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# 51 CALTHORPE STREET, LONDON, WC1X 0HH

# Basement Impact Assessment – Revision C Version 3 – Volume 5 of 5

# APPENDIX P

**CALCULATION SHEET**

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| Project: 51 Calthorpe Street BIA | Sheet no. of | Job No: P12-385 |
|---|---|---|
| | Calc. no: P/1 | Checked by: |
| Subject: CLASSIFICATION OF VISIBLE DAMAGE ASSESSMENT | Made by: PMO REV. MARCH Date: 2017 | Date: |

## Ground Movement Calculations for Proposed Basement at 51 Calthorpe Street

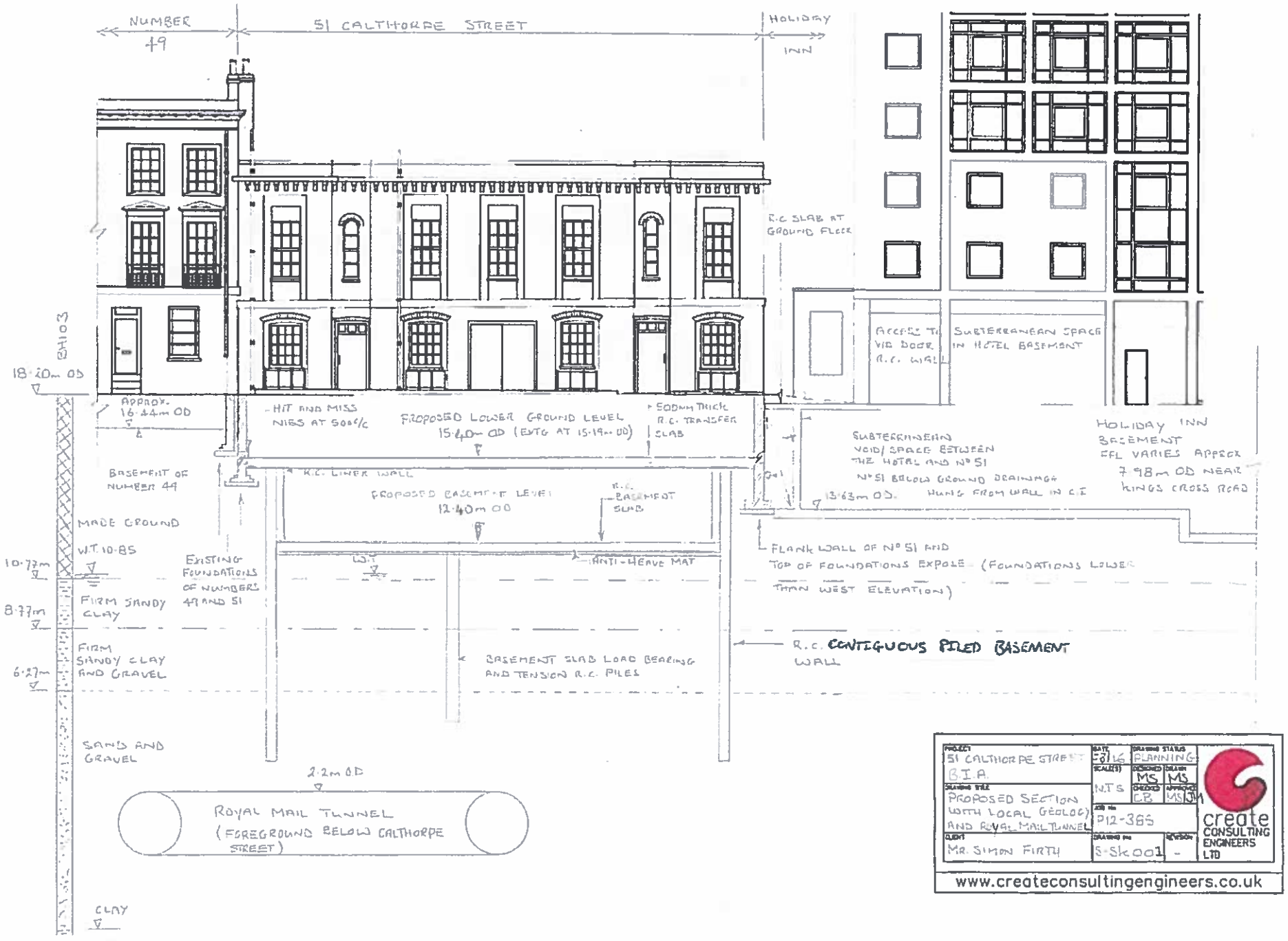
Ground movement estimates have been made using the guide CIRIA C580 Embedded Retaining Walls Guidance for Economic Design, Gaba et al., CIRIA, 2003. Some tables and graphs are reproduced in the calculations.

GROUND COMPRISES SANDY CLAYS & GRAVELS.

PILES ARE EMBEDDED INTO FIRM SANDY CLAY AND GRAVEL LAYERS.

GROUND IN EXCAVATED ZONE MADE - GROUND MORE SANDY.

GROUND MOVEMENTS LIKELY BETWEEN THOSE IF STIFF CLAY ASSUMED AND FULL SAND CONDITION ASSUMED.




| | | | |
|---|---|---|---|
| PROJECT: 51 CALTHORPE STREET B.I.A. | DATE: 7.8.16 | DRAWING STATUS: PLANNING | |
| DRAWING TITLE: PROPOSED SECTION WITH LOCAL GEOLOGY AND ROYAL MAIL TUNNEL | SCALE(S): N.T.S. | DESIGNED: MS DRAWN: MS CHECKED: C.B. APPROVED: MS | create CONSULTING ENGINEERS LTD |
| CLIENT: MR. SIMON FIRTH | JOB No: P12-385 | DRAWING No: S-Sk001 | REVISION: - |

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51 CALTHORPE ST. BIA

P12 REV. MARCH 2017

**CALCULATION SHEET**

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| | Date: 09/09/16 | |

## Horizontal Movement Due to Bored Piles (Secant Piled Wall)

Depth of bored Piles = 10m

Table 2.2 *Ground surface movements due to bored pile and diaphragm wall installation in stiff clay*

| Wall type | Horizontal movements | | Vertical movements | |
|---|---|---|---|---|
| | Surface movement at wall (per cent of wall depth) | Distance behind wall to negligible movement (multiple of wall depth) | Surface movement at wall (per cent of wall depth) | Distance behind wall to negligible movement (multiple of wall depth) |
| **Bored piles** | | | | |
| Contiguous | 0.04 | 1.5 | 0.04 | 2 |
| Secant | 0.08 | 1.5 | 0.05 | 2 |
| **Diaphragm walls** | | | | |
| Planar | 0.05 | 1.5 | 0.05 | 1.5 |
| Counterfort | 0.1 | 1.5 | 0.05 | 1.5 |

Notes

1. Maximum surface movement occurs close to the wall and is calculated as a percentage of the pile depth/diaphragm wall trench depth, as appropriate.
2. Extent of movement is calculated non-dimensionally by dividing by the pile depth/diaphragm wall trench depth, as appropriate

Table 2.3 *Support stiffness categories (Carder, 1995)*

| Support stiffness | Description/examples |
|---|---|
| High | *Top-down construction*, temporary props installed before permanent props at *high* level |
| Moderate | Temporary props of high stiffness installed before permanent props at *low* level |
| Low | *Cantilever walls*, temporary props of *low* stiffness or temporary props installed at low level |

Table 2.4 *Ground surface movements due to excavation in front of bored pile, diaphragm wall and sheet pile walls wholly embedded in stiff clays*

| Movement type | High support stiffness (high propped wall, top-down construction) | | Low support stiffness (cantilever or low-stiffness temporary props or temporary props installed at low level) | |
|---|---|---|---|---|
| | Surface movement at wall (per cent of max excavation depth) | Distance behind wall to negligible movement (multiple of max excavation depth) | Surface movement at wall (per cent of max excavation depth) | Distance behind wall to negligible movement (multiple of max excavation depth) |
| Horizontal | 0.15 | 4 | 0.4 | 4 |
| Vertical | 0.1 – CONSERVATIVE | 3.5 | 0.35 | 4 |

– ALSO SEE FIG. 2.12 – MOVEMENTS IN SAND

**CALCULATION SHEET**

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| Subject: GROUND MOVEMENT | Made by: PMO | Date: |
| | Date: REV. MARCH 2017 | |

## HORIZONTAL MOVEMENT - CIRIA C580 EMBEDDED RETAINING WALLS -

### GROUND SURFACE MOVEMENT DUE TO BORED PILES

PROPOSED BASEMENT DEPTH =
DEPTH = 3.0m BELOW EXISTING B'MENT / NEW LOWER GROUND LEVEL.
DEPTH OF PILES = 10m APPROX.

TABLE 2.2

CONTIG. WALL
HORIZ. SURFACE MOVEMENT = 0.04%
$\delta_h$ = 4.0mm
DIST. TO NEG. MOVEMENT = 1.5x 10 = 15m

VERT. SURFACE MOVEMENT = 0.04%
$\delta_v$ = 4mm
DIST. TO NEG. MOVEMENT = 2x 10 = 20m

### POTENTIAL MOVEMENT DUE TO WALL EXCAVATION

TABLE 2.3

HIGH SUPPORT STIFFNESS - TOP DOWN CONSTRUCTION
DEPTH OF EXCAVATION = 3m

FIG. 2.12

HORIZONTAL
SURFACE MOVEMENT = 0.15% - HIGH STIFFNESS TOP-DOWN CONSTRUCTION

VERTICAL
SURFACE MOVEMENT AT 1.0m = 0.18% 3m = 5.4mm
DIST. TO NEG. MOVEMENT = 6m

↳ CONSERVATIVE SINCE DEFLECTION AT TOP OF WALL SHOULD BE EXTREMELY LOW.

**CALCULATION SHEET**

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| Project: 57 CALTHORPE STREET | Sheet no. of | Job No: |
|---|---|---|
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| Subject: GROUND MOVEMENT | Made by: PMO | |
| | Date: MARCH 2017 | Date: |

FOR EXCAVATING IN SAND

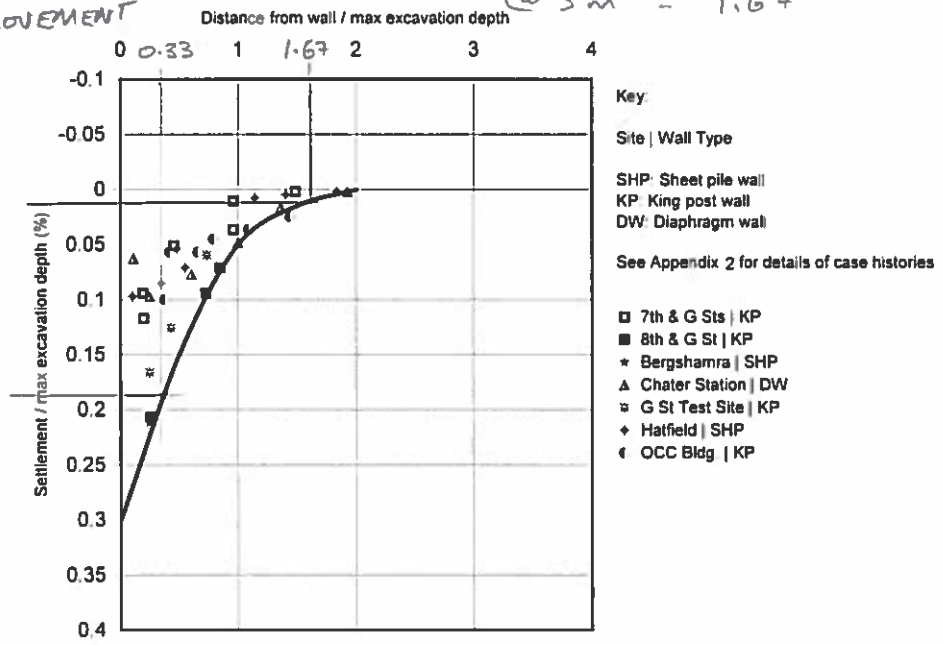
MAX EXCAVATION DEPTH = 3m

@ 1m : 0.33

@ 17.5m = 5.8 → 0

@ 5m = 1.67

DIST. TO NEG. MOVEMENT = 2 x 3 = 6m




0.02

$\frac{\delta}{3}$ = 0.18%

0.18%

S = 5.4mm

**Figure 2.12** *Ground surface settlement due to excavation in front of wall in sand*

GROUND MOVEMENTS LIKELY SOMEWHERE BETWEEN THOSE FOR SAND AND THOSE FOR EXCAVATING IN CLAY.

↳ USE AVERAGE PREDICTED SETTLEMENT

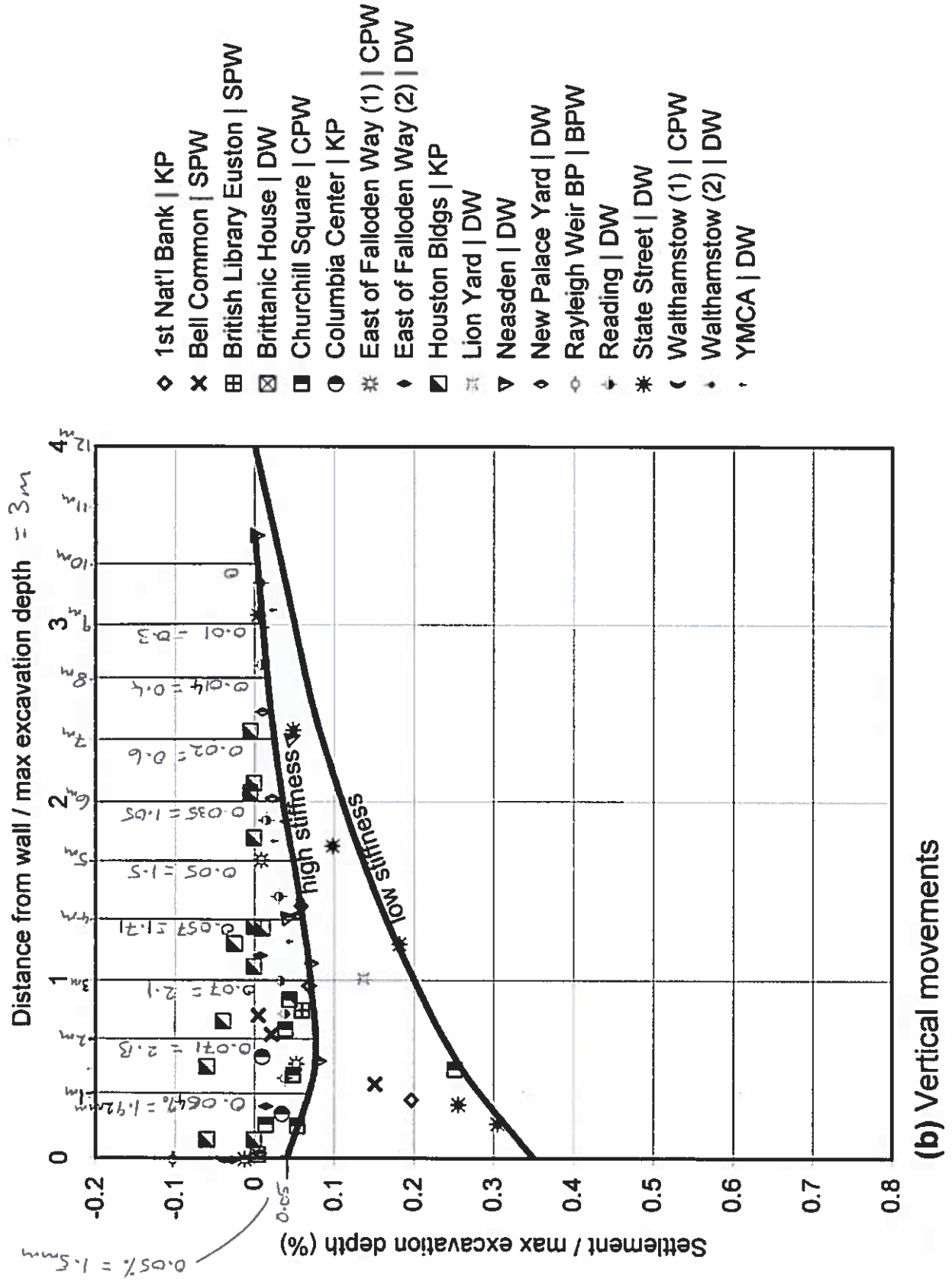



**Figure 2.11** *Ground surface movements due to excavation in front of wall in stiff clay*

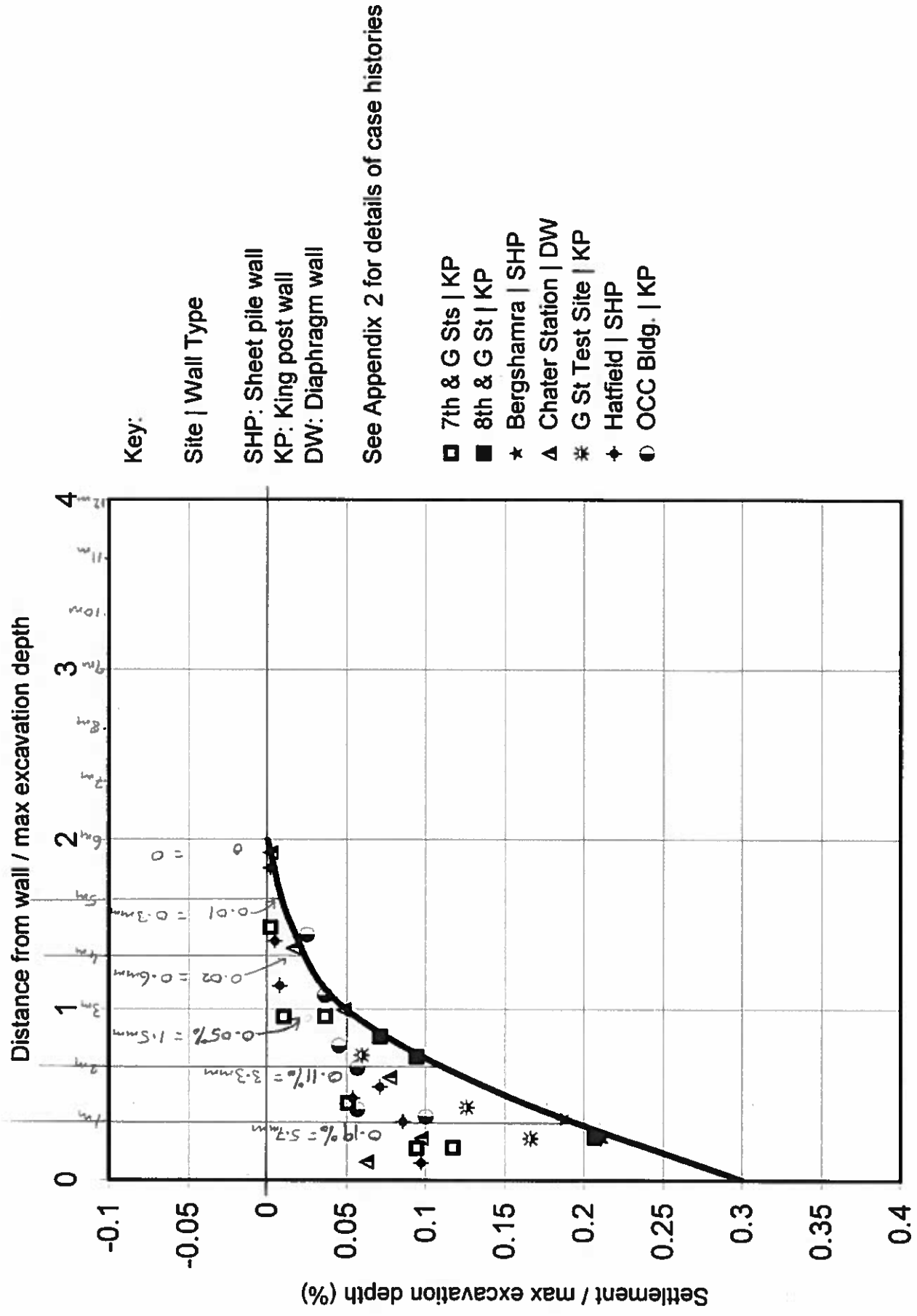



**Figure 2.12** *Ground surface settlement due to excavation in front of wall in sand*

**Ground Surface Movement due to Installation of Piles**

Contiguous Piles
Depth of Piles 10 m

| | | | | At 1 m | | At 17.5 m | |
|---|---|---|---|---|---|---|---|
| | | | | Horizontal | Vertical | Horizontal | Vertical |
| Table 2.2 | Horizontal surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 1.5 | 15 m | | | | |
| | | | 0.27 mm/m | 3.73 mm | | 0 mm | |
| | Vertical surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 2 | 20 m | | | | |
| | | | 0.20 mm/m | | 3.80 mm | | 0.50 mm |

**Ground Surface Movement due to Excavation in front of Wall**

Depth of Excavation 3 m

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Table 2.4 | Horizontal surface movement | 0.15% | 4.5 mm | | | | |
| | Distance to neg. movement | 4 | 12 m | | | | |
| | | | 0.375 mm/m | 4.13 mm | | | |
| Fig. 2.12 | Vertical surface movement | 0.10% | 3 mm | | | | |
| | Distance to neg. movement | 3.5 | 10.5 m | | | | |
| | | | 0.29 mm/m | | 2.71 mm | | 0.00 mm |

**Ground Surface Movement due to Excavation in front of Wall in sand**

Depth of Excavation 3 m

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fig. 2.12 | Vertical surface movement | 0.18% | 5.4 mm | | | | |
| | Distance to neg. movement | 2 | 6 m | | | | |
| | | | 0.90 mm/m | | 4.50 mm | | 0.00 mm |

**Average Ground Surface Movement due to excavation in front of Wall**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Average of estimates of vertical movements in clay and sand | | | | 3.61 mm | | 0.00 mm |
| | | | | 7.86 mm | 7.41 mm | 0.00 mm | 0.50 mm |

49 Calthorpe Street Ground Movement Assessment

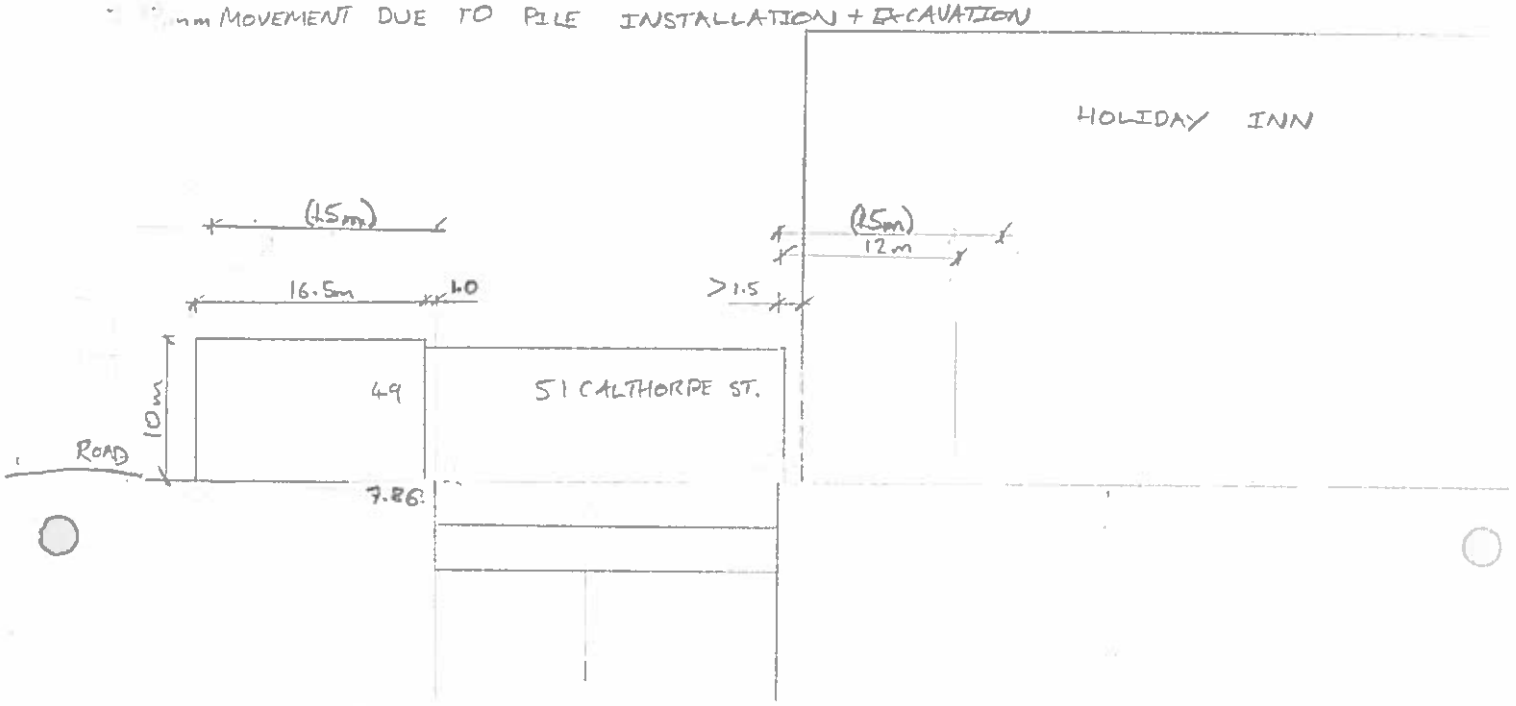
| Distance from Piles | Vertical Settlements along Building: Pile install movement (mm) | Distance/ excavation depth 3 | Stiff Clay Fig. 2.11 (mm) | Sand Fig. 2.12 (mm) | Average (mm) | Total (mm) | Straight Line | Δv | Horizontal: Pile install movement (mm) | Fig. 2.11 (a) (mm) | Total (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 4 | 0 | 3 | 9 | 12 | 16.00 | | | 4 | 4.5 | 8.5 |
| 1 | 3.80 | 0.33 | 1.92 | 5.7 | 7.62 | 11.42 | 11.42 | 0.00 | 3.73 | 4.125 | 7.86 |
| 2 | 3.60 | 0.67 | 2.13 | 3.3 | 5.43 | 9.03 | 10.76 | 1.73 | 3.47 | 3.75 | 7.22 |
| 3 | 3.40 | 1.00 | 2.1 | 1.5 | 3.6 | 7.00 | 10.10 | 3.10 | 3.20 | 3.375 | 6.58 |
| 4 | 3.20 | 1.33 | 1.71 | 0.6 | 2.31 | 5.51 | 9.43 | 3.92 | 2.93 | 3 | 5.93 |
| 5 | 3.00 | 1.67 | 1.5 | 0.3 | 1.8 | 4.80 | 8.77 | 3.97 | 2.67 | 2.625 | 5.29 |
| 6 | 2.80 | 2.00 | 1.05 | 0 | 1.05 | 3.85 | 8.11 | 4.26 | 2.40 | 2.25 | 4.65 |
| 7 | 2.60 | 2.33 | 0.6 | 0 | 0.6 | 3.20 | 7.45 | 4.25 | 2.13 | 1.875 | 4.01 |
| 8 | 2.40 | 2.67 | 0.4 | 0 | 0.4 | 2.80 | 6.79 | 3.99 | 1.87 | 1.5 | 3.37 |
| 9 | 2.20 | 3.00 | 0.3 | 0 | 0.3 | 2.50 | 6.13 | 3.63 | 1.60 | 1.125 | 2.73 |
| 10 | 2.00 | 3.33 | 0 | 0 | 0 | 2.00 | 5.46 | 3.46 | 1.33 | 0.75 | 2.08 |
| 11 | 1.80 | 3.67 | 0 | 0 | 0 | 1.80 | 4.80 | 3.00 | 1.07 | 0.375 | 1.44 |
| 12 | 1.60 | 4.00 | 0 | 0 | 0 | 1.60 | 4.14 | 2.54 | 0.80 | 0 | 0.80 |
| 13 | 1.40 | 4.33 | 0 | 0 | 0 | 1.40 | 3.48 | 2.08 | 0.53 | 0 | 0.53 |
| 14 | 1.20 | 4.67 | 0 | 0 | 0 | 1.20 | 2.82 | 1.62 | 0.27 | 0 | 0.27 |
| 15 | 1.00 | 5.00 | 0 | 0 | 0 | 1.00 | 2.15 | 1.15 | 0.00 | 0 | 0.00 |
| 16 | 0.80 | 5.33 | 0 | 0 | 0 | 0.80 | 1.49 | 0.69 | 0.00 | 0 | 0.00 |
| 16.5 | 0.70 | 5.50 | 0 | 0 | 0 | 0.70 | 1.16 | 0.46 | 0.00 | 0 | 0.00 |
| 17.5 | 0.50 | 5.83 | 0 | 0 | 0 | 0.50 | 0.50 | 0.00 | 0.00 | 0 | 0.00 |
| 18 | 0.40 | 6.00 | 0 | 0 | 0 | 0.40 | | | | | |
| 19 | 0.20 | 6.33 | 0 | 0 | 0 | 0.20 | | | | | |
| 20 | 0.00 | 6.67 | 0 | 0 | 0 | 0.00 | | | | | |

MAX $\Delta_v$ = 4.26mm

## HORIZONTAL MOVEMENTS

AFFECTED BY CONSTRUCTION ONLY SINCE TOP-DOWN CONSTRUCTION PROVIDES RIGID PROP AT TOP OF PILES.

mm MOVEMENT DUE TO PILE INSTALLATION + EXCAVATION




TOTAL = mm @ 1.0m

AFFECTED ZONE = 15 m FROM PILES

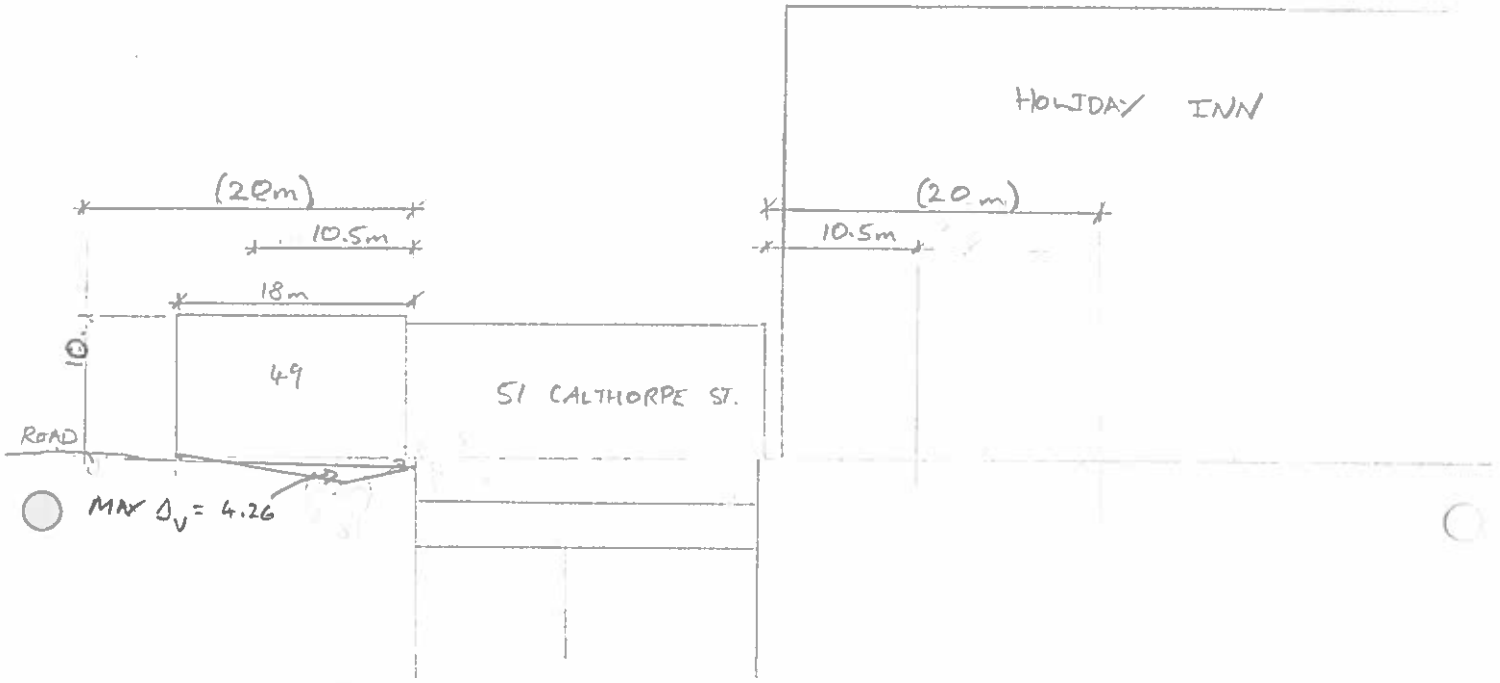
49 CALTHORPE: $\varepsilon_h = \frac{7.86}{16.5\,m} = 0.047$

$\varepsilon_{Lim} = 0.075$ - VERY SLIGHT (CATEGORY 1)

$\frac{\varepsilon_h}{\varepsilon_{Lim}} = \frac{0.047}{0.075} = 0.63$

# VERTICAL MOVEMENTS

## CONSTRUCTION RELATED MOVEMENTS




TOTAL CONSTRUCTION RELATED MOVEMENTS = 7.62mm
AFFECTED ZONE = 20m
BUILDINGS > 1.0m FROM PILES:
DISPLACEMENTS AT 1.0m = 11.42mm

$\Delta_v$ = 4.26 mm

$L$ = 16.5m $\rightarrow$ $\frac{\Delta}{L} = \frac{4.26}{16500} = 0.0258\ \%$

FOR CATEGORY 1 V. SLIGHT: $\varepsilon_{lim} = 0.075\%$

$\frac{0.0258}{0.075} = 0.34$

51 CALTHORPE ST. BIA

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EXTRACT FROM CIRIA C580 – TABLE 2.5

REV. MARCH 2017

**Stage 1**

Ground movements behind the retaining wall should be estimated as described in Section 2.5.2 assuming greenfield conditions, ie ignoring the presence of the building or utility and the ground above foundation level. Contours of ground surface movements should be drawn and a zone of influence established based on specified settlement and distortion criteria. All structures and utilities within the zone of influence should be identified.

**Stage 2**

A condition survey should be carried out on all structures and utilities within the zone of influence before starting work on site. The structure or utility should be assumed to follow the ground (ie it has negligible stiffness), so the distortions and consequently the strains in the structure or utility can be calculated. The method of damage assessment should adopt the limiting tensile strain approach as described by Burland *et al* (1977), Boscardin and Cording (1989) and Burland (2001): see Table 2.5 and Figure 2.18.

**Table 2.5** *Classification of visible damage to walls (after Burland* et al*, 1977, Boscardin and Cording, 1989, and Burland, 2001)*

| Category of damage | Description of typical damage (ease of repair is underlined) | Approximate crack width (mm) | Limiting tensile strain $\varepsilon_{lim}$ (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. | |

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

51 CALTHORPE ST. BIA

EXTRACTS FROM C580

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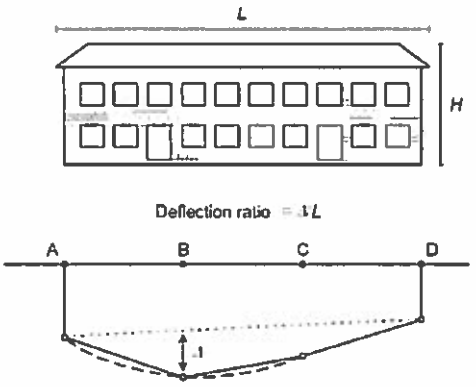
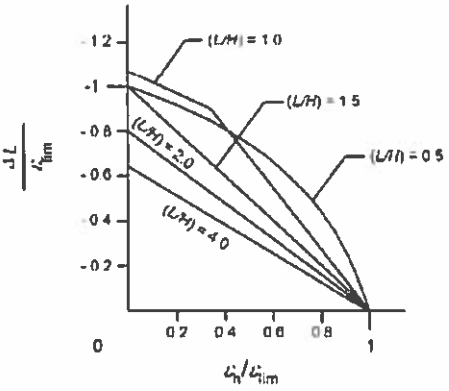
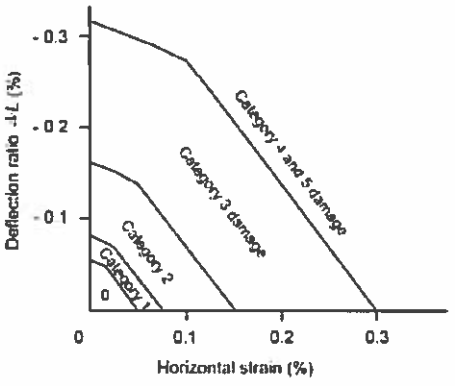



(a) Definition of deflection ratio.




(b) Influence of horizontal strain on $\Delta/L$ / $\varepsilon_{lim}$ (after Burland, 2001)




(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (*L*/*H*) = 1.0 (after Burland, 2001)

By adopting values of $\varepsilon_{lim}$ associated with the various damage categories given in Table 2.5, Figure (b) can be developed into an interaction diagram showing the relationship between $\Delta/L$ and $\varepsilon_h$ for a particular value of *L*/*H*. Figure (c) shows such a diagram for (*L*/*H*) = 1.0

**Figure 2.18** *Relationship between damage category, deflection ratio and horizontal tensile strain (after Burland, 2001)*

Reinforced concrete-framed structures are more flexible in shear than are masonry structures and are consequently less susceptible to damage. Nevertheless, for the purposes of a stage 2 assessment of potential damage, all structures should be treated as masonry structures.

**Box 2.5** *Procedure for stage 2 damage category assessment*

The following steps should be undertaken in making a stage 2 assessment of the damage to a structure:

(i) establish *L* and *H* for the structure (see Figure 2.18(a) for definitions of *L* and *H*)

(ii) determine (*L*/*H*)

(iii) determine relationship between ($\Delta$/L) and $\varepsilon_h$ for the required (*L*/*H*) from Figure 2.18(b) for $\varepsilon_{lim}$ values from Table 2.5

(iv) estimate vertical and horizontal ground surface movements in the vicinity of the structure from Figure 2.14

(v) determine ($\Delta$/L) and $\varepsilon_h$ (= $\delta_h$/L) where $\delta_h$ is the horizontal movement

(vi) estimate damage category from the relationship between ($\Delta$/*L*) and $\varepsilon_h$ established from step (iii) above.

## BUILDINGS JOINING WEST OF 51 CALTHORPE ST (49 CALTHORPE ETC.)

EAST OF 51 CALTHORPE ST. = HOLIDAY INN : - - -

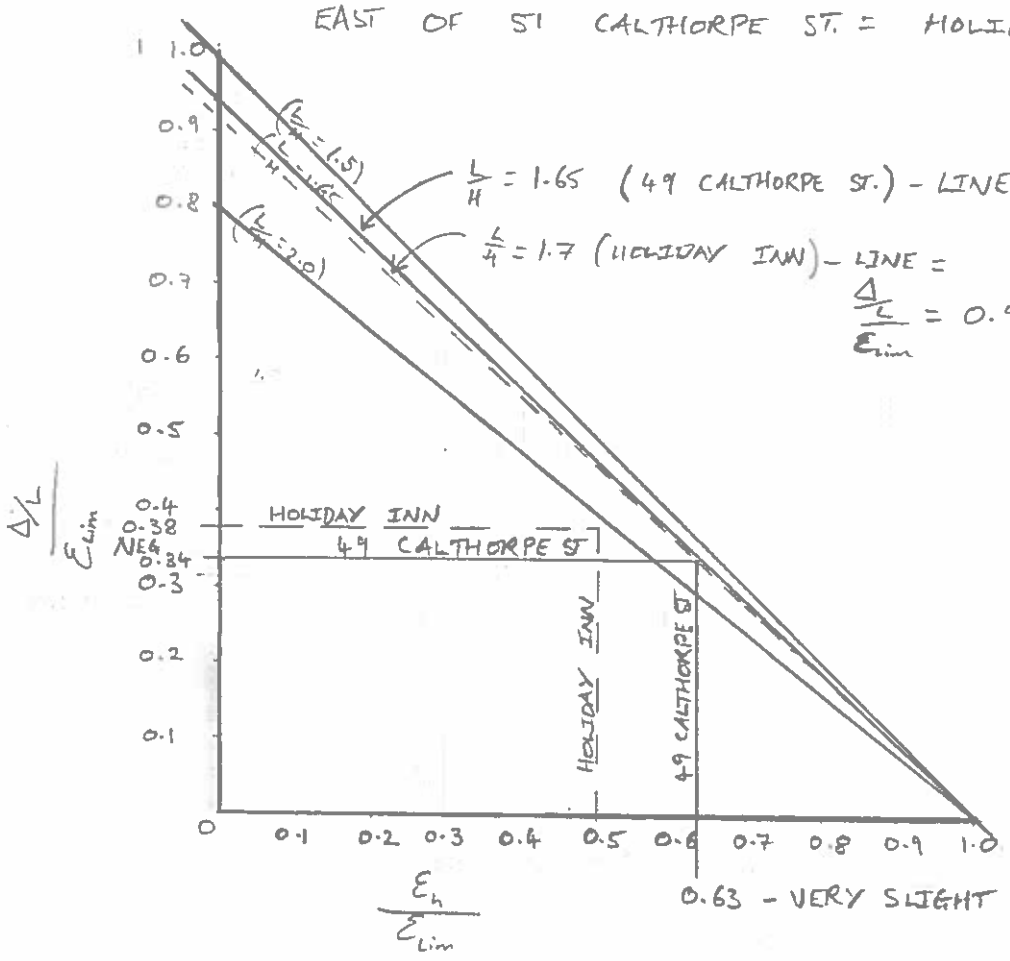



FIG. 2.18 (b)

49 CALTHORPE ST.

∴ DAMAGE CATEGORY = 1 - VERY SLIGHT

HOLIDAY INN

DAMAGE CATEGORY : 0 - NEGLIGIBLE

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| | Calc. no: P/15 | Checked by: |
| Subject: CLASSIFICATION OF VISIBLE DAMAGE CHECKS MIXED USE SCHEME | Made by: AMO REV. MARCH 2017 Date: 9/9/16 | Date: |

## CHECK ON HOLIDAY INN

HOLIDAY INN HAS A BASEMENT OF SIMILAR SIZE / DEPTH TO THAT PROPOSED AT 51 CALTHORPE ST.
∴ NO GROUND MOVEMENT DUE TO EXCAVATION WOULD BE EXPECTED.

3.73 mm HORIZONTAL

3.8 mm VERTICAL

## DAMAGE CATEGORY

LENGTH OF BUILDING = 52 m

TAKING STRAIN ONLY OVER : 15 m HORIZ.
20 m VERT.

$$\frac{L}{H} = \frac{52}{30} = 1.73$$

HORIZONTAL STRAINS :

$$\varepsilon_h = \frac{3.7}{15000} = 0.025\%$$

FOR V. SLIGHT CATEGORY : $\frac{0.025}{0.075} = 0.33$

FOR NEG. : $\frac{0.025}{0.05} = 0.50$

VERTICAL

$$\frac{3.8}{20m} = 0.019\%$$

FOR V. SLIGHT : $\frac{0.019}{0.075} = 0.25$

NEG. $\frac{0.019}{0.05} = 0.38$

SEE PREVIOUS = NEGLIGIBLE CATEGORY

## Ground Surface Movement due to Installation of Piles

Contiguous Piles

Depth of Piles 10 m

| | | | | At 1 m | | At 52 m | |
|---|---|---|---|---|---|---|---|
| | | | | Horizontal | Vertical | Horizontal | Vertical |
| Table 2.2 | Horizontal surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 1.5 | 15 m | | | | |
| | | | 0.27 mm/m | 3.73 mm | | 0 mm | |
| | Vertical surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 2 | 20 m | | | | |
| | | | 0.20 mm/m | | 3.80 mm | | 0.00 mm |

## Ground Surface Movement due to Excavation in front of Wall

Depth of Excavation 3 m

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Table 2.4 | Horizontal surface movement | 0.00% | 0 mm | | | | |
| | Distance to neg. movement | 4 | 12 m | | | | |
| | | | 0.00 mm/m | 0.00 mm | | | |
| Fig. 2.12 | Vertical surface movement | 0.00% | 0 mm | | | | |
| | Distance to neg. movement | 3.5 | 10.5 m | | | | |
| | | | 0.00 mm/m | | 0.00 mm | | 0.00 mm |

## Ground Surface Movement due to Excavation in front of Wall in sand

Depth of Excavation 3 m

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fig. 2.12 | Vertical surface movement | 0.00% | 0 mm | | | | |
| | Distance to neg. movement | 2 | 6 m | | | | |
| | | | 0.00 mm/m | | 0.00 mm | | 0.00 mm |

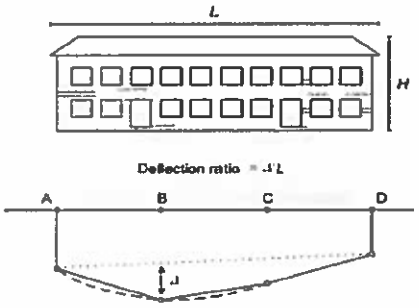
## Average Ground Surface Movement due to excavation in front of Wall

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Average of estimates of vertical movements in clay and sand | | | | 0.00 mm | | 0.00 mm |
| | | | | 3.73 mm | 3.80 mm | 0.00 mm | 0.00 mm |

## Hoiday Inn

**Vertical Movements**

| | | | |
|---|---|---|---|
| | Length of building | 52 | m |
| | Height of building | 30 | m |
| | L/H (for use in Fig. 2.18(b)) | 1.733 | |
| | Distance to piles | 1 | m |
| Fig. 2.18(a) | $\Delta$ Vertical settlement | 3.80 | mm |
| | Length for vertical strain | 20.00 | m |
| | Vertical strain $\Delta/L$ | 0.019% | |




(a) Definition of deflection ratio

**Horizontal Movements**

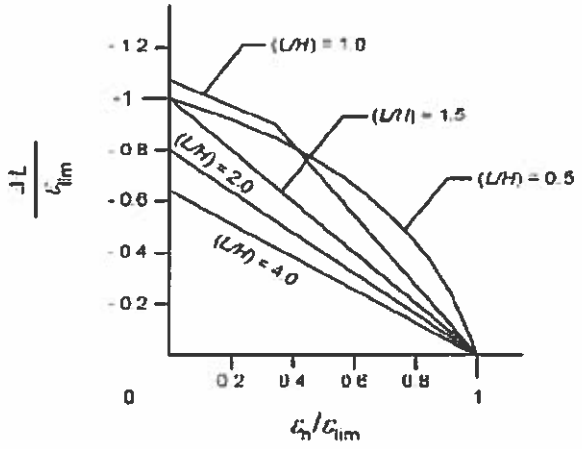
| | | | |
|---|---|---|---|
| | $\Delta_H$ | 3.73 | mm |
| | Length for horizontal strain | 15.00 | m |
| | Horizontal strain $\varepsilon_h = \Delta_H/L$ | 0.025% | |

**For Category 1 Very slight**

| | | | |
|---|---|---|---|
| Table 2.5 | $\varepsilon_{lim}$ | 0.15% | |
| | $\Delta/L/\varepsilon_{lim}$ | 0.13 | |
| | $\varepsilon_h/\varepsilon_{lim}$ | 0.17 | |
| | Limits | | |
| Fig. 2.18(b) | $K = \Delta/L/\varepsilon_{lim}$ | 0.92 | |
| | $\Delta/L/\varepsilon$ Max | 0.77 | OK |

**For Category 0 Negligible**

| | | | |
|---|---|---|---|
| Table 2.5 | $\varepsilon_{lim}$ | 0.050% | |
| | $\Delta/L/\varepsilon_{lim}$ | 0.38 | |
| | $\varepsilon_h/\varepsilon_{lim}$ | 0.50 | |
| | Limits | | |
| Fig. 2.18(b) | $K = \Delta/L/\varepsilon_{lim}$ | 0.92 | |
| | $\Delta/L/\varepsilon_{lim}$ Max | 0.46 | OK |




(b) Influence of horizontal strain on $\Delta/L / \varepsilon_{lim}$
(after Burland, 2001)

**CALCULATION SHEET**

create CONSULTING ENGINEERS LTD

| Project: 51 CALTHORPE ST BIA | Sheet no. of | Job No: |
|---|---|---|
| | Calc. no: P118 | Checked by: |
| Subject: CLASSIFICATION OF VISIBLE DAMAGE ASSESSMENT | Made by: RMC REV. MARCH 2017 | Date: |
| | Date: 09/09/16 | |

EFFECTS ON ROAD

MIN DISTANCE TO ROAD = AT S/E CORNER
= ~5m

AT 5m FROM PILES, VERT. MOVEMENTS ≈ 0.02 %
= 0.6mm

HORIZONTAL = 2.67 mm + 0.88 = 3.54mm

VERTICAL = 3.00mm + 0.6mm = 3.6mm

CARRIAGEWAY IS AT GRADE. THIS SORT OF MOVEMENT (MAX.) WOULD ONLY GENERATE VERY LOW STRAINS, WELL WITHIN WHAT CAN BE TOLERATED BY A HIGHWAY.

NEGLIGIBLE EXPECTED EFFECT ON ROAD

**Ground Surface Movement due to Installation of Piles**

Contiguous Piles

Depth of Piles 10 m

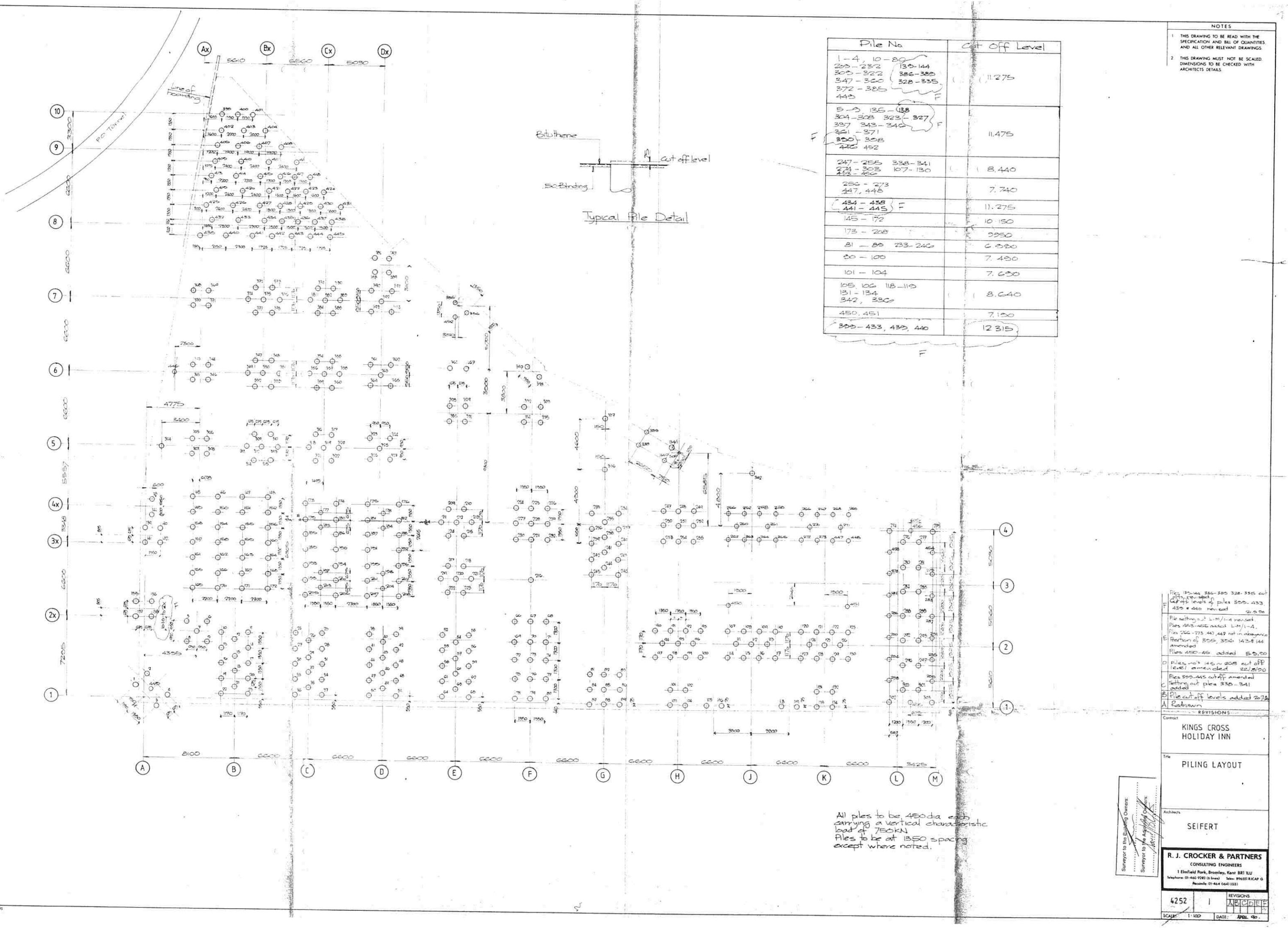
| | | | | At 5 m | | At 12.5 m | |
|---|---|---|---|---|---|---|---|
| | | | | Horizontal | Vertical | Horizontal | Vertical |
| Table 2.2 | Horizontal surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 1.5 | 15 m | | | | |
| | | | 0.27 mm/m | 2.67 mm | | 0.666667 mm | |
| | Vertical surface movement | 0.04% | 4 mm | | | | |
| | Distance to neg. movement | 2 | 20 m | | | | |
| | | | 0.20 mm/m | | 3.00 mm | | 1.50 mm |

**Ground Surface Movement due to Excavation in front of Wall**

Depth of Excavation 3 m

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Table 2.4 | Horizontal surface movement | 0.05% | 1.5 mm | | | | |
| | Distance to neg. movement | 4 | 12 m | | | | |
| | | | 0.13 mm/m | 0.88 mm | | | |
| | Vertical surface movement | 0.10% | 3 mm | | | | |
| | Distance to neg. movement | 3.5 | 10.5 m | | | | |
| | | | 0.29 mm/m | | 1.57 mm | | 0.00 mm |
| | | | | 3.54 mm | 4.57 mm | 0.67 mm | 1.50 mm |

# APPENDIX Q







Typical Pile Detail

| Pile No. | Cut Off Level |
|---|---|
| 1 – 4, 10 – 80, 265 – 282, 303 – 322, 347 – 360, 372 – 385, 445 (135–144, 386–388, 328–335) F | 11.275 |
| 5 – 9, 135 – 138, 304 – 308, 323 – 327, 337, 343 – 346, 361 – 371, 389 – 398, 446 – 452 F | 11.475 |
| 247 – 255, 338 – 341, 274 – 303, 107 – 130, 453 – 456 | 8.440 |
| 256 – 273, 447, 448 | 7.740 |
| 434 – 438, 441 – 445 F | 11.275 |
| 145 – 172 | 10.150 |
| 173 – 208 | 9.950 |
| 81 – 88, 233 – 246 | 6.890 |
| 90 – 100 | 7.490 |
| 101 – 104 | 7.690 |
| 105, 106, 118 – 119, 131 – 134, 342, 336 | 8.640 |
| 450, 451 | 7.150 |
| 399 – 433, 439, 440 | 12.315 |

F

NOTES

1 THIS DRAWING TO BE READ WITH THE SPECIFICATION AND BILL OF QUANTITIES AND ALL OTHER RELEVANT DRAWINGS.

2 THIS DRAWING MUST NOT BE SCALED. DIMENSIONS TO BE CHECKED WITH ARCHITECTS DETAILS.

All piles to be 450 dia each carrying a vertical characteristic load of 750KN
Piles to be at 1350 spacing except where noted.

Surveyor to this Building Owners:

Surveyor to the Adjoining Owners:

| | |
|---|---|
| F | Piles 135-144, 386-388, 328-335 cut off level amended Cut off levels of piles 399-433, 439 & 440 revised 2.5.90 |
| E | Pile setting out L-M/1-4 revised. Piles 453-456 added L-M/1-4. Piles 256-273, 447, 449 not in sequence. Position of 399, 336, 143 & 144 amended. Piles 450-452 added 5.5.90 |
| D | Piles no's 145 to 208 cut off level amended 22.3.90 |
| C | Piles 399-445 cut off amended Setting out piles 336-341 added |
| B | Pile cut off levels added 20.2.90 |
| A | Redrawn |

REVISIONS

Contract: KINGS CROSS HOLIDAY INN

Title: PILING LAYOUT

Architects: SEIFERT

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4252 | 1 | REVISIONS A B C D E F

SCALE: 1:100 | DATE: APRIL 90.

GEOPRINT 1695