Appendix 4 Ground Movement and Damage Impact Assessment

Ref MES/1611/PMA/003 Page 1
Date Nov-16
Site 20 Crediton Hill, NW6 1HP

Ground Movement Assessment in Accordance with CIRIA C580

	Nearby Structures	Distance	Foundation Depth		
20 Crediton Hill, Main House	1 storey basement, not across full footprint	14.6m	-3.0m		
	Foundations to non-basement areas	12.0m	-0.5m		
20 Crediton Hill, Garage 4	Basement across full footprint	0m	-3.3m		
20 Crediton Hill, Garages 1 - 3	No basement	0m	-0.5m		
22 Crediton Hill, Main House	No basemet	9.0m	N/A	See GMA page 2	
22 Crediton Hill, Studio	Temporary wooden structure (shed studio)	2m	N/A		
	Assume worst case for all as conservative approach		-0.5		0.5
	Proposd Development				
	Excavation depth - 3.75m, basement slab -3.3m plus 450mm slab Embedded 300mm contig piles @ 450mm centres to -8.0m Tope down construction, high stiffness, fully propped				8

Fig 2.8 — Movements due to piling

△h — Assume worst case for all as conservative approach = 7.5m — 7.5

Dist. From wall (m)	Dist.from wall / 7.5m (x axis)	(horiz) Distance from wall / wall depth	(vertical) Dist. from wall / wall depth	Horizontal movement (mm)	Vertical movement (mm)
0	0.00	0.04	0.04	3.0	3.0
1	0.13	0.035	0.038	2.6	3.4
3	0.40	0.025	0.031	1.9	2.8
6	0.80	0.013	0.023	1.0	2.1
9	1.20	0.008	0.018	0.6	1.6
12	1.60	0	0.009	0.0	0.8
15	2.00	0	0	0.0	0.0
18	2.40	0	0	0.0	0.0

fig 2.11 — Movements due to excavation of basement — 3.75

Assume worst case for all as conservative approach = 3.25m 'max excavation' (Dig -3.75m, foundations at 20main house -0.5m) — 3.25

Dist. From wall (m)	Dist.from wall / 3.25m	(horiz) Distance from wall / max. Excavation	(vertical) Dist. from wall / max. Excavation	Horizontal movement (mm)	Vertical movement (mm)
0	0.00	0.15	0.04	4.9	1.3
1	0.31	0.14	0.06	4.6	2.0
3	0.92	0.12	0.07	3.9	2.3
6	1.85	0.08	0.04	2.6	1.3
9	2.77	0.05	0.02	1.6	0.7
12	3.69	0.02	0	0.7	0.0
15	4.62	0	0	0.0	0.0
18	5.54	0	0	0.0	0.0

Total movements (piling installation plus excavation)

Ground movements from pile installation and excavation of the basement are combined.
The movements are considered to represent an upper bound, due to a conservative assumptions.
Corner stiffening effects have been taken into account, reducing by 50%

Dist. From wall (m)	Horizontal movement (mm)	Vertical movement (mm)
0	7.9	4.3
1	7.2	5.4
3	5.8	5.1
6	3.6	3.4
9	2.2	2.3
12	0.7	0.8
15	0.0	0.0
18	0.0	0.0

Damage Impact Assessment - Burland Scale

Structure	Wall	Length (m)	Height (m)	L / H	
No 22 Crediton Hill	Side Wall A	5	11	See Page 2	(only 5m of 14m affected by movement)
	Side Wall B	4	4	See Page 2	
	Rear Wall C	4	3.5	See Page 2	
No 20 Crediton Hill	Side Wall D	10	14	0.71	
	Rear Wall E	8	14	0.57	
Garages 1 - 3	Walls F, G, H, I	6	2.5	2.40	
	Walls J, K, L, M	3	2.5	1.20	

Structure	Wall	dmax (Vertical Deflection) (mm)	dmax / L	△h (mm) (horiz.)	△h / L	L/H
No 22 Crediton Hill	Side Wall A					See Page 2
	Side Wall B					See Page 2
	Rear Wall C					See Page 2
No 20 Crediton Hill	Side Wall D	N/A	N/A	N/A	N/A	N/A
	Rear Wall E	N/A	N/A	N/A	N/A	N/A
Garages 1 - 3	Walls F, G, H, I	2.5	0.0417	2.5	0.0004	2.40
	Walls J, K, L, M	1	0.0333	2.5	0.0008	1.20

Ref	MES/1611/PMA/003	Page 2	
Date	Nov-16	Ground Movement Assessment in Accordance with CIRIA C580	
Site	20 Crediton Hill, NW6 1HP		

		Nearby Structures	Distance	Foundation Depth		
	20 Crediton Hill, Main House	1 storey basement, not across full footprint	14.6m	N/A	See GMA Page 1	
		Foundations to non-basement areas	12.0m	N/A	See GMA Page 1	
	20 Crediton Hill, Garage 3	Basement across full footprint	0m	N/A	See GMA Page 1	
	20 Crediton Hill, Garages 1, 2	No basement	0m	N/A	See GMA Page 1	
	22 Crediton Hill, Main House	No basemet	9.0m	+1.0m		
	22 Crediton Hill, Studio	Temporary wooden structure (shed studio)	2m	N/A		
		Assume worst case for all as conservative approach		+1m		1
		Proposd Development				
		Excavation depth - 3.75m, basement slab -3.3m plus 450mm slab Embedded 300mm contig piles @ 400mm centres to -8.0m Tope down construction, high stiffness, fully propped				8
Fig 2.8		Movements due to piling				
	△h	Assume worst case as conservative approach = 9m (No.22 foundations to base of wall)				9

Dist. From wall (m)	Dist.from wall / 9m (x axis)	(horiz) Distance from wall / wall depth	(vertical) Dist. from wall / wall depth	Horizontal movement (mm)	Vertical movement (mm)
0	0.00	0.04	0.04	3.6	3.6
1	0.11	0.037	0.038	3.3	3.4
3	0.33	0.025	0.032	2.3	2.9
6	0.67	0.015	0.025	1.4	2.3
9	1.00	0.01	0.02	0.9	1.8
12	1.33	0.005	0.015	0.5	1.4
15	1.67	0	0.007	0.0	0.6
18	2.00	0	0	0.0	0.0

fig 2.11		Movements due to excavation of basement				3.75
	Assume worst case for all as conservative approach = 4.75m 'max excavation' (Dig -3.75m, foundations at 22 main house +1.0m)					4.75

Dist. From wall (m)	Dist.from wall / 4.75m	(horiz) Distance from wall / max. Excavation	(vertical) Dist. from wall / max. Excavation	Horizontal movement (mm)	Vertical movement (mm)
0	0.00	0.15	0.04	7.1	1.9
1	0.21	0.14	0.06	6.7	2.9
3	0.63	0.12	0.08	5.7	3.8
6	1.26	0.1	0.07	4.8	3.3
9	1.89	0.08	0.05	3.8	2.4
12	2.53	0.05	0.02	2.4	1.0
15	3.16	0.03	0.01	1.4	0.5
18	3.79	0.01	0	0.5	0.0

Total movements (piling installation plus excavation)

Ground movements from pile installation and excavation of the basement are combined.
The movements are considered to represent an upper bound, due to a conservative assumptions.
Corner stiffening effects have been taken into account, reducing by 50%

Dist. From wall (m)	Horizontal movement (mm)	Vertical movement (mm)
0	10.7	5.5
1	10.0	6.3
3	8.0	6.7
6	6.1	5.6
9	4.7	4.2
12	2.8	2.3
15	1.4	1.1
18	0.5	0.0

Damage Impact Assessment - *Burland Scale*

Structure	Wall	Length (m)	Height (m)	L / H	
No 22 Crediton Hill	Side Wall A	5	11	0.45	(only 5m of 14m affected by movement)
	Side Wall B	4	4	1.00	
	Rear Wall C	4	3.5	1.14	
No 20 Crediton Hill	Side Wall D	10	14	See Page 1	
	Rear Wall E	8	14	See Page1	
Garages 1, 2	Walls F, G, H, I	6	2.5	See Page 1	
	Walls J, K, L, M	3	2.5	See Page 1	

		dmax (Vertical Deflection) (mm)	dmax / L	△h (mm) (horiz.)	△h / L	L/H
No 22 Crediton Hill	Side Wall A	1.4	0.0280	1.5	0.0003	0.45
	Side Wall B	1.75	0.0438	1.5	0.0004	1.00
	Rear Wall C	3	0.0750	3	0.0008	1.14
No 20 Crediton Hill	Side Wall D					See Page 1
	Rear Wall E					See Page1
Garages 1, 2	Walls F, G, H, I					See Page 1
	Walls J, K, L, M					See Page 1

Blue Values Input by User

L	0.1	m
H	1.0	m
L/H	0.5	

Cat	ε_{lim}	
0	0.000	0.050
0	0.000	0.050
0	0.000	0.050
1	0.050	0.075
1	0.050	0.075
1	0.050	0.075
2	0.075	0.150
2	0.075	0.150
2	0.075	0.150
3	0.150	0.300
3	0.150	0.300
3	0.150	0.300
4	0.300	
4	0.300	
4	0.300	

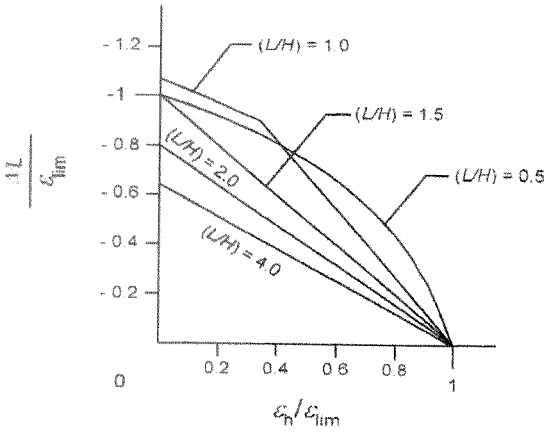
From DMA

$\varepsilon_h=\delta h/L$ $M=\Delta/L$

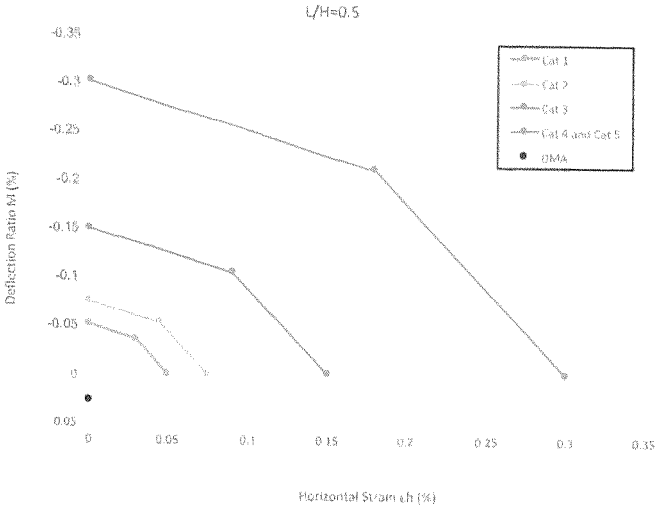
0.0003 0.0280 WALL A

$\varepsilon_h/\varepsilon_{lim}$	M/ε_{lim}	
0.0	-1.0	
0.6	0.7	These values should be based on Fig. 2.18b
1.0	0.0	

ε_h	M
0	-0.05
0.03	-0.035
0.05	0
0	-0.075
0.045	-0.0525
0.075	0
0	-0.15
0.09	-0.105
0.15	0
0	-0.3
0.18	-0.21
0.3	0



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



Blue Values Input by User

L	1.0 m
H	1.0 m
L/H	1.0

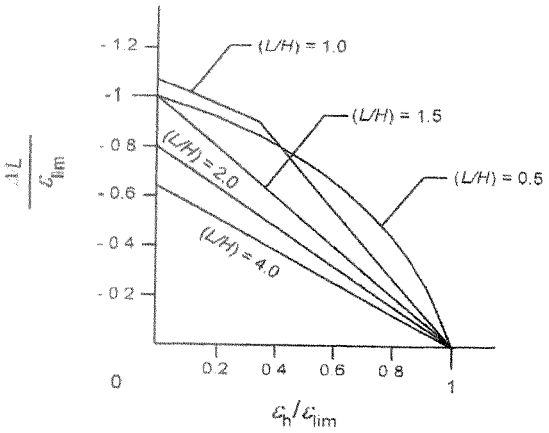
Cat	ε_{lim}	
0	0.000	0.050
0	0.000	0.050
0	0.000	0.050
1	0.050	0.075
1	0.050	0.075
1	0.050	0.075
2	0.075	0.150
2	0.075	0.150
2	0.075	0.150
3	0.150	0.300
3	0.150	0.300
3	0.150	0.300
4	0.300	
4	0.300	
4	0.300	

From DMA

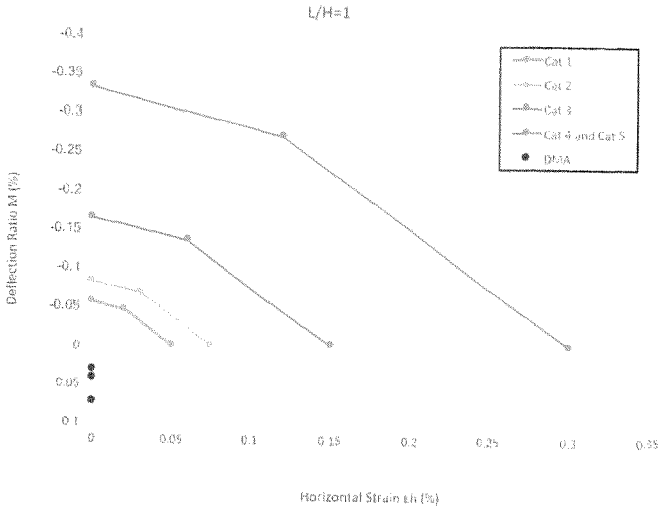
$\varepsilon_h=\delta h/L$	$M=\Delta/L$	
0.0008	0.0333	WALLS J, K, L, M
0.0004	0.0438	WALL B
0.0006	0.0750	WALL C

$\varepsilon_h/\varepsilon_{lim}$	M/ε_{lim}	
0.0	-1.1	
0.4	-0.5	These values should be based on Fig. 2.18b
1.0	0.0	

ε_h	M
0	-0.055
0.02	-0.045
0.05	0
0	-0.0825
0.03	-0.0675
0.075	0
0	-0.165
0.06	-0.135
0.15	0
0	-0.33
0.12	-0.27
0.3	0



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



Blue Values Input by User

L	2.0	m
H	1.0	m
L/H	2.0	

Cat	ε_{lim}	
0	0.000	0.050
0	0.000	0.050
0	0.000	0.050
1	0.050	0.075
1	0.050	0.075
1	0.050	0.075
2	0.075	0.150
2	0.075	0.150
2	0.075	0.150
3	0.150	0.300
3	0.150	0.300
3	0.150	0.300
4	0.300	
4	0.300	
4	0.300	

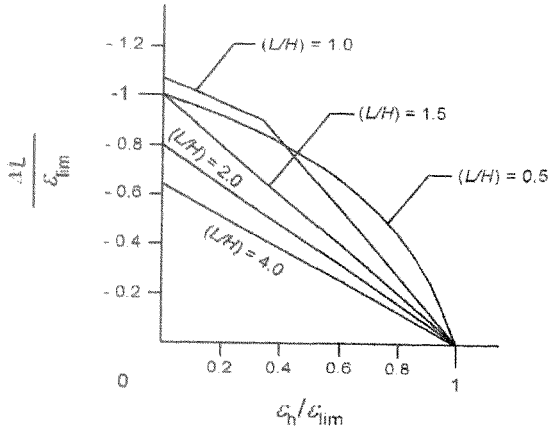
From DMA

$\varepsilon_h=\delta h/L$ $M=\Delta/L$

0.0004 0.0417 WALLS F, G, H, I

$\varepsilon_h/\varepsilon_{lim}$	M/ε_{lim}	
0.0	0.8	
1.0	0.0	These values should be based on Fig. 2.18b
1.0	0.0	

ε_h	M
0	-0.04
0.05	0
0.05	0
0	-0.06
0.075	0
0.075	0
0	-0.12
0.15	0
0.15	0
0	-0.24
0.3	0
0.3	0



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