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PROJECT NO: 5006835	BY: ML CHK'D: RL

Partnership House
Moorside Road
Winchester
SO23 7RX

Tel: 01962 834400
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GROUND MOVEMENT ASSESSMENT TO CIRIA C760

NEIGHBOURING PROPERTY - 1 St John's Wood Park

BUILDING WIDTH, L = 12600mm
DISTANCE TO CLOSEST POINT FROM EXCAVATION & INSTALLATION, L_1 = 2900mm
DISTANCE TO FURTHEST POINT FROM EXCAVATION & INSTALLATION, L_2 = 15500mm

HEIGHT, H = 9000mm

L/H = 1.4

MAX EXCAVATION DEPTH, H_b = 6.0m
PILE WALL DEPTH, D = 13.25m

- POTENTIAL MOVEMENT DUE TO INSTALLATION OF WALL (USING PARAMETERS FROM TABLE 6.1 & FIGURE 6.8)

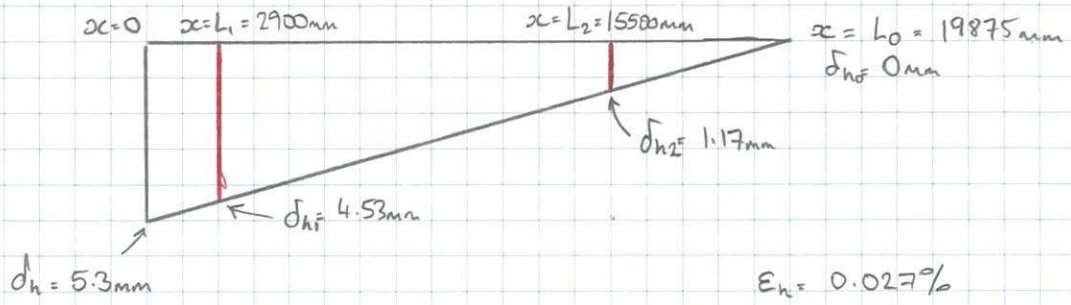
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

∴ MAX δ_h = (0.04/100) × 13250mm = 5.3mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 1.5

∴ L_o = 13.25m × 1.5 = 19.875m

HORIZONTAL MOVEMENT GRADIENT DUE TO INSTALLATION



ε_h = 0.027%

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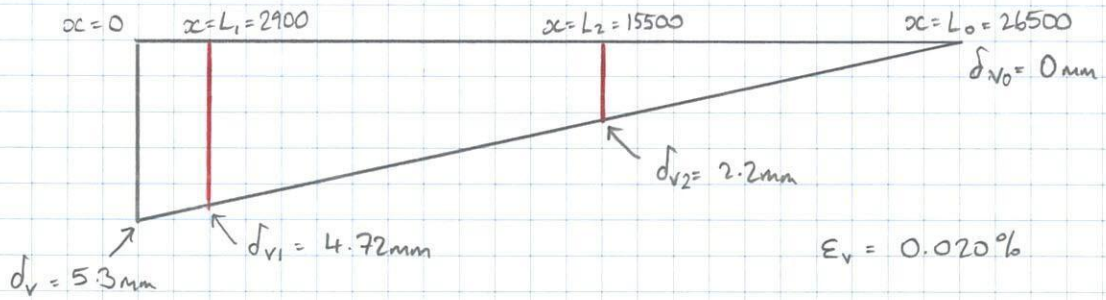
VERTICAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

$\therefore$ MAX $\delta_v = (0.04/100) \times 13250\text{mm} = 5.3\text{mm}$

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 2.0

$\therefore L_o = 13.25\text{m} \times 2.0 = 26.5\text{m}$

VERTICAL MOVEMENT GRADIENT DUE TO INSTALLATION



- POTENTIAL MOVEMENT DUE TO EXCAVATION OF GROUND IN FRONT OF WALL (USING PARAMETERS FROM TABLE 6.3 & FIGURE 6.15)

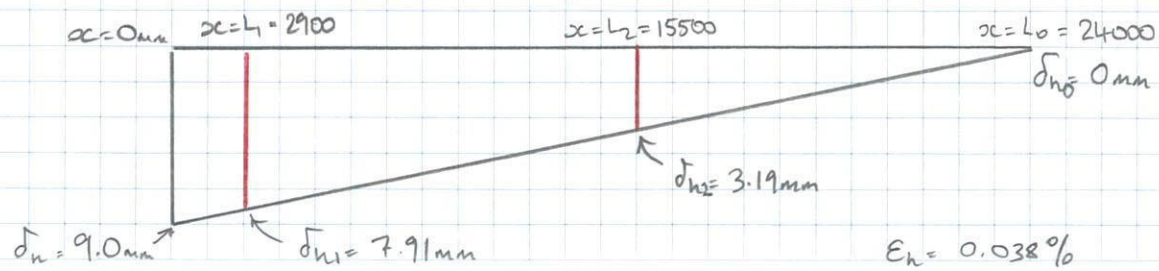
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF EXCAVATION DEPTH) = 0.15%

$\therefore$ MAX $\delta_h = (0.15/100) \times 6000 = 9.0\text{mm}$

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAVATION DEPTH) = 4

$\therefore L_o = 6\text{m} \times 4 = 24\text{m}$

HORIZONTAL MOVEMENT GRADIENT DUE TO EXCAVATION.



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VERTICAL SURFACE MOVEMENT AT WALL: [USE FIGURE 6.15b]

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAV. DEPTH) = 3.5

$\therefore L_o = 6.0 \times 3.5 = 21.0m$

INTERPRETATION OF FIGURE 6.15b:

→ @ $x = 0$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.04%

→ @ POINT OF MAX SETTLEMENT

↳ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.075%

↳ DISTANCE FROM WALL / MAX EXCAVATION DEPTH = 0.64

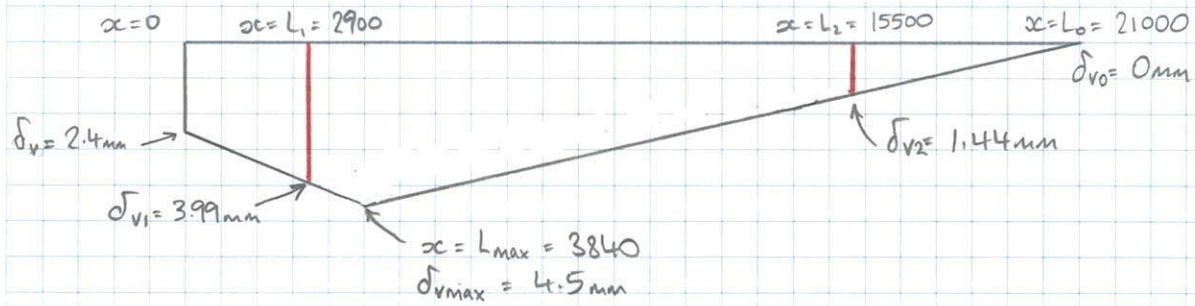
→ @ $x = 21.0m$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0%.

@ $x=0$ VERTICAL MOVEMENT = $(0.04/100) \times 6000 = 2.4mm$

@ δ_v (MAX) VERTICAL MOVEMENT = $(0.075/100) \times 6000 = 4.5mm$

@ d_v (MAX) DISTANCE FROM WALL = $0.64 \times 6000 = 3840mm$

$\therefore$ SIMPLIFIED VERTICAL MOVEMENT GRADIENT:



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- COMBINED POTENTIAL MOVEMENTS DUE TO INSTALLATION & EXCAVATION.

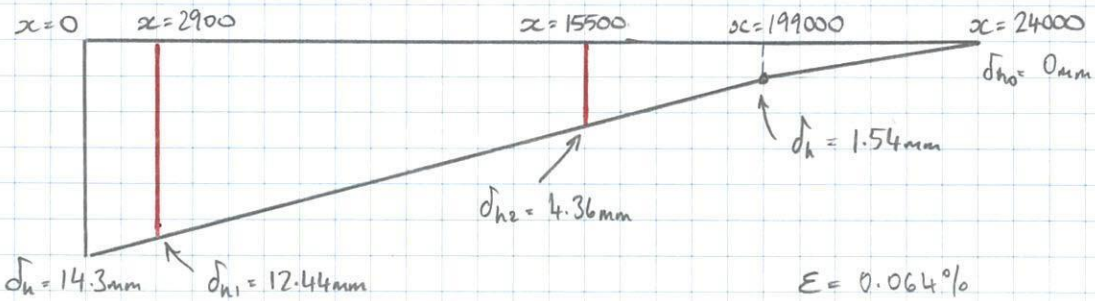
HORIZONTAL MOVEMENT:

INSTALLATION: $\delta_h = 5.3mm$, $\delta_{h1} = 4.53mm$, $\delta_{h2} = 1.17mm$, $L_o = 19900mm$

EXCAVATION: $\delta_h = 9.0mm$, $\delta_{h1} = 7.91mm$, $\delta_{h2} = 3.19mm$, $L_o = 24000mm$

FIND MOVEMENT DUE TO EXCAV. @ 19900mm

$$\delta_h = \tan\left(\tan^{-1}\left(\frac{9.0}{24000}\right)\right) \times (24000 - 19900) = 1.54mm$$



$\varepsilon = 0.064\%$

VERTICAL MOVEMENT:

INSTALLATION: $\delta_v = 5.3mm$, $\delta_{v1} = 4.72mm$, $\delta_{v2} = 2.2mm$, $L_o = 26500$

EXCAVATION: $\delta_v = 2.4mm$, $\delta_{v1} = 3.99mm$, $\delta_{v2} = 1.44mm$, $L_o = 21000$, $\delta_{vmax} = 4.5mm$
$L_{max} = 3840mm$

FIND MOVEMENT DUE TO INSTALLATION @ 21000

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 21000) = 1.1mm$$

FIND MOVEMENT DUE TO INSTALLATION @ 3840 + δ_{vmax}

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 3840) + 4.5 = 9.03mm$$

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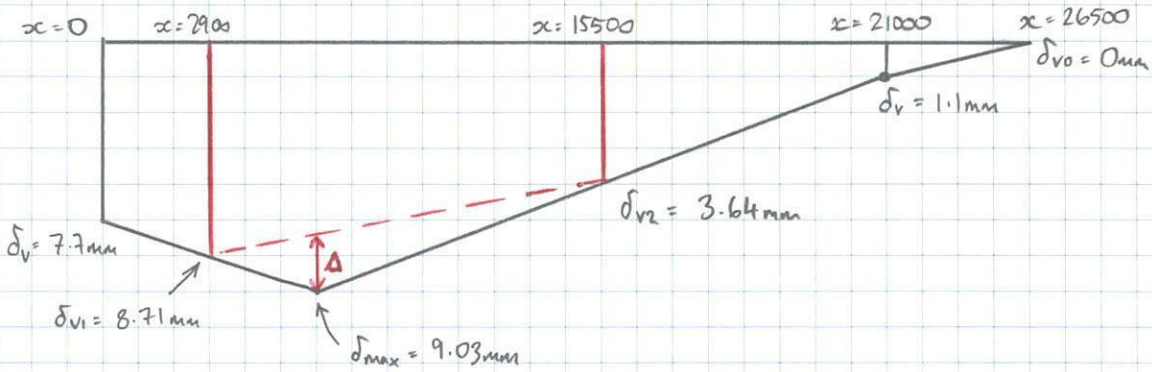

∴ RELATIVE VERTICAL MOVEMENT WITHIN BUILDING:

$$\Delta = 9.03 - \left[\left[\tan\left(\tan^{-1}\left(\frac{d_{v1} - d_{v2}}{L_2 - L_1}\right)\right) \times (L_2 - L_{max})\right] + d_{v2}\right]$$

$$= 2.90\,mm$$

- CALCULATION OF DAMAGE CATEGORY (USING FIGURE 6.27 & TABLE 6.4)

CAMDEN COUNCIL REQUIRES A DAMAGE CATEGORY NOT EXCEEDING CATEGORY 1 'VERY SLIGHT' ON THE BURLAND SCALE.

∴ $\varepsilon_{LIM} = 0.075\%$

$\varepsilon_h = 0.064\%$

$\Delta/L = 2.90 / 12600 \times 100 = 0.023\%$

CONSERVATIVELY USE LINE 'L/H = 1.5' ⇒ EQ. OF LINE = $y = 1 - x$

$y = \Delta/L = 0.023$, $x = \varepsilon_h = 0.064$

∴ TOTAL TENSILE STRAIN, $\varepsilon = 0.023 + 0.064 = 0.087\%$

∴ MOVEMENT WITHIN DAMAGE CATEGORY 2 'SLIGHT'

MITIGATION MEASURES WILL THEREFORE BE REQUIRED, SEE OVER.

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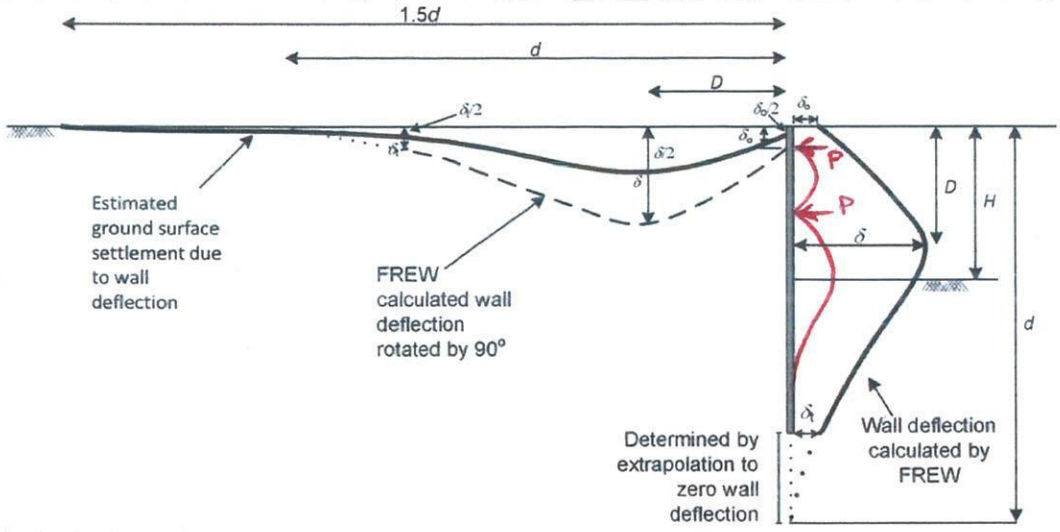
FIGURE 6.17 SHOWS THE RELATIONSHIP BETWEEN ANALYSED LATERAL (PROPPED) WALL DEFLECTIONS AND PREDICTED GROUND SURFACE SETTLEMENTS IN STIFF GROUND

THE FIGURE SHOWS THAT THE ESTIMATED GROUND SURFACE SETTLEMENT DUE TO WALL DEFLECTION IS CIRCA 1/2 THE DEFLECTION EXPERIENCED BY THE WALL.

THEREFORE, LIMITING THE DEFLECTION OF THE WALL WILL REDUCE THE TOTAL TENSILE STRAIN, ε.

THE WALL DEFLECTION WILL THEREFORE BE LIMITED DURING CONSTRUCTION AS PER APPENDIX H.

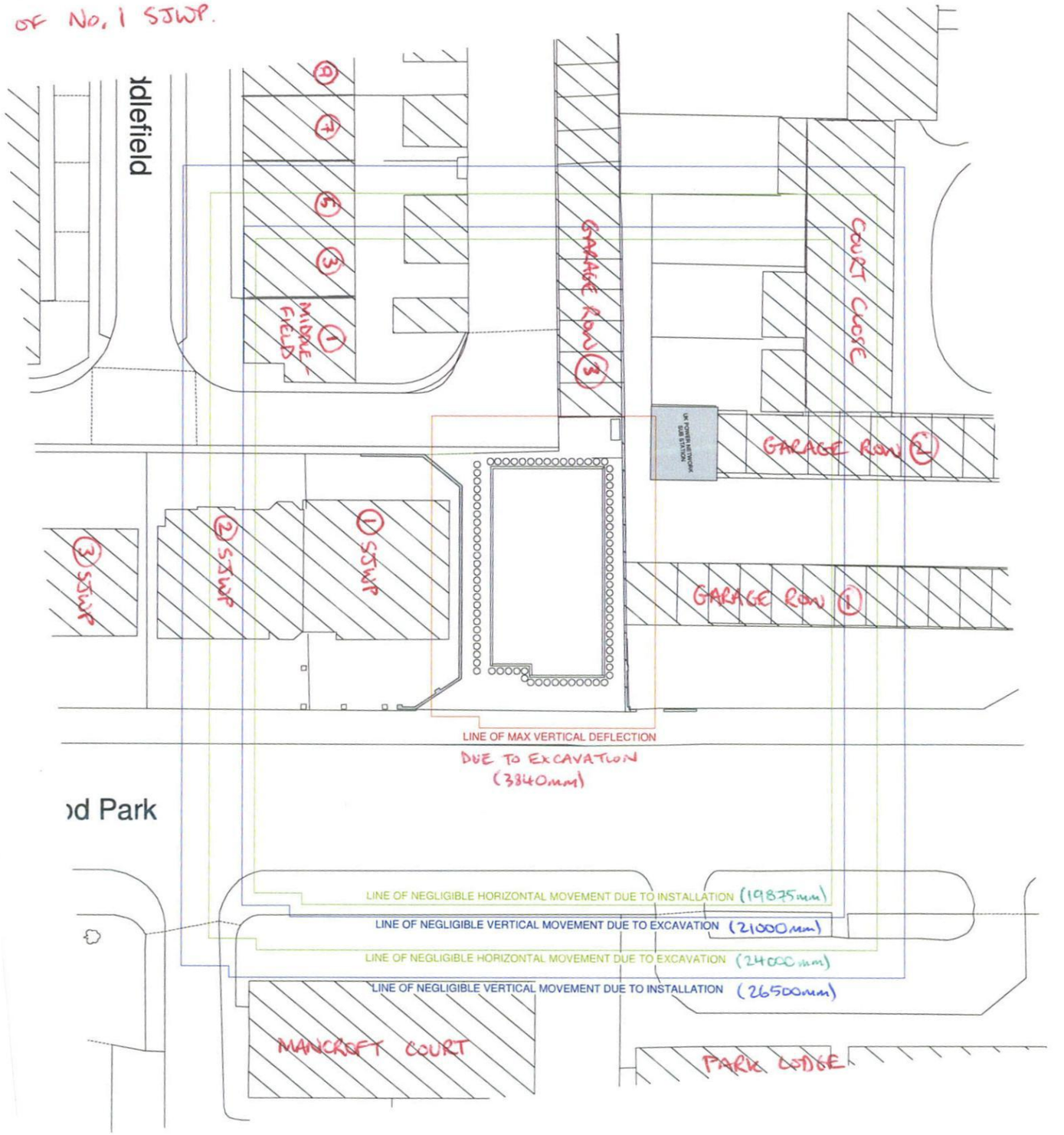
FINAL PROPPING SCHEME IS TO BE DECIDED BY THE CONTRACTOR, HOWEVER, WE WOULD RECOMMEND THAT THEY CONSIDER A SECONDARY LINE OF PROPPING AT MID-HEIGHT OF THE EXCAVATION DEPTH. A MARK-UP OF FIGURE 6.17 SHOWS HOW THIS WOULD AFFECT THE DEFLECTION OF THE WALL.



THE SECONDARY LINE OF PROPPING WILL SIGNIFICANTLY REDUCE WALL DEFLECTIONS, AND SUBSEQUENTLY LIMIT GROUND MOVEMENT TO WITHIN THE ACCEPTABLE ε LIMIT BY INSPECTION.

THE RESIDUAL IMPACTS TO THE NEIGHBOURING BUILDING WILL BE POSSIBLE FINE CRACKING THAT CAN EASILY BE TREATED DURING NORMAL DECORATION [DAMAGE CATEGORY 1 - VERY SLIGHT]

PLAN SHOWING LINES OF INFLUENCE OF HORIZONTAL & VERTICAL GROUND MOVEMENTS DUE TO INSTALLATION OF WALL & EXCAVATION. IN THE CONSTRUCTION OF THE PROPOSED BASEMENT. LINES PLOTTED FROM RESULTS OBTAINED IN ASSESSMENT OF No. 1 SJWP.



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NEIGHBOURING PROPERTY - 2 St John's Wood Park

BUILDING CONSTRUCTION AND DIMENSIONS ARE IDENTICAL TO No. 1 SJWP.

BY INSPECTION OF THE LINE OF INFLUENCE DIAGRAM IT CAN BE SEEN THAT THE STRUCTURE IS NOT NEAR TO THE LINE OF MAX VERTICAL DEFLECTION & THE LINES OF NEGLIGIBLE MOVEMENT, BOTH HORIZONTAL & VERTICAL, DUE TO INSTALATION AND EXCAVATION ARE WITHIN THE BUILDING ENVELOPE.

∴ THE BUILDING WILL EXPERIENCE VERY LOW DEFLECTIONS & STRAIN RESULTING IN A SIGNIFICANTLY LOWER RISK OF DAMAGE & CAN BE CONSIDERED ACCEPTABLE BY INSPECTION OF PREVIOUS CALCULATIONS.

NEIGHBOURING PROPERTY - 3 St John's Wood Park.

BY INSPECTION OF LINE OF INFLUENCE DIAGRAM THE ENTIRE STRUCTURE LIES OUTSIDE THE LINES OF NEGLIGENT DEFLECTION FOR BOTH VERTICAL & HORIZONTAL MOVEMENT DUE TO INSTALATION & EXCAVATION.

MANCROFT COURT

AS PER No. 3 SJWP

PARK LODGE

AS PER No. 3 SJWP.

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GROUND MOVEMENT ASSESSMENT TO CIRIA C760

NEIGHBOURING PROPERTY - 1 MIDDLEFIELD

BUILDING WIDTH, L = 10200 mm
DISTANCE TO CLOSEST POINT FROM EXCAVATION & INSTALLATION, L_1 = 10800 mm
DISTANCE TO FURTHEST POINT FROM EXCAVATION & INSTALLATION, L_2 = 21000 mm

HEIGHT, H = 9000 mm

L/H = 1.13

MAX EXCAVATION DEPTH, H_b = 6.0 m
PILE WALL DEPTH, D = 13.25 m

- POTENTIAL MOVEMENT DUE TO INSTALLATION OF WALL (USING PARAMETERS FROM TABLE 6.1 & FIGURE 6.8)

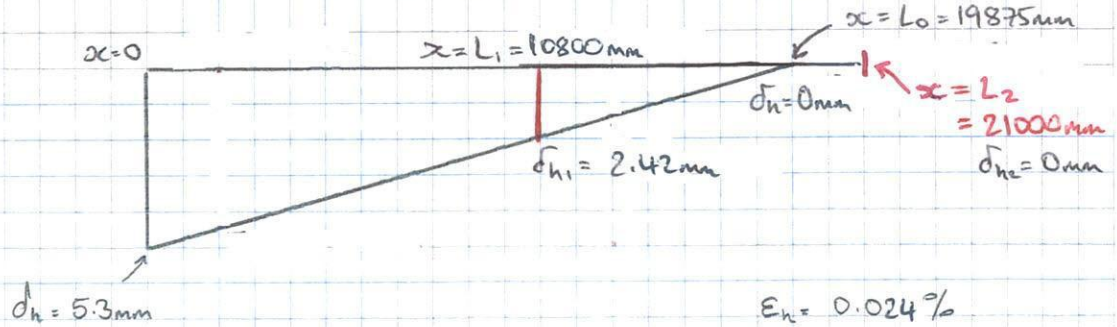
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

$\therefore$ MAX δ_h = (0.04/100) × 13250 mm = 5.3 mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 1.5

$\therefore L_o$ = 13.25 m × 1.5 = 19.875 m

HORIZONTAL MOVEMENT GRADIENT DUE TO INSTALLATION



ε_h = 0.024%

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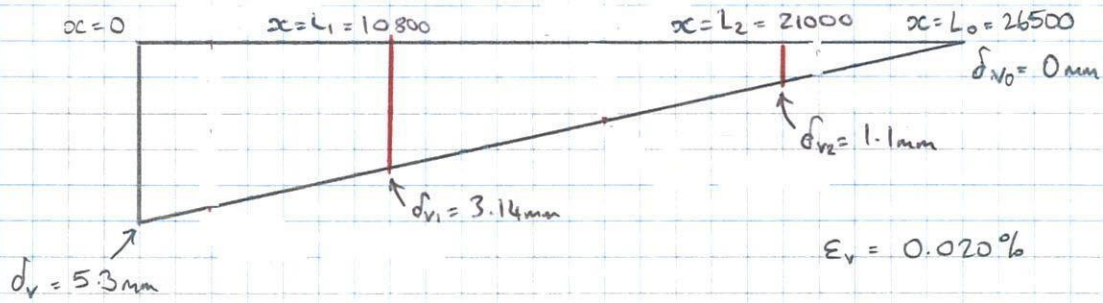
VERTICAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

∴ MAX δ_v = (0.04/100) × 13250mm = 5.3mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 2.0

∴ L_o = 13.25m × 2.0 = 26.5m

VERTICAL MOVEMENT GRADIENT DUE TO INSTALLATION



ε_v = 0.020%

- POTENTIAL MOVEMENT DUE TO EXCAVATION OF GROUND IN FRONT OF WALL (USING PARAMETERS FROM TABLE 6.3 & FIGURE 6.15)

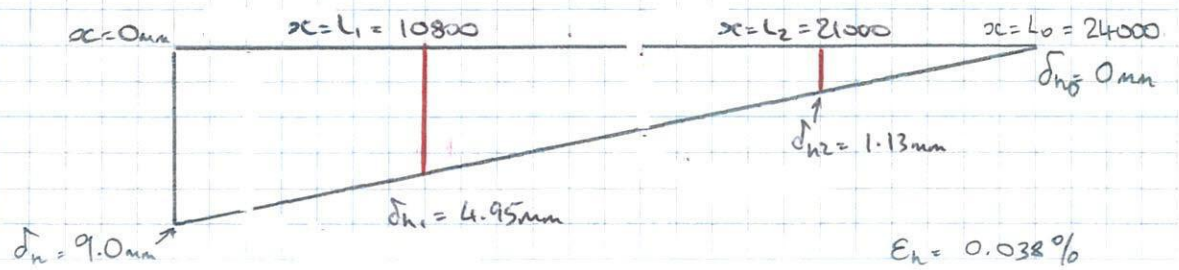
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF EXCAVATION DEPTH) = 0.15%

∴ MAX δ_h = (0.15/100) × 6000 = 9.0mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAVATION DEPTH) = 4

∴ L_o = 6m × 4 = 24m

HORIZONTAL MOVEMENT GRADIENT DUE TO EXCAVATION.



ε_h = 0.038%

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VERTICAL SURFACE MOVEMENT AT WALL: [USE FIGURE 6.15b]

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAV. DEPTH) = 3.5

$\therefore L_o = 6.0 \times 3.5 = 21.0m$

INTERPRETATION OF FIGURE 6.15b:

→ @ $x = 0$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.04%

→ @ POINT OF MAX SETTLEMENT

↳ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.075%

↳ DISTANCE FROM WALL / MAX EXCAVATION DEPTH = 0.64

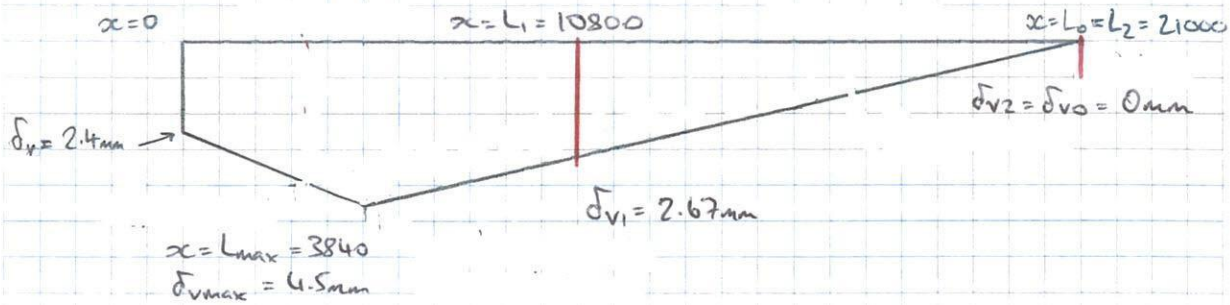
→ @ $x = 21.0m$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0%.

@ $x=0$ VERTICAL MOVEMENT = $(0.04/100) \times 6000 = 2.4mm$

@ δ_v (MAX) VERTICAL MOVEMENT = $(0.075/100) \times 6000 = 4.5mm$

@ δ_v (MAX) DISTANCE FROM WALL = $0.64 \times 6000 = 3840mm$

$\therefore$ SIMPLIFIED VERTICAL MOVEMENT GRADIENT:



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- COMBINED POTENTIAL MOVEMENTS DUE TO INSTALLATION & EXCAVATION.

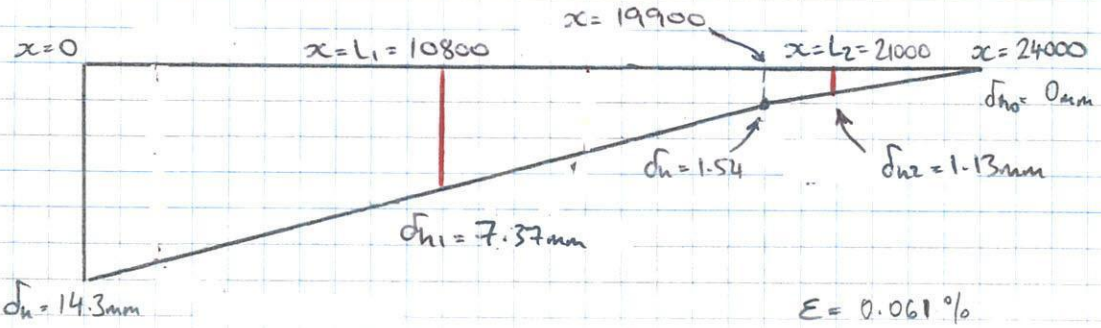
HORIZONTAL MOVEMENT:

INSTALLATION: $\delta_h = 5.3mm$, $\delta_{h1} = 2.42mm$, $\delta_{h2} = 0mm$, $L_o = 19900mm$

EXCAVATION: $\delta_h = 9.0mm$, $\delta_{h1} = 4.95mm$, $\delta_{h2} = 1.13mm$, $L_o = 24000mm$

FIND MOVEMENT DUE TO EXCAV. @ 19900mm

$$\delta_h = \tan\left(\tan^{-1}\left(\frac{9.0}{24000}\right)\right) \times (24000 - 19900) = 1.54mm$$



$\varepsilon = 0.061\%$

VERTICAL MOVEMENT:

INSTALLATION: $\delta_v = 5.3mm$, $\delta_{v1} = 3.14mm$, $\delta_{v2} = 1.1mm$, $L_o = 26500$

EXCAVATION: $\delta_v = 2.4mm$, $\delta_{v1} = 2.67mm$, $\delta_{v2} = 0mm$, $L_o = 21000$, $\delta_{vmax} = 4.5mm$
$L_{max} = 3840mm$

FIND MOVEMENT DUE TO INSTALLATION @ 21000

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 21000) = 1.1mm$$

FIND MOVEMENT DUE TO INSTALLATION @ 3840 + δ_{vmax}

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 3840) + 4.5 = 9.03mm$$

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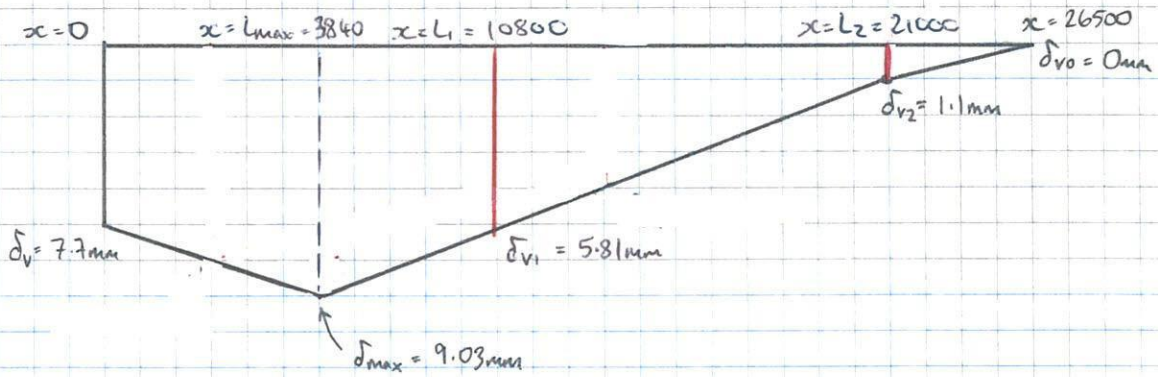

∴ RELATIVE VERTICAL MOVEMENT WITHIN BUILDING:

$\Delta = 0mm$

BUILDING EXPERIENCES NEGLIGIBLE RELATIVE VERTICAL MOVEMENT.

- CALCULATION OF DAMAGE CATEGORY (USING FIGURE 6.27 & TABLE 6.4)

CAMDEN COUNCIL REQUIRES A DAMAGE CATEGORY NOT EXCEEDING CATEGORY 1 'VERY SLIGHT' ON THE BURLAND SCALE.

∴ $\varepsilon_{lim} = 0.075\%$

$\varepsilon_h = 0.064\%$

$\Delta/L = 0 / 12600 \times 100 = 0.0\%$

$\varepsilon_h / \varepsilon_{lim} = 0.86$

$\Delta/L / \varepsilon_{lim} = 0.00$

SEE OVER FOR PLOT ONTO FIGURE 6.27

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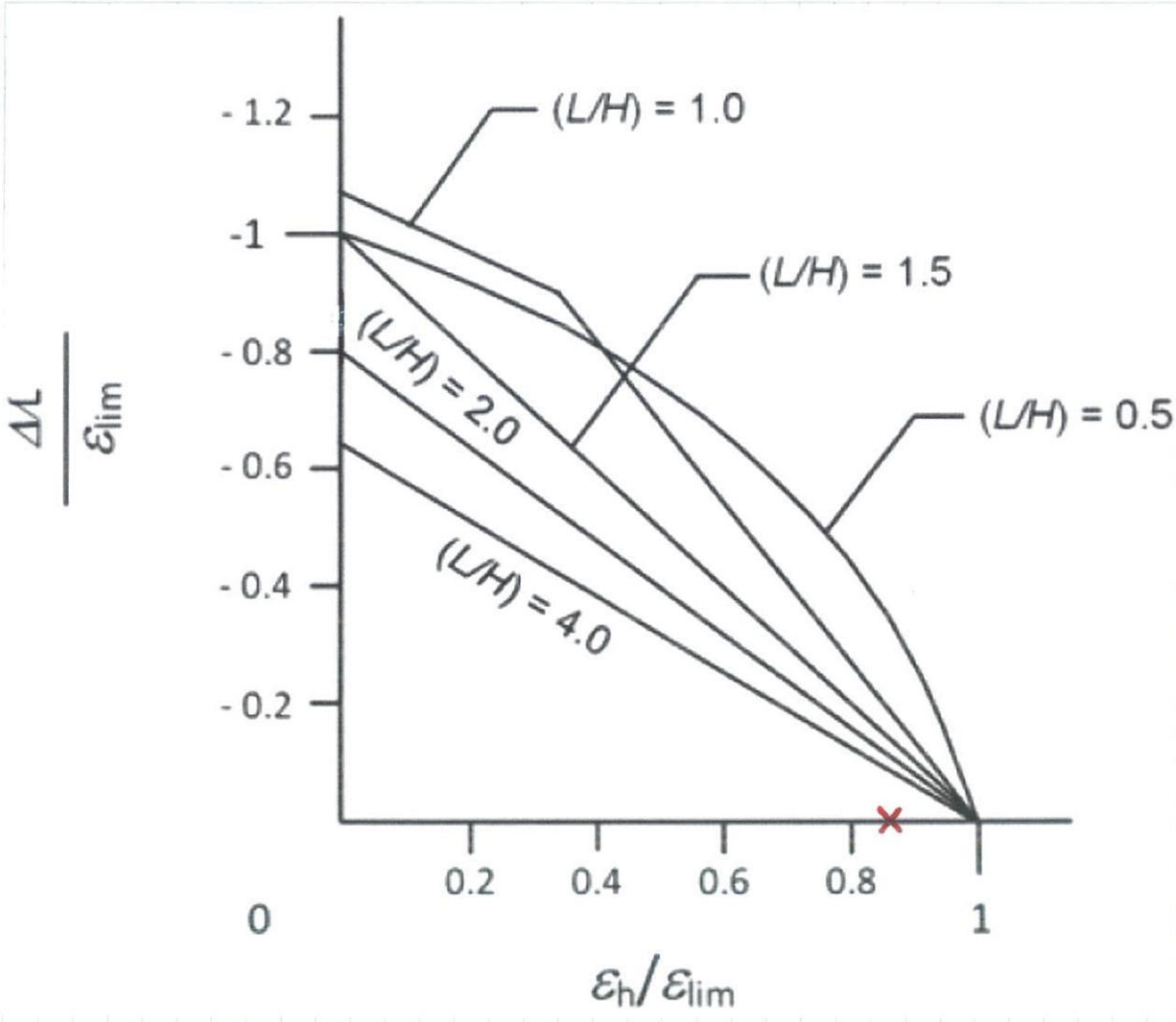

∴ GROUND MOVEMENT LIES WITHIN THE ACCEPTED LIMITS TO RESTRICT DAMAGE CATEGORY TO 1 - VERY SLIGHT.

THE PROPPING PROPOSED IN THE ISJWP CALCULATION WILL FURTHER RESTRICT THIS GROUND MOVEMENT.

No 1. MIDDLEFIELD IS THE WORST CASE OF ALL BUILDINGS ON MIDDLEFIELD THE CONSTRUCTION AND DIMENSIONS ARE SIMILAR & THIS IS THE CLOSEST TO THE BASEMENT.

∴ BY INSPECTION THE OTHER BUILDINGS WILL BE IN DAMAGE CATEGORY 1 'VERY SLIGHT' OR LESS.

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BY INSPECTION OF THE RESULTS FROM THE G.M.A OF 1 MIDDLEFIELD THE VALUE OF ε_h DOES NOT EXCEED 0.064%, REDUCING. IF BUILDING IS LOCATED OUTSIDE OF THE LINES OF INFLUENCE AND Δ IS ONLY PRESENT IF THE LINE OF MAX VERTICAL DEFLECTION LIES WITHIN THE BUILDING ENVELOPE.

∴ BY INSPECTION OF THE MARKED-UP FIGURE 6.27 ALL STRUCTURES IN THE VICINITY THAT DO NOT CONTAIN THE LINE OF MAX VERTICAL DEFLECTION DUE TO EXCAVATION WILL HAVE A 'VERY SLIGHT' DAMAGE CATEGORY [1] OR LESS. [REGARD LESS OF L/H AS ALL PASS x AXIS @ 1.0].

∴ COURT CLOSE, GARAGE ROW (3), GARAGE ROW (2) ALL IN DAMAGE CATEGORY 1 – 'VERY SLIGHT' BY INSPECTION.

TUBE TUNNELS ARE ALSO PRESENT & RUN UNDER ST JOHN'S WOOD PARK (ROAD) THESE TUNNELS ARE ALSO OUTSIDE THE LINE OF MAX VERTICAL DEFLECTION. CIRIA C760 GROUND SURFACE MOVEMENTS & AS SUCH ARE NOT REPRESENTATIVE OF THE GROUND MOVEMENT ON SUBTERRANEAN STRUCTURES. WHICH WILL BE LOWER THAN THAT EXPERIENCED ON THE SURFACE. CONSULTATION WITH LUL (ASSET OWNER) SHALL BE CARRIED OUT & MAINTAINED DURING THE DETAILED DESIGN + CONSTRUCTION PHASES TO LIMIT & CONTROL GROUND MOVEMENTS & THE EFFECTS ON THE TUNNELS.

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GROUND MOVEMENT ASSESSMENT TO CIRIA C760

NEIGHBOURING PROPERTY - SUBSTATION

BUILDING WIDTH, L = 6020
DISTANCE TO CLOSEST POINT FROM EXCAVATION & INSTALLATION, L_1 = 3400
DISTANCE TO FURTHEST POINT FROM EXCAVATION & INSTALLATION, L_2 = 9400

HEIGHT, H = 3000 mm

L/H = 2.0

MAX EXCAVATION DEPTH, H_b = 6.0m
PILE WALL DEPTH, D = 13.25m

- POTENTIAL MOVEMENT DUE TO INSTALLATION OF WALL (USING PARAMETERS FROM TABLE 6.1 & FIGURE 6.8)

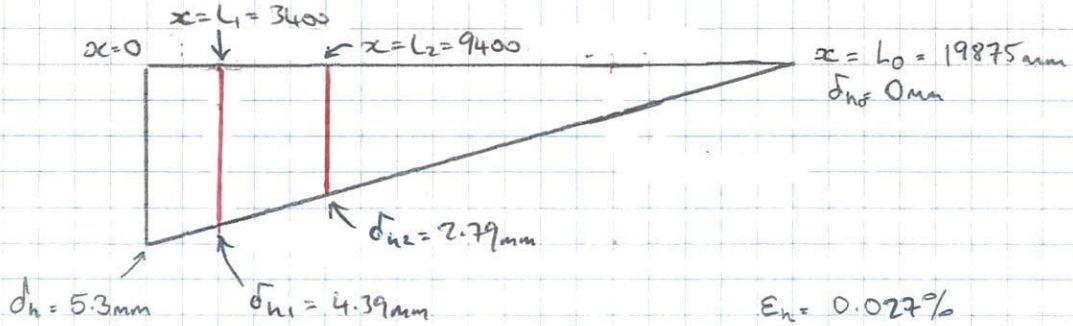
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

∴ MAX δ_h = (0.04/100) × 13250mm = 5.3mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 1.5

∴ L_o = 13.25m × 1.5 = 19.875m

HORIZONTAL MOVEMENT GRADIENT DUE TO INSTALLATION



ε_h = 0.027%

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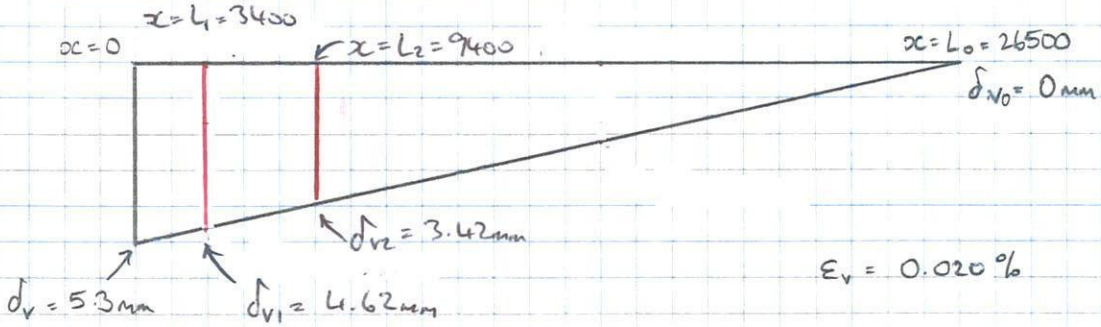
VERTICAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

∴ MAX δ_v = (0.04 / 100) × 13250mm = 5.3mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 2.0

∴ L_o = 13.25m × 2.0 = 26.5m

VERTICAL MOVEMENT GRADIENT DUE TO INSTALLATION



- POTENTIAL MOVEMENT DUE TO EXCAVATION OF GROUND IN FRONT OF WALL (USING PARAMETERS FROM TABLE 6.3 & FIGURE 6.15)

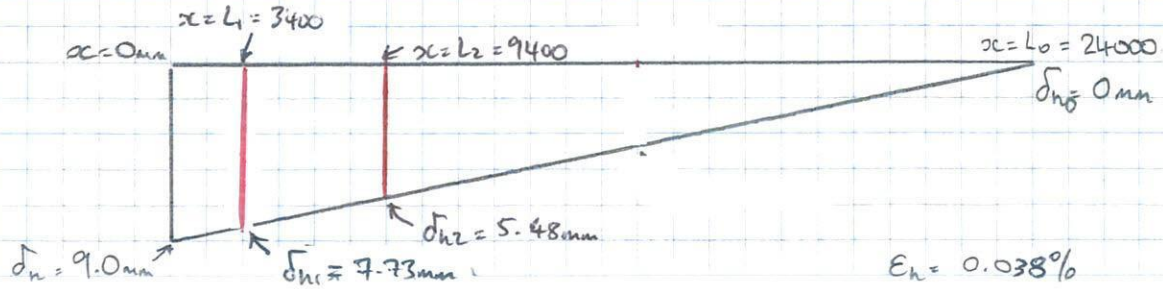
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF EXCAVATION DEPTH) = 0.15%

∴ MAX δ_h = (0.15 / 100) × 6000 = 9.0mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAVATION DEPTH) = 4

∴ L_o = 6m × 4 = 24m

HORIZONTAL MOVEMENT GRADIENT DUE TO EXCAVATION.



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VERTICAL SURFACE MOVEMENT AT WALL: [USE FIGURE 6.15b]

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAV. DEPTH) = 3.5

$\therefore L_o = 6.0 \times 3.5 = 21.0m$

INTERPRETATION OF FIGURE 6.15b:

→ @ $x = 0$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.04%

→ @ POINT OF MAX SETTLEMENT

↳ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.075%

↳ DISTANCE FROM WALL / MAX EXCAVATION DEPTH = 0.64

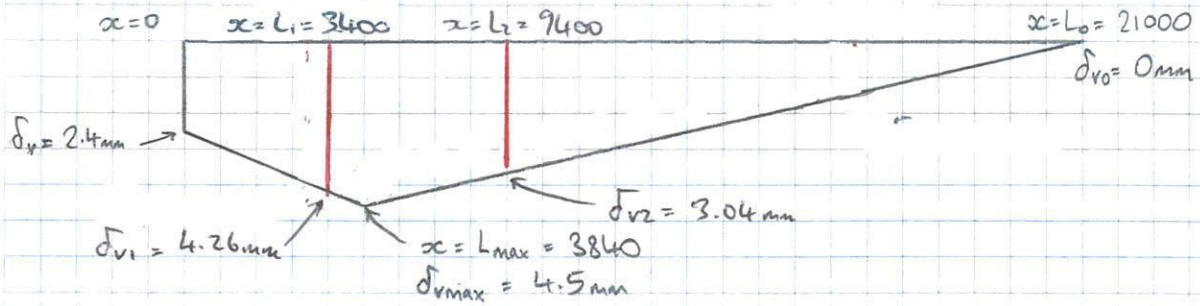
→ @ $x = 21.0m$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0%.

@ $x=0$ VERTICAL MOVEMENT = $(0.04/100) \times 6000 = 2.4mm$

@ δ_v (MAX) VERTICAL MOVEMENT = $(0.075/100) \times 6000 = 4.5mm$

@ δ_v (MAX) DISTANCE FROM WALL = $0.64 \times 6000 = 3840mm$

∴ SIMPLIFIED VERTICAL MOVEMENT GRADIENT:



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- COMBINED POTENTIAL MOVEMENTS DUE TO INSTALLATION & EXCAVATION.

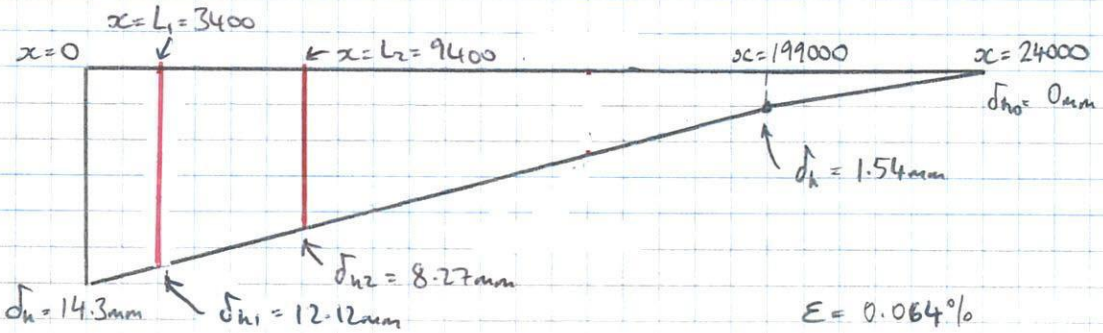
HORIZONTAL MOVEMENT:

INSTALLATION: $\delta_h = 5.3mm$, $\delta_{h1} = 4.39mm$, $\delta_{h2} = 2.79mm$, $L_o = 19900mm$

EXCAVATION: $\delta_h = 9.0mm$, $\delta_{h1} = 7.73mm$, $\delta_{h2} = 5.48mm$, $L_o = 24000mm$

FIND MOVEMENT DUE TO EXCAV. @ 19900mm

$$\delta_h = \tan\left(\tan^{-1}\left(\frac{9.0}{24000}\right)\right) \times (24000 - 19900) = 1.54\,mm$$



$\varepsilon = 0.064\%$

VERTICAL MOVEMENT:

INSTALLATION: $\delta_v = 5.3mm$, $\delta_{v1} = 4.62mm$, $\delta_{v2} = 3.42mm$, $L_o = 26500$

EXCAVATION: $\delta_v = 2.4mm$, $\delta_{v1} = 4.26mm$, $\delta_{v2} = 3.04mm$, $L_o = 21000$, $\delta_{vmax} = 4.5mm$
$L_{max} = 3840mm$

FIND MOVEMENT DUE TO INSTALLATION @ 21000

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 21000) = 1.1mm$$

FIND MOVEMENT DUE TO INSTALLATION @ 3840 + δ_{vmax}

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 3840) + 4.5 = 9.03mm$$

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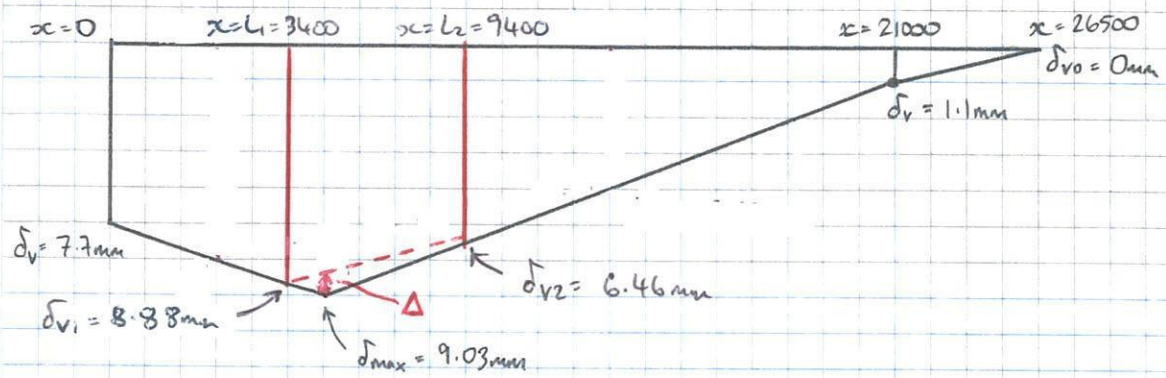

∴ RELATIVE VERTICAL MOVEMENT WITHIN BUILDING:

$$\Delta = 9.03 - \left[\left[\tan\left(\tan^{-1}\left(\frac{d_{v1} - d_{v2}}{L_2 - L_1}\right)\right) \times (L_2 - L_{max})\right] + d_{v2}\right]$$

$$= 0.33 \text{ mm}$$

- CALCULATION OF DAMAGE CATEGORY (USING FIGURE 6.27 & TABLE 6.4)

CAMDEN COUNCIL REQUIRES A DAMAGE CATEGORY NOT EXCEEDING CATEGORY 1 'VERY SLIGHT' ON THE BURLAND SCALE.

∴ $\varepsilon_{LIM} = 0.075\%$

$\varepsilon_h = 0.064\%$

$\Delta/L = 0.33 / 6000 \times 100 = 0.005\%$

CONSERVATIVELY USE LINE 'L/H = 1.5' ⇒ EQ. OF LINE = $y = 1 - x$

$y = \Delta/L = 0.005$, $x = \varepsilon_h = 0.064$

∴ TOTAL TENSILE STRAIN, $\varepsilon = 0.005 + 0.064 = 0.069\%$

∴ MOVEMENT WITHIN DAMAGE CATEGORY 1 - 'VERY SLIGHT'

∴ GROUND MOVEMENT WITHIN ACCEPTABLE LIMITS.

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GROUND MOVEMENT ASSESSMENT TO CIRIA C760

NEIGHBOURING PROPERTY - GARAGE ROW 1

BUILDING WIDTH, L = 38700
DISTANCE TO CLOSEST POINT FROM EXCAVATION & INSTALLATION, L_1 = 1200
DISTANCE TO FURTHEST POINT FROM EXCAVATION & INSTALLATION, L_2 = 39900

HEIGHT, H = 3000

L/H = 12.9

MAX EXCAVATION DEPTH, H_b = 6.0m
PILE WALL DEPTH, D = 13.25m

- POTENTIAL MOVEMENT DUE TO INSTALLATION OF WALL (USING PARAMETERS FROM TABLE 6.1 & FIGURE 6.8)

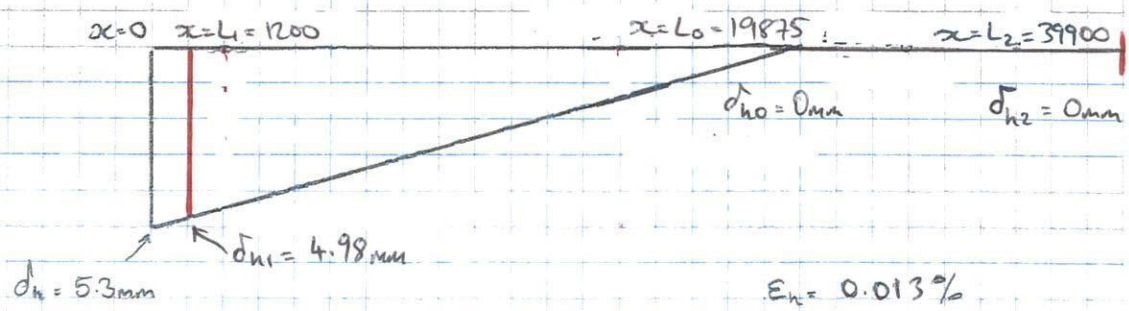
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

$\therefore$ MAX $\delta_h = (0.04/100) \times 13250mm = 5.3mm$

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 1.5

$\therefore L_o = 13.25m \times 1.5 = 19.875m$

HORIZONTAL MOVEMENT GRADIENT DUE TO INSTALLATION



ε_h = 0.013%

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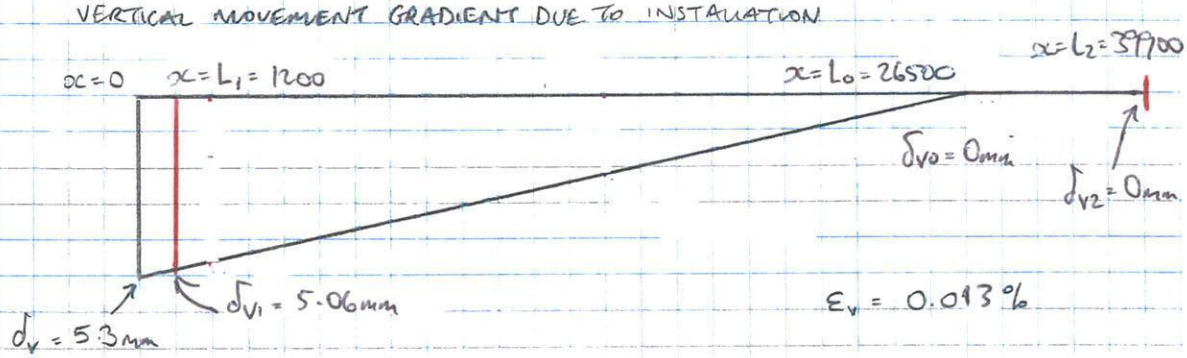
VERTICAL SURFACE MOVEMENT AT WALL (% OF WALL DEPTH) = 0.04%

∴ MAX δ_v = (0.04/100) x 13250mm = 5.3mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF WALL DEPTH) = 2.0

∴ L_o = 13.25m x 2.0 = 26.5m

VERTICAL MOVEMENT GRADIENT DUE TO INSTALLATION



- POTENTIAL MOVEMENT DUE TO EXCAVATION OF GROUND IN FRONT OF WALL (USING PARAMETERS FROM TABLE 6.3 & FIGURE 6.15)

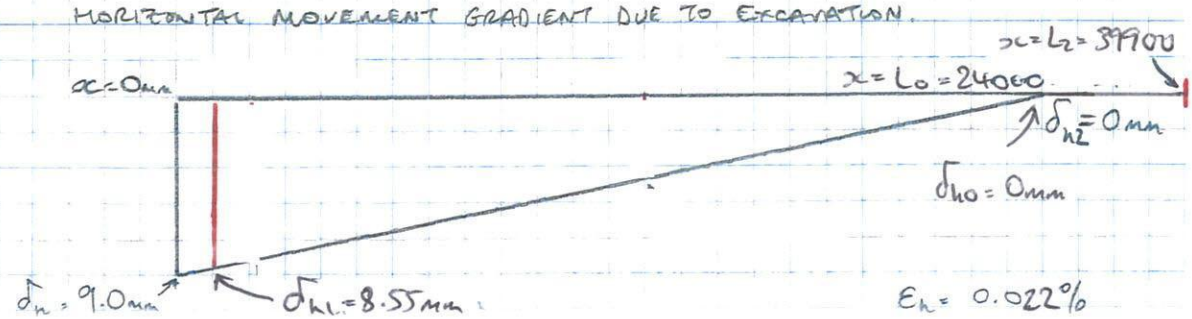
HORIZONTAL SURFACE MOVEMENT AT WALL (% OF EXCAVATION DEPTH) = 0.15%

∴ MAX δ_h = (0.15/100) x 6000 = 9.0mm

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAVATION DEPTH) = 4

∴ L_o = 6m x 4 = 24m

HORIZONTAL MOVEMENT GRADIENT DUE TO EXCAVATION.



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VERTICAL SURFACE MOVEMENT AT WALL: [USE FIGURE 6.15b]

DISTANCE BEHIND WALL TO NEGLIGIBLE MOVEMENT (MULTIPLE OF EXCAV. DEPTH) = 3.5

$\therefore L_o = 6.0 \times 3.5 = 21.0m$

INTERPRETATION OF FIGURE 6.15b:

→ @ $x = 0$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.04%

→ @ POINT OF MAX SETTLEMENT

↳ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0.075%

↳ DISTANCE FROM WALL / MAX EXCAVATION DEPTH = 0.64

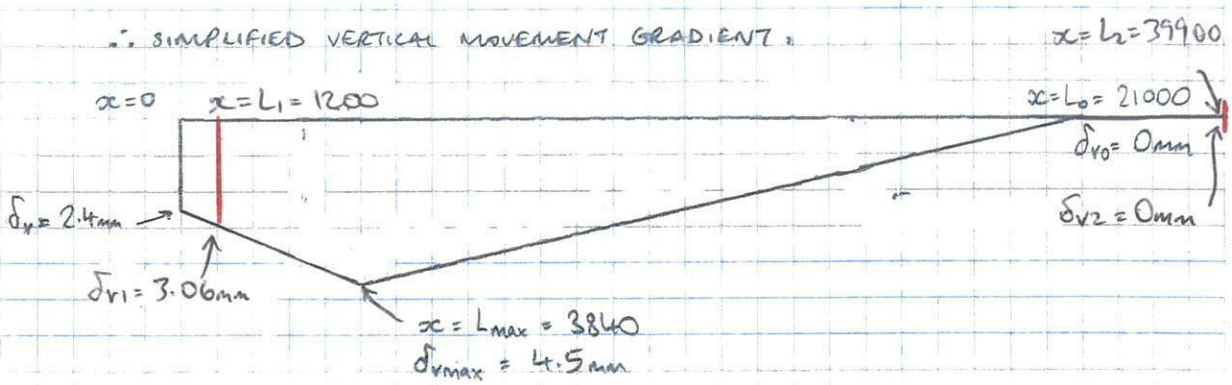
→ @ $x = 21.0m$ ⇒ SETTLEMENT / MAX EXCAVATION DEPTH (%) = 0%.

@ $x = 0$ VERTICAL MOVEMENT = $(0.04/100) \times 6000 = 2.4mm$

@ δ_v (MAX) VERTICAL MOVEMENT = $(0.075/100) \times 6000 = 4.5mm$

@ δ_v (MAX) DISTANCE FROM WALL = $0.64 \times 6000 = 3840mm$

$\therefore$ SIMPLIFIED VERTICAL MOVEMENT GRADIENT:



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- COMBINED POTENTIAL MOVEMENTS DUE TO INSTALLATION & EXCAVATION.

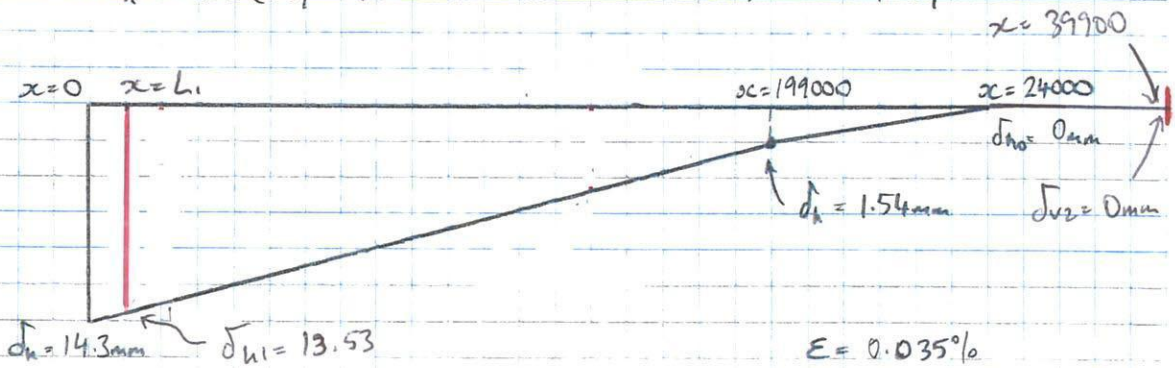
HORIZONTAL MOVEMENT:

INSTALLATION: $\delta_h = 5.3mm$, $\delta_{h1} =$, $\delta_{h2} =$, $L_o = 19900mm$

EXCAVATION: $\delta_h = 9.0mm$, $\delta_{h1} =$, $\delta_{h2} =$, $L_o = 24000mm$

FIND MOVEMENT DUE TO EXCAV. @ 19900mm

$$\delta_h = \tan\left(\tan^{-1}\left(\frac{9.0}{24000}\right)\right) \times (24000 - 19900) = 1.54mm$$



$\varepsilon = 0.035\%$

VERTICAL MOVEMENT:

INSTALLATION: $\delta_v = 5.3mm$, $\delta_{v1} = 4.98mm$, $\delta_{v2} = 0mm$, $L_o = 26500$

EXCAVATION: $\delta_v = 2.4mm$, $\delta_{v1} = 8.55mm$, $\delta_{v2} = 0mm$, $L_o = 21000$, $\delta_{vmax} = 4.5mm$
$L_{max} = 3840mm$

FIND MOVEMENT DUE TO INSTALLATION @ 21000

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 21000) = 1.1mm$$

FIND MOVEMENT DUE TO INSTALLATION @ 3840 + δ_{vmax}

$$\delta_v = \tan\left(\tan^{-1}\left(\frac{5.3}{26500}\right)\right) \times (26500 - 3840) + 4.5 = 9.03mm$$

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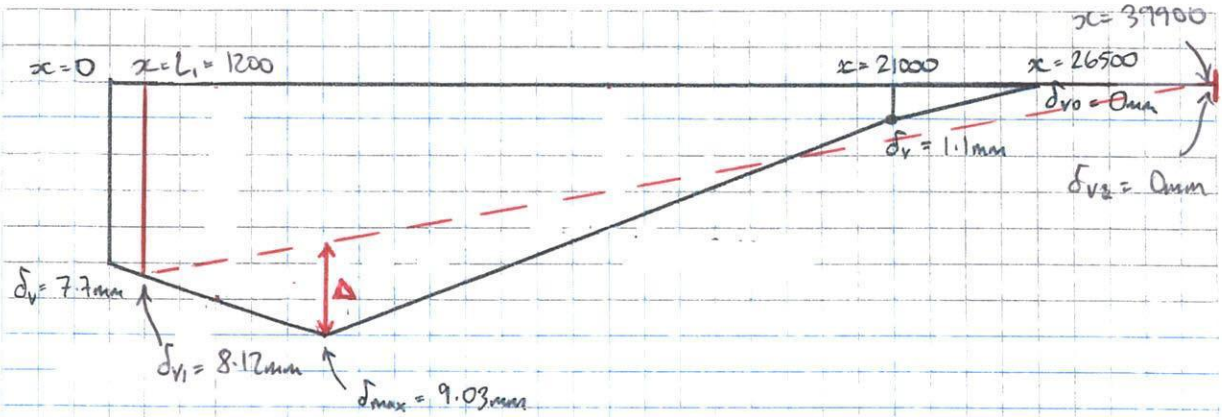

∴ RELATIVE VERTICAL MOVEMENT WITHIN BUILDING:

$$\Delta = 9.03 - \left[\left[\tan\left(\tan^{-1}\left(\frac{d_{v1} - d_{v2}}{L_2 - L_1}\right)\right) \times (L_2 - L_{max})\right] + d_{v2}\right]$$

$$= 1.47 \text{ mm}$$

- CALCULATION OF DAMAGE CATEGORY (USING FIGURE 6.27 & TABLE 6.4)

CAMDEN COUNCIL REQUIRES A DAMAGE CATEGORY NOT EXCEEDING CATEGORY 1 'VERY SLIGHT' ON THE BURLAND SCALE.

∴ $\varepsilon_{lim} = 0.075\%$

$\varepsilon_h = 0.035\%$

$\Delta/L = 1.47/38700 \times 100 = 0.004\%$

$\varepsilon_h/\varepsilon_{lim} = 0.47$

$\Delta/L/\varepsilon_{lim} = 0.05$

SEE OVER FOR PLOT ONTO FIGURE 6.27.

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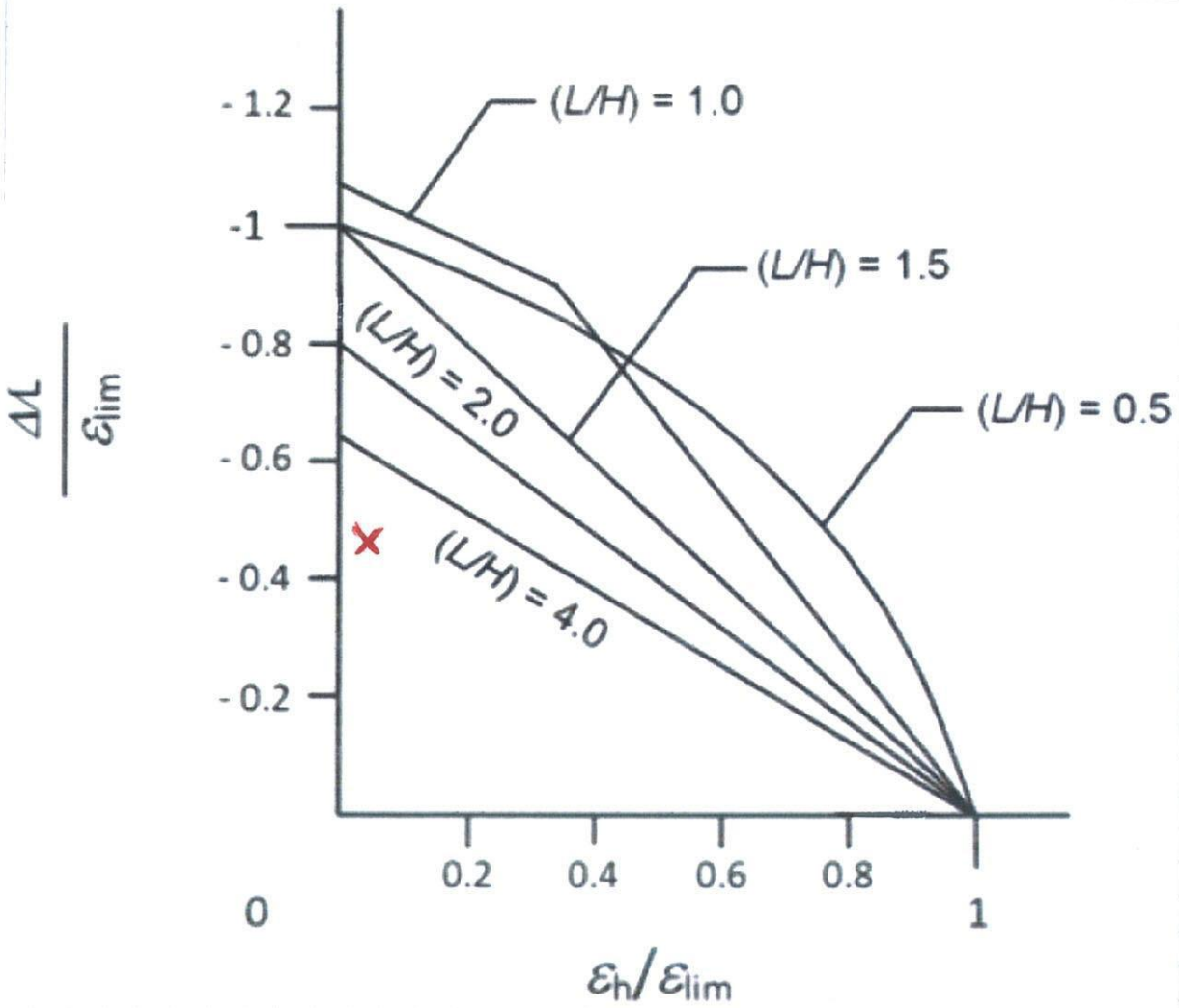

∴ GROUND MOVEMENT LIES WITHIN THE ACCEPTED LIMITS TO RESTRICT DAMAGE CATEGORY TO 1 - VERY SLIGHT.

THE PROPPING PROPOSED IN THE ISJWP CALCULATION WILL FURTHER RESTRICT THIS GROUND MOVEMENT.