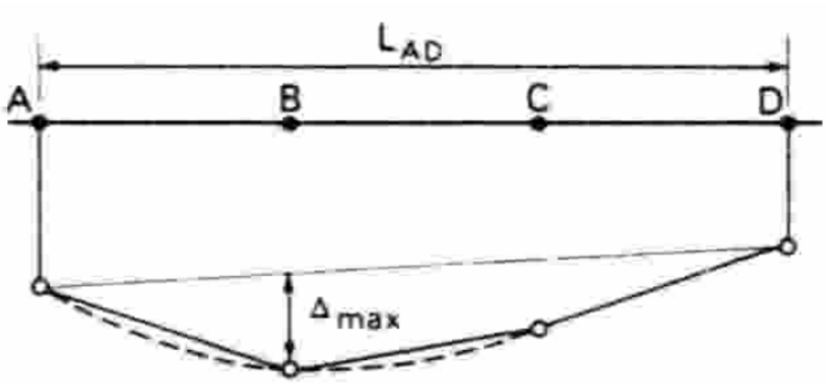

Figure 4.6 Definition of relative deflection Δ and deflection ratio Δ/L

5. Impact Assessment Results

5.1. Existing Building Retained Facades

The results of the assessment for the retained facades of the existing building are presented in Table 5.1. The results of the analyses show that all retained facades will fall within the acceptable damage classification (i.e. not exceeding Category 1 – Very Slight).

Table 5.1 Retained facades evaluated damage categories from XDisp

Façade Reference	Analysis Scenario			
	A1	A2	B1	B2
NE Façade	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)	Category 0 (Negligible)
SE Façade	Category 1 (Very Slight)	Category 1 (Very Slight)	Category 0 (Negligible)	Category 0 (Negligible)
SW Façade	Category 0 (Negligible)	Category 0 (Negligible)	Category 0 (Negligible)	Category 0 (Negligible)
NW Façade	Category 1 (Very Slight)	Category 1 (Very Slight)	Category 0 (Negligible)	Category 0 (Negligible)

5.2. Neighbouring Building Facades

The results of the assessment for the neighbouring building facades are presented in Table 5.2. For clarity, only the facades with evaluated damage categories above Category 0 (Negligible) are reported. All other facades have an evaluated damage category of Category 0 (Negligible) or less.

Note that the results presented in this table represent the worst-case results from all analysis runs. Figure 5.1 depicts the vertical movements as a result of unloading pressures from the demolition and basement excavation. Figure 5.2 depicts the vertical movements as a result of the unloading pressures from the demolition and the basement excavation, plus the long-term loading of the building. Figure 5.3 and Figure 5.4 depict the vertical and horizontal displacements induced by the pile wall installation and basement excavation, calculated as per the CIRIA 760 movement curves listed in the previous section. Figure 5.5 and Figure 5.6 depict the vertical and horizontal displacements induced by the pile wall installation, basement excavation and long-term structural loading.

Table 5.2 Evaluated damage categories above Category 0 (Negligible) from XDisp

Façade Reference	Analysis Scenario			
	A1	A2	B1	B2
F1.2	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F1.3	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F1.4	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)
F8.2	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)
F8.3	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)

F8.4	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F9.3	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F9.5	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F9.7	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F9.9	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F14.5	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F16.1	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F21.12	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F21.14	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F21.20	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F21.22	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F21.24	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)
F25.1	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 1 (Very Slight)
F25.3	Category 0 (Negligible)	Category 0 (Negligible)	Category 1 (Very Slight)	Category 0 (Negligible)

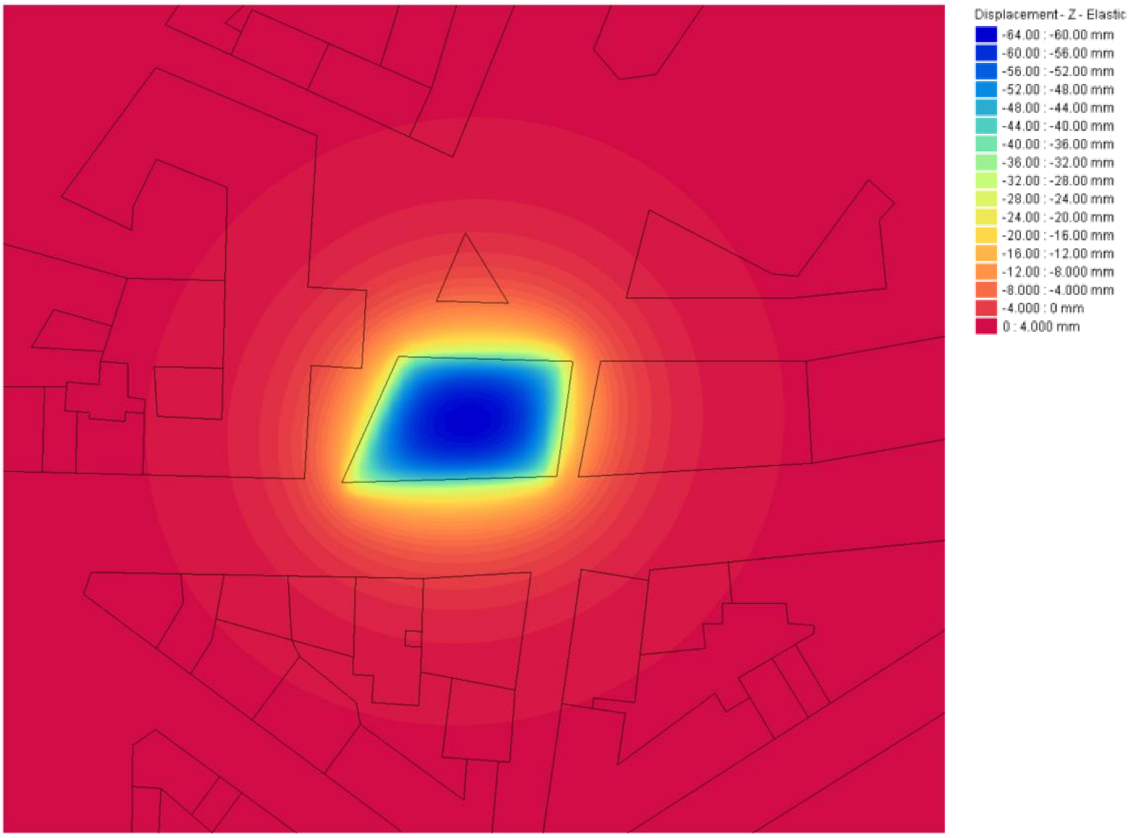

Figure 5.1 XDisp output A1 - Demolition & basement excavation (short-term) vertical displacement (-ve = upward movement, +ve = downward movement)

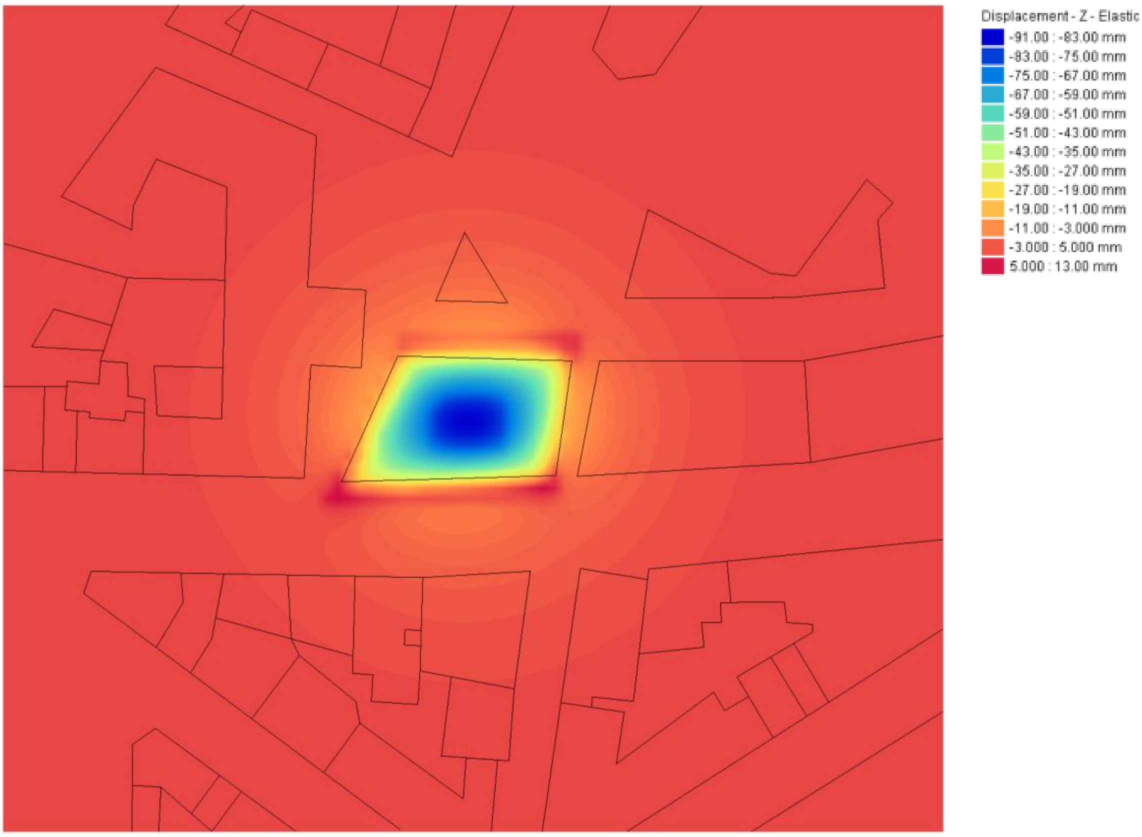

Figure 5.2 XDisp output A2 – Demolition, basement excavation & long-term building loading vertical displacement (-ve = upward movement, +ve = downward movement)

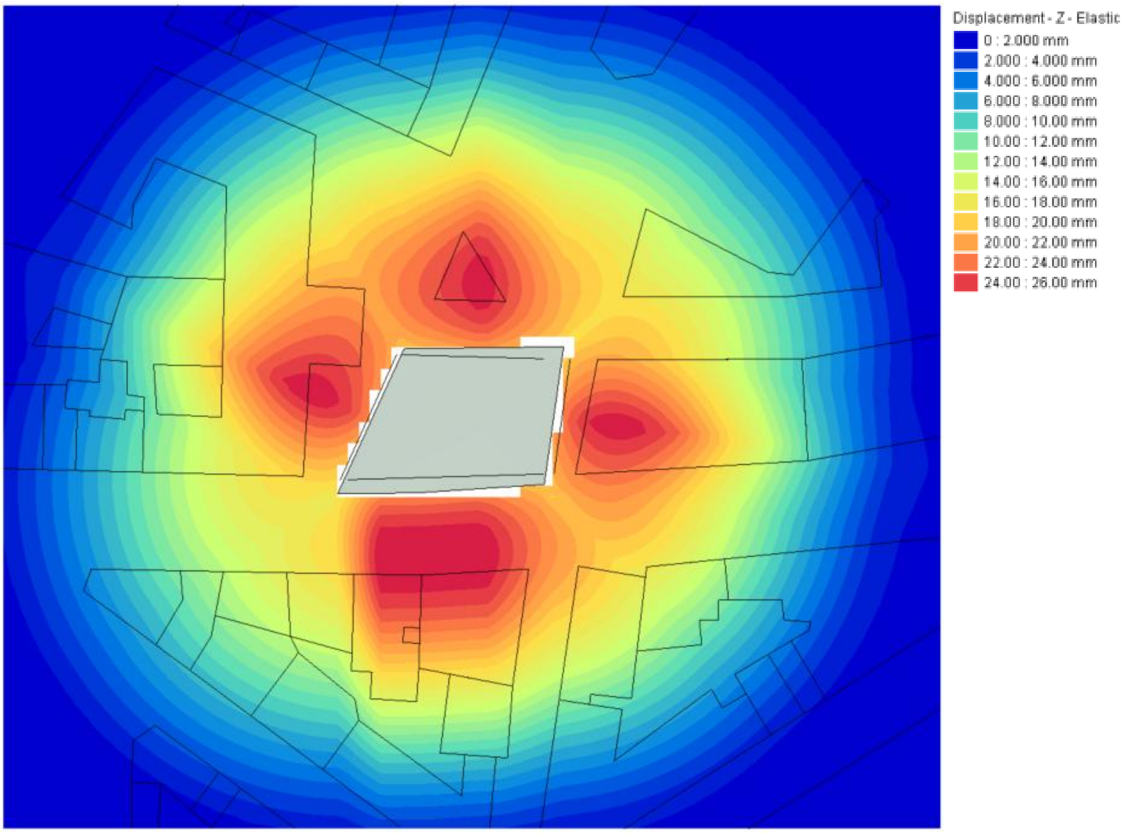

Figure 5.3 **XDisp B1 – Wall installation & basement excavation (CIRIA curves) – vertical displacement (-ve = upward movement, +ve = downward movement)**

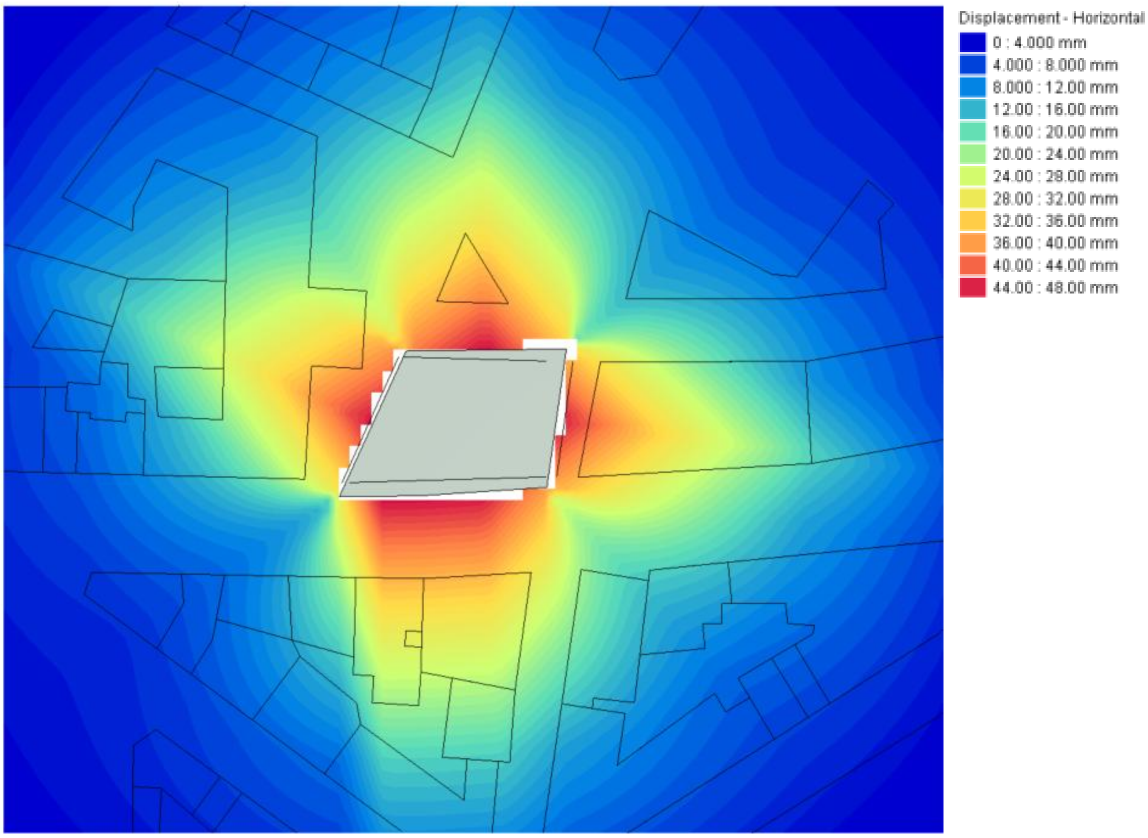

Figure 5.4 **XDisp B1 – Wall installation & basement excavation (CIRIA curves) – horizontal displacement (+ve = movement towards the dig)**

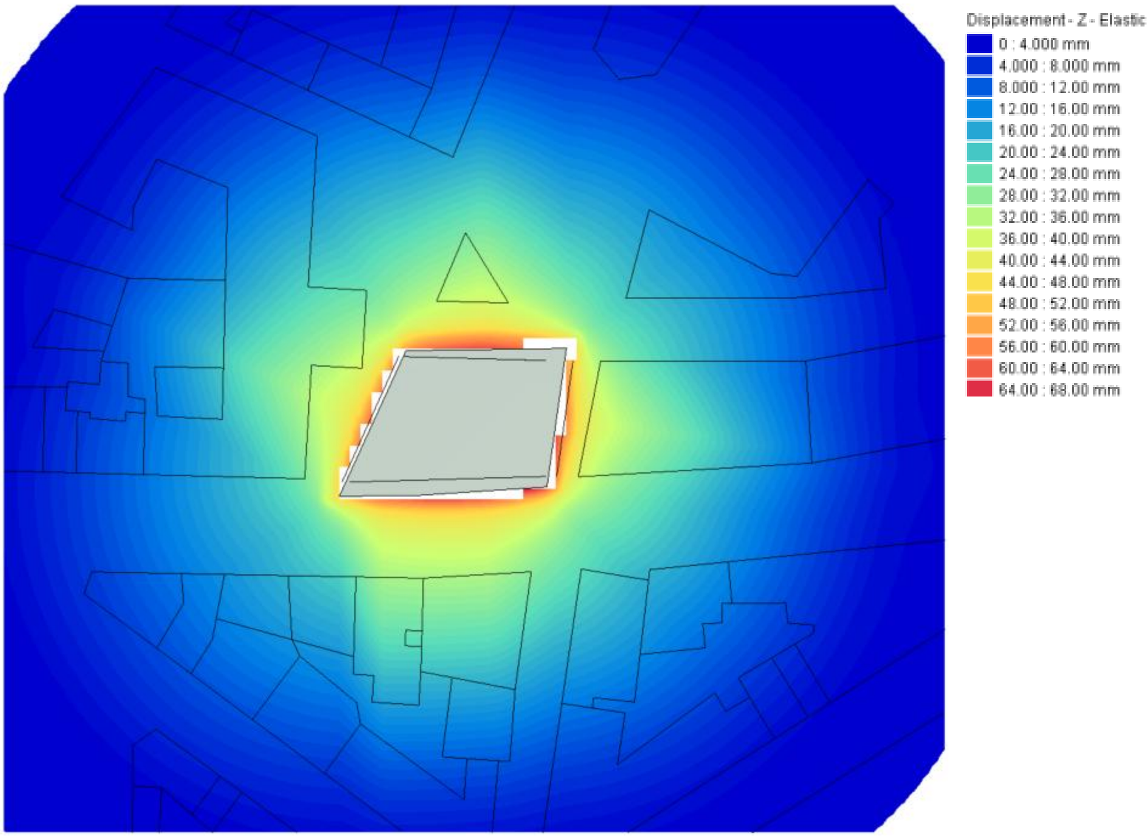

Figure 5.5 XDisp B2 – Wall installation, basement excavation, building loading (long-term) – vertical displacement (-ve = upward movement, +ve = downward movement)

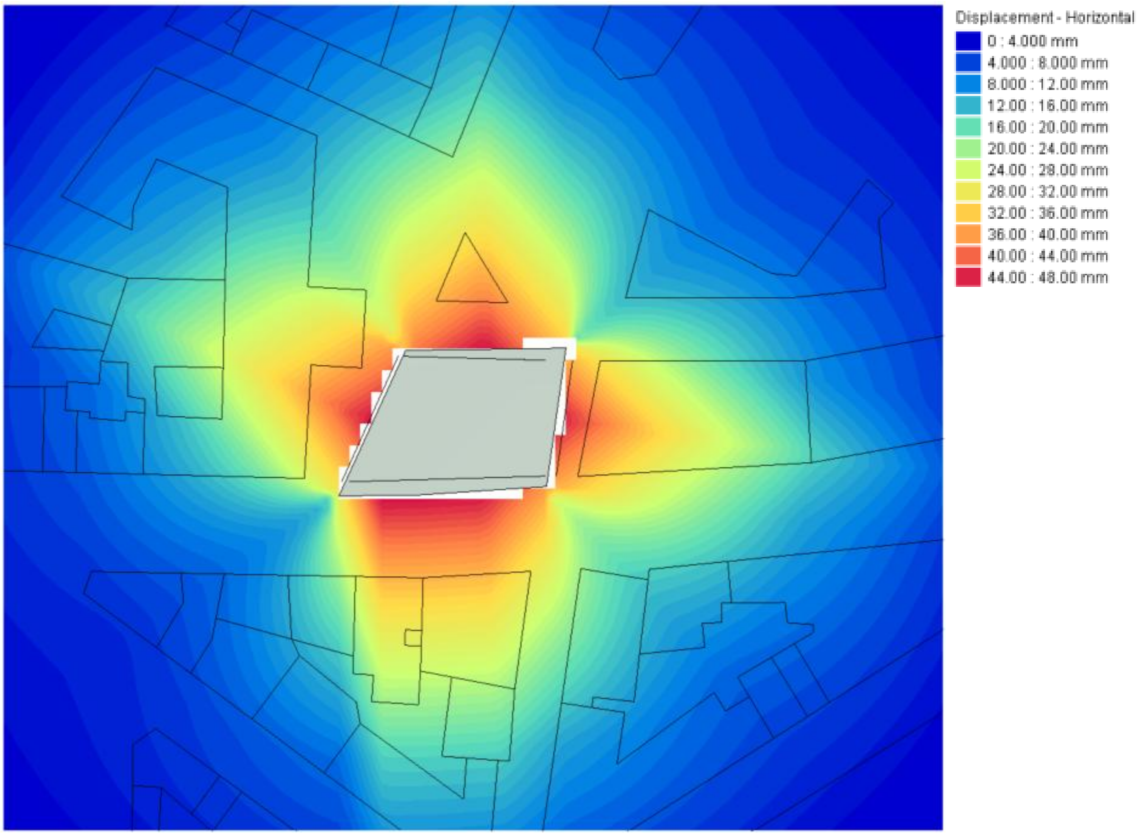

Figure 5.6 XDisp B2 – Wall installation, basement excavation, building loading (long-term) – horizontal displacement (+ve = movement towards the dig)

5.3. Excavation Criteria

The results of the analyses show that all buildings will fall within the acceptable damage classification (i.e. not exceeding Category 1 – Very Slight), if the ground movements caused by the wall installation, excavation and scheme construction are limited to the values presented in Table 5.3.

It is also noted that the GMA will be supplemented by a project-specific monitoring regime and Action Plan, which will delineate lines of responsibility, trigger levels in accordance with those presented in this GMA and appropriate mitigation measures.

Table 5.3 Limiting ground movement values at the location of the embedded wall for various construction stages

Stage	Maximum Cumulative Ground Movement (mm) [1]	
	Vertical	Horizontal
Secant pile wall installation	13	13
Basement Excavation	21	46
Long-Term Condition	67	46

[1] Ground movements directly adjacent to the secant pile wall

6. Conclusions and Closing Remarks

A-squared Studio Engineers Ltd has been engaged by Yoo Capital Ltd to prepare a ground movement assessment for the proposed development at Saville Theatre, 135 Shaftesbury Avenue, London, WC2H 8AH. The scope of this report comprises an assessment of the potential impact of ground movements associated with proposed demolition, excavation and construction works on the neighbouring properties in close proximity to the proposed development.

The proposed commercial redevelopment comprises the extension of the existing two-storey basement to a five-storey basement while maintaining the existing basement footprint. The works will involve the partial demolition of the existing structure with partial retention of the building facades, followed by the construction of a five-storey vertical extension plus plant level on top of the existing building. The basement will extend to a depth of approximately 22.21m bgl. The facades on the southeast, southwest and northeast elevations will be fully retained, while the northwest elevation will be partially preserved. The proposed building loads will be supported by a suspended slab on pile foundations with steel plunge columns to support the top-down construction methodology.

The geology underlying the site comprises Made Ground underlain by the Lynch Hill Gravel, followed by the London Clay Formation, the Thanet Formation, and the Chalk Group.

The proposed development construction operations comprise a series of stages, including installation of the pile wall, bulk excavation of the basement, and the construction of the proposed permanent works elements. The impact of the various stages of construction have been reviewed using the following methods: evaluating the effects of unloading (overburden removal) using PDisp; and simulating the excavation induced ground movements using empirical CIRIA curves in XDisp. In the latter case, a top-down construction sequence has been considered, utilising the CIRIA C760 ground movement curves for high stiffness walls in stiff clay. The “Installation of contiguous bored pile wall in stiff clay” CIRIA C760 curve has been adopted against the “Installation of secant bored pile wall in stiff clay” curve, as it provides a more representative ground movement field for this assessment. It is widely accepted in the industry that the secant dataset is an upper bound for the movements induced by embedded pile wall installations – based on data measured in the field – and the contiguous curve presents a better fit to the empirical data set.

These two scenarios have been considered to bind the potential ground movements arising from the excavation operations (i.e. maximum potential heave and settlement, respectively). This strategy ensures a robust evaluation of the potential impact in light of the bespoke, intricate and workmanship-dependent basement construction methodology. Both short-term (undrained) and long-term (drained) conditions have been assessed by adopting the relevant soil stiffness parameters for each case.

The results from the GMA analyses are presented in Table 5.2, denoting the evaluated damage categorisation in accordance with the Burland criteria described herein. It is observed that the maximum potential damage classification for the neighbouring properties is Category 1 – Very Slight. The deflections predicted by the GMA should be the maximum acceptable in order to ensure the Very Slight damage category.

It is noted that the predicted ground movements, the associated wall tensile strains, and the level of damage categorisation are moderately conservative in view of the relatively cautious data selection and greenfield nature of the assessment undertaken. The assessment presented herein is dependent and reliant on the works being undertaken by an experienced contractor, high quality workmanship and appropriate supervision of construction means and methods by experienced personnel.

It is recommended that this report is reviewed and understood in full by the project team and major stakeholders. Where significant changes are made to items such as the construction sequence, temporary propping arrangements and scheme design, the engineer should thoroughly review the discrepancy and evaluate any potential impacts on ground movement and building damage. If necessary, the building damage categories should be re-evaluated.

It is critical that the permanent and temporary works designs are carried out in a coordinated manner between performance specified elements and substructure contractors, with the aim to ensure that such design elements are in alignment with the assumptions / findings of the GMA and overall design intent.

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