Appendix I – Ground movement assessment

Design Note – Ground Movement Assessment

Project: Gloucester Lodge

Job No: 15060

Date: 12.08.2016

By: AA

Chk: FG

Introduction

A single storey basement extension to an existing residential building is to be constructed and is situated adjacent to Gloucester Gate Mews, London. The building neighbours the Mews to the east and existing buildings to the remaining sides as can be seen in the aerial view in Figure 1 below.

This design note provides an assessment of the ground movement and damage classification onto the existing adjacent structures. The calculations of the structural behaviour of proposed basement structure in the temporary and permanent conditions are also presented.

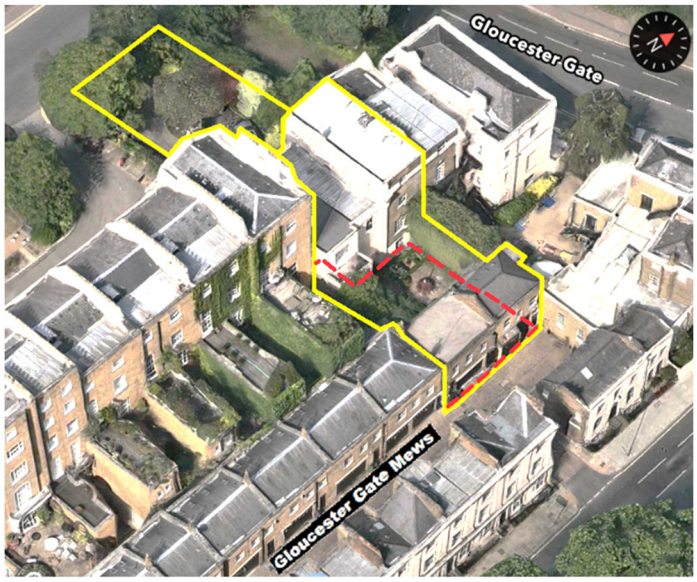


Fig. 1 Aerial view of Gloucester Lodge, dashed line represents extent of basement extension

Existing Structure

The existing buildings date to the late 19th century and are a Victorian house style of construction with traditional load bearing masonry with timber floors. The buildings have a lower ground level and vary in height between two to four storeys. Above the proposed basement the existing building is two storeys in height.

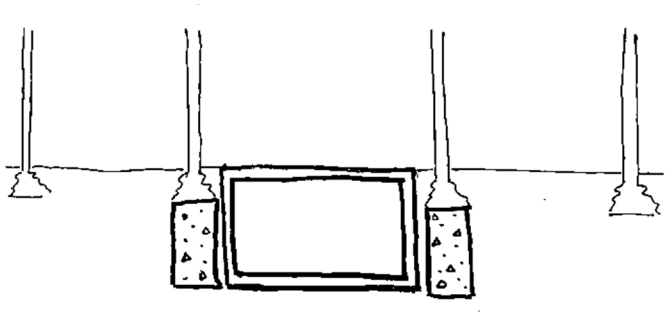
Proposed Construction

The proposed basement is formed of reinforced concrete construction and forms a box structure with perimeter retaining walls that are propped by the lower ground floor slab. The basement slab behaves as a ground bearing raft transferring the forces onto the subsoil.

In relation to supporting the existing superstructure, there are two options that are considered and outlined below:

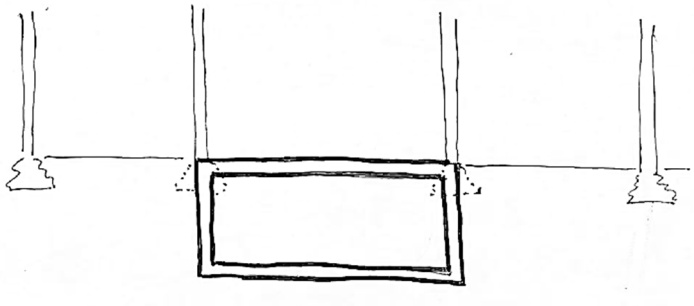
Option 1

The existing masonry walls will be underpinned with mass concrete to the same level as the basement. This means that the vertical loads transferred from the existing superstructure to its existing foundations will be unchanged. The new basement will be independent while supporting the lateral loads.



Option 2

The existing masonry walls will be underpinned by new basement structure itself making the existing foundations redundant. This means the basement structure will support itself and the superstructure. Susceptible



Assumptions and Loadings

Temporary Condition (Options 1 and 2)

The basement structure will be temporarily propped during construction and designed for an applied internal construction load of 2.5kN/m² and an applied external surcharge traffic loading of 10kN/m².

Permanent Condition

The retaining walls are propped by the lower ground floor slab and a 10kN/m² traffic load has been conservatively assumed to act on all sides of the basement. This will prevent uncertainty in any unknown present or future built adjacent basements.

An imposed residential loading of 1.50kN/m² plus lightweight partitions of 0.50kN/m² is assumed for the floors.

Option 1

The basement structure is vertically self-supporting and retaining the soil only. The existing superstructure is supported on its existing foundations which are underpinned.

Option 2

The basement structure supports itself and the existing superstructure as well as retaining the soil.

Soil Conditions

A safe allowable bearing pressure of 150kPa for London soil at 4m depth and a water table at 1m below ground level is conservatively assumed in the analysis.

Ground Movement

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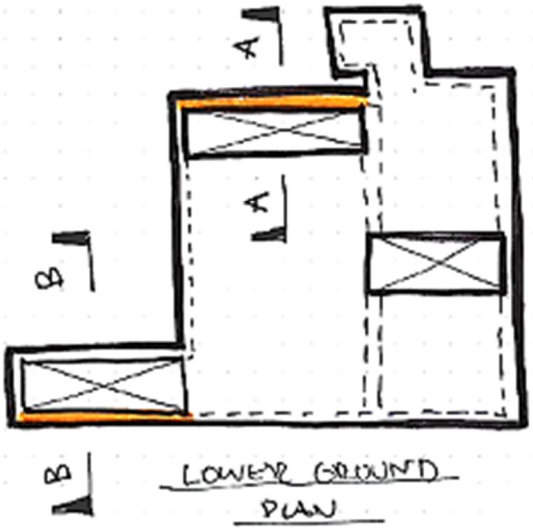
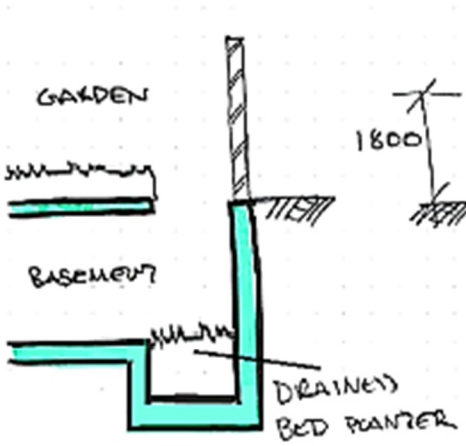


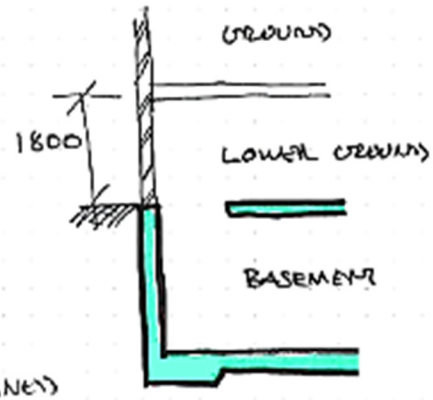
AREAS SUSCEPTIBLE TO MOVEMENT

ALL OTHER AREAS ARE PROPPED BY THE RC SLAB THEREFORE NO MOVEMENT IS EXPECTED ACCORDING TO ANALYSIS.



SECTION A-A

GARDEN WALL WILL MOVE WITH BASEMENT RC WALL. NO CRACKS OCCUR

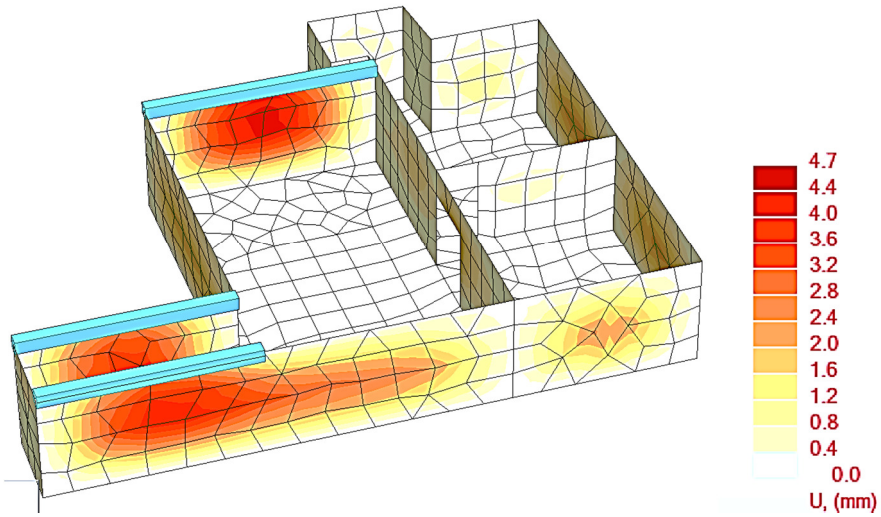


SECTION B-B

MASONRY WALL ABOVE RESTRAINED BY GROUND FLOOR SLAB. POSSIBLE CRACK OCCURANCE. SEE NEXT PAGE FOR ASSESSMENT.

Summary of Analysis

The detailed analysis and design calculations can be found at the end of this design note. In summary, the maximum movement of the basement walls is less than 5mm at the worst case positions (adjacent to openings). This results in a maximum potential crack width of 0.92mm in the existing wall above as calculated in the following page.



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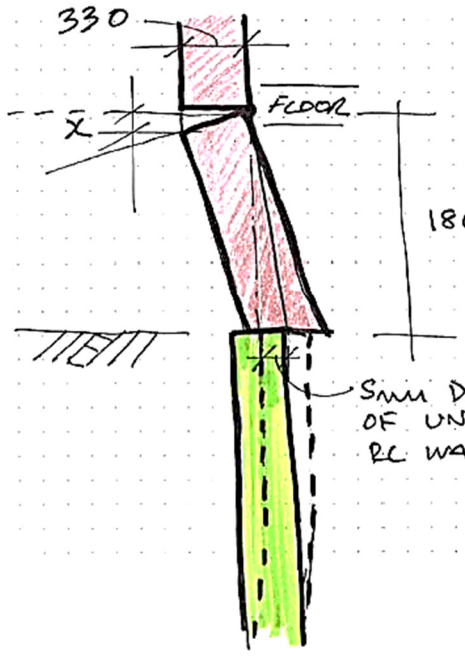
FROM THE FE ANALYSIS, THE RC WALL ADJACENT TO THE OPENING SHOWN IN SECTION B-B IN PREVIOUS PAGE IS EXPECTED TO MOVE LATERALLY BY 5MM. THE CORRESPONDING CRACK WIDTH INDUCED IN THE EXISTING WALL ABOVE IT, IS CALCULATED HEREIN.



$$x = \frac{330}{1800} \times 5$$

$$= 0.92\ \text{mm}$$

CRACK WIDTH < 1.0 mm THEREFORE CATEGORY I

Detailed Calculations and Analysis

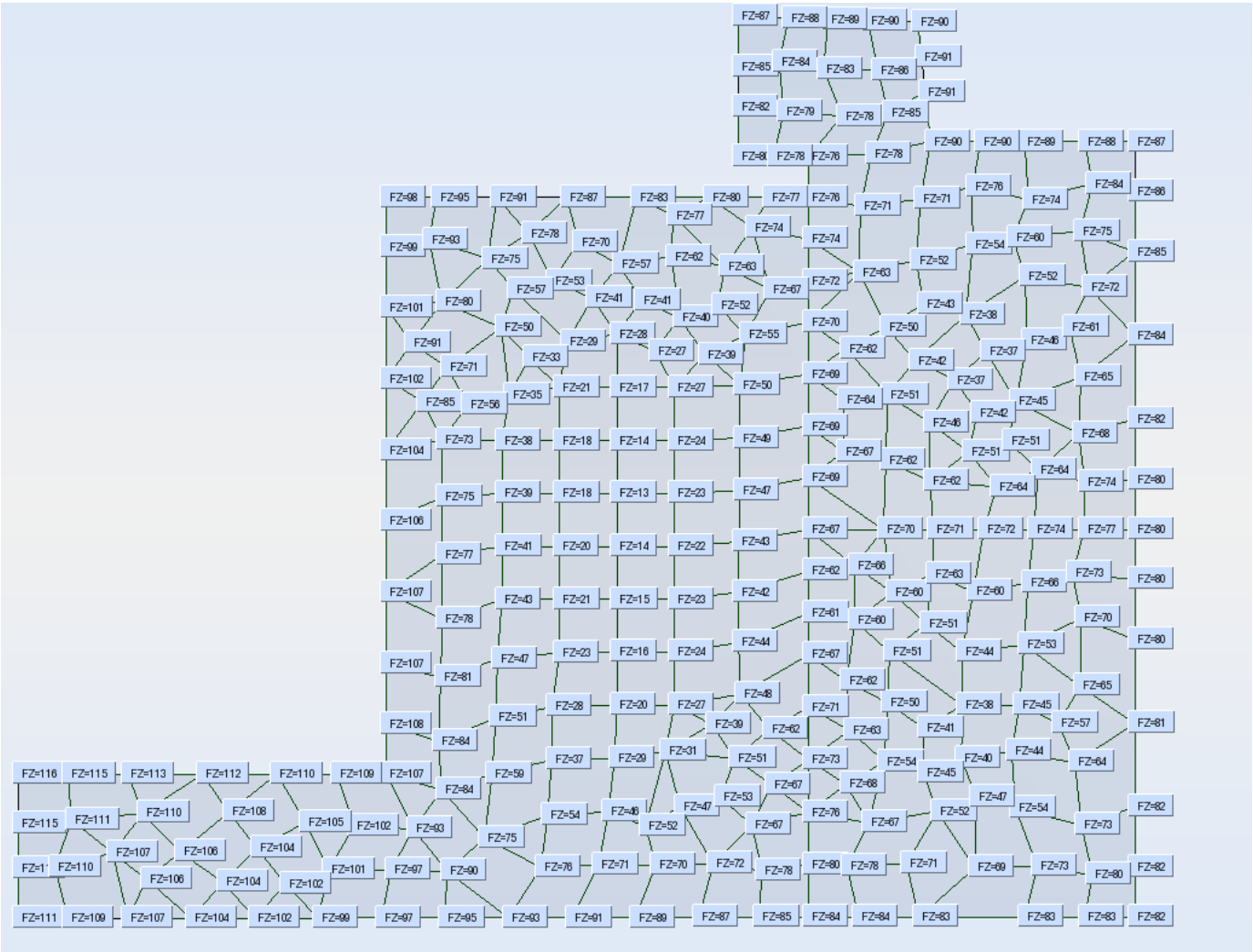
The applied loads in the FE model are listed below

Loads on Floors	**Description**	**Dead Loads kN/m²**	**Live Loads kN/m²**
Basement	Screed and finishes	2.50	
	Domestic live load and partitions		2.00
Lower Ground	Screed and finished	2.50	
	Domestic live load and partitions		2.00
Floors above	Timber floors	1.00	
	Domestic live load and partitions		2.00

Lateral Loads on Retaining Walls	**Description**	**Dead Loads kN/m²**	**Live Loads kN/m²**
Soil	Soil pressure at 4m	27	
Water Table	Water pressure at 3m	29	
Surcharge	10 kN/m² Surcharge	3.33	
Floors above	Timber floors	1.00	
	Domestic live load and partitions		2.00

Vertical Line Loads on Retaining Walls	**Description**	**Dead Loads kN/m**	**Live Loads kN/m**
	Two storey 330mm masonry wall above	50.0	
	Average 3m tributary width dead loads from 3 floors above	9.0	
	Average 3m tributary width live loads from 3 floors above		18.0

Unfactored bearing pressures kPa (kN/m²)



Maximum Applied Bearing Pressure < allowable 150 kPa OK

Maximum vertical deflections of the basement structure (mm)

The maximum vertical settlement of the basement slab is expected to be an average value of 4mm with a maximum of 6.3mm.