

Basement Potential Damage Assessment

The proposed new basement to 69 Cromwell Avenue is around 2.8m below the existing ground level.

Planning condition requires any damage to be Burland Scale 1, or less.

The soil is generally a sandy clay.

Soil Consultant's ground investigation report describe the soil as being the Bagshot Formation (Sand).

The clay and silt content in the soil was low, between 6% and 35%.

Granular soil was found to greater than the proposed basement depth.

All ground investigations (trial pits and window samples) were found to be dry.

Predicted ground movements and any likely damage caused by the construction of the basement are assessed to Ciria C760.

It should be noted that this document is based on limited case-study data and tends to overestimate ground movements, especially when using the lower-bound curves of the data.

Ground Engineering Technical paper dated September 2014 provided case study data of movements to Ciria C580 (the predecessor to C760, but very similar) being halved by good construction controls (for a CFA piled propped wall).

The analysis is also conservative as:

- For the retaining wall moments and predicted movements, a high-water table has been considered. This is highly unlikely.
- Analysis has ignored the propping effect of the ground floor and any wall returns.
- Retaining wall friction has not been taken in the analysis.

The basement is to be constructed using a robust arrangement of temporary bracing and props, including near the top and base of vertical excavations.

Ciria C760

With reference to figure 6.16, predicted ground settlements are negligible at a distance of 1.5-2.0 of the excavation depth:

$$= 2.0 \times 2.8 = 5.6\text{m}$$

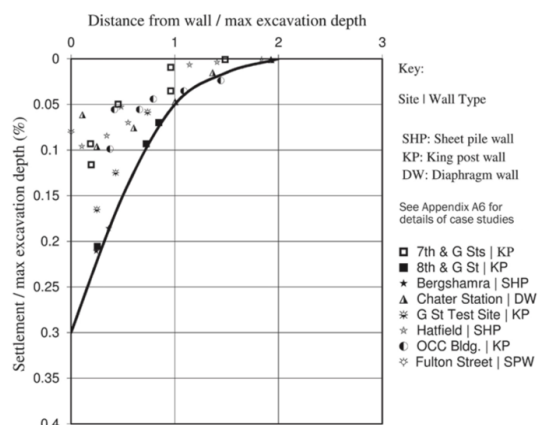
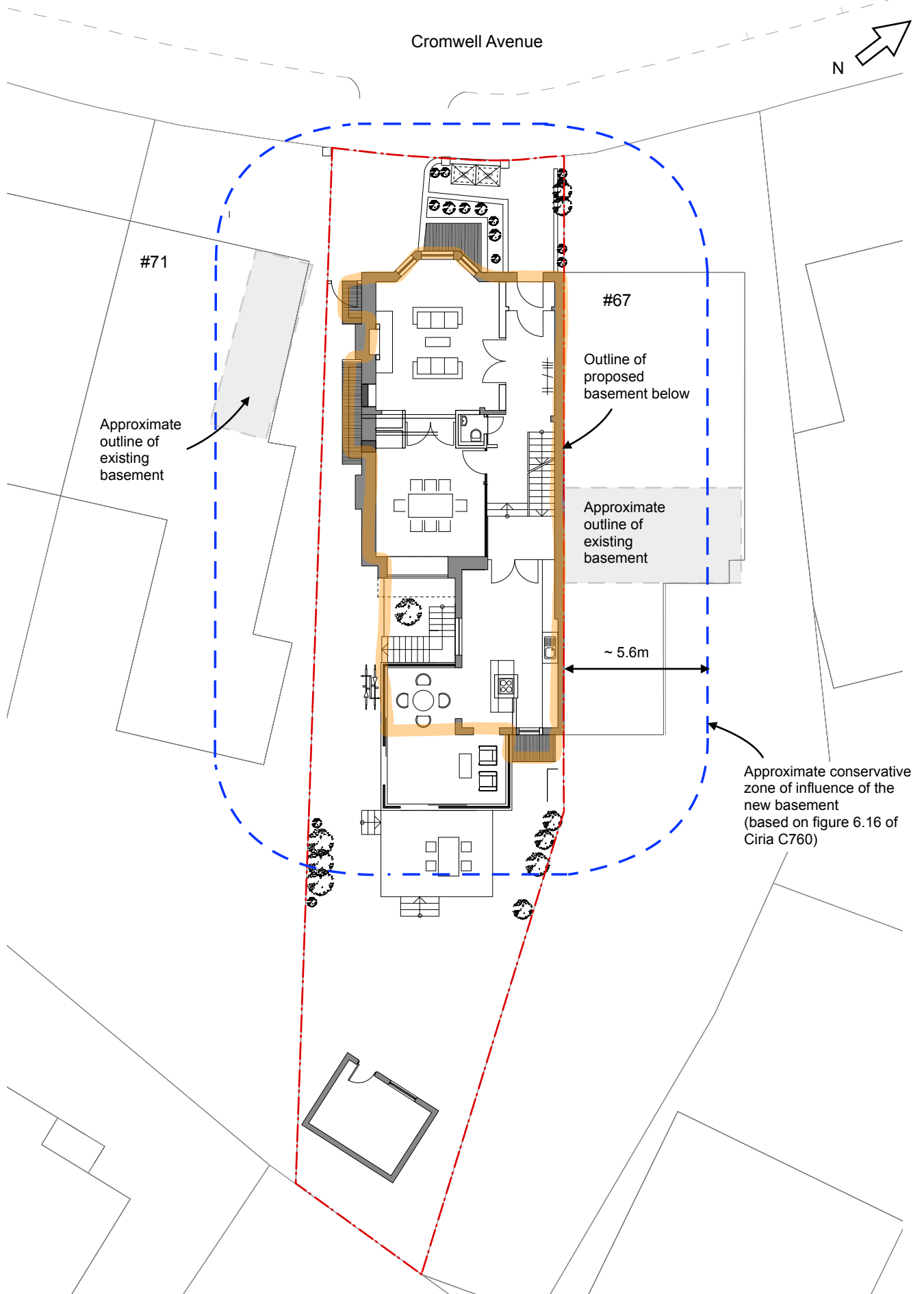
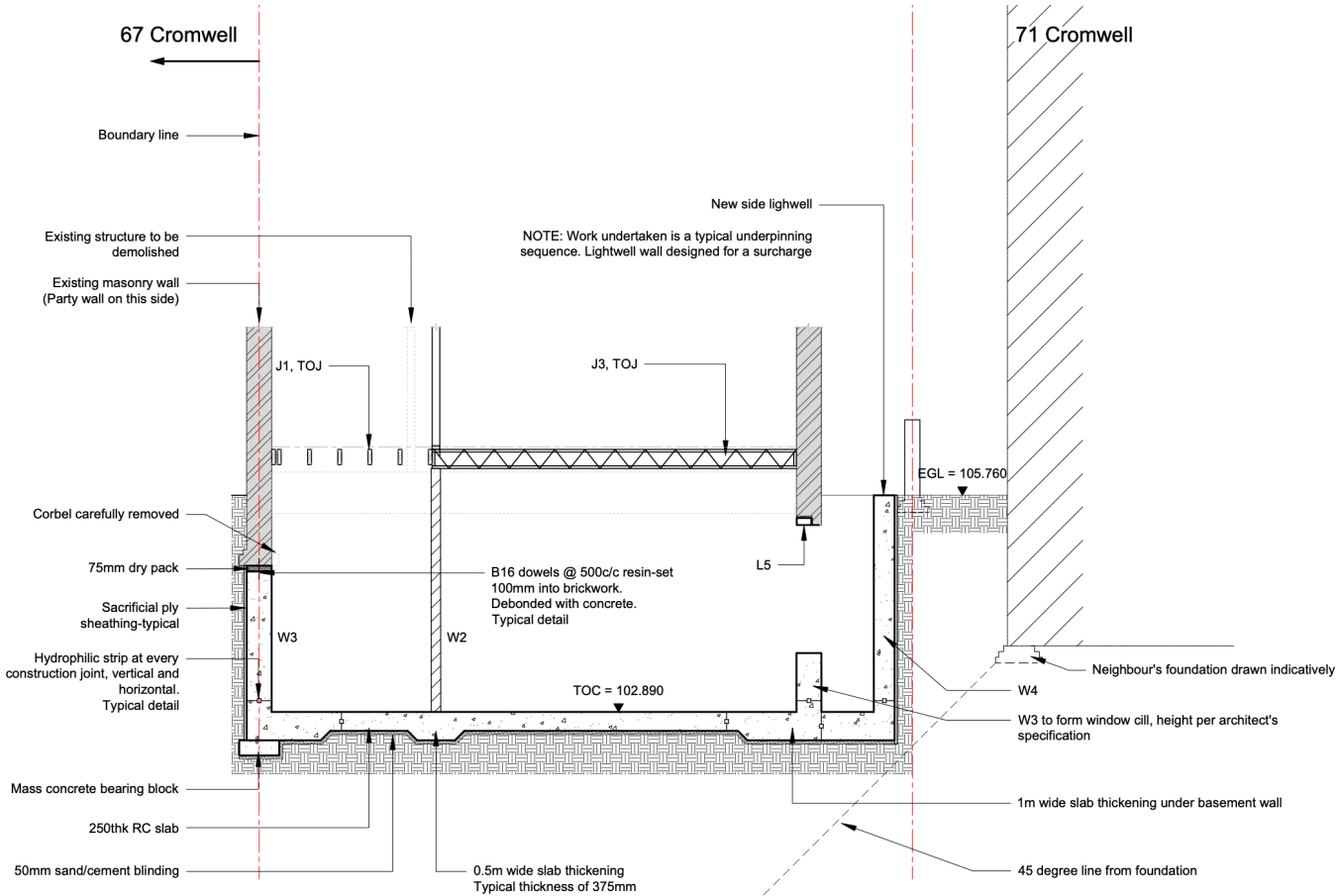


Figure 6.16 Ground surface settlement due to excavation in front of wall in sand



22011 - 69 Cromwell Avenue - Typical Site Section for Reference for Damage Assessment

1:100 @ A4



Case 1A - Against #67, where no existing basement is present

With reference to the site plan and typical section on sheets DA-2 & 3.

For return footings adjacent to the Party Wall, case study data suggests vertical movement to be:
 $\leq 0.2 \times 2800 / 100 =$ 5.6 mm

This can be considered to be a worst case, as most case study data suggests it to be half this figure (i.e. 2.8mm)

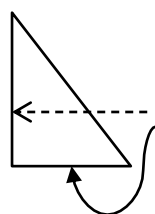
Retaining wall design, conservatively considering a water height of 2.0m (due to local accidental leaky drain), gives the below results:

Maximum wall moment = 85.2 kNm - ULS

Maximum wall shear = 80.4 kN - ULS

For simplicity, idealise the retaining wall loading as triangular, with its centroid at (from base):

$$= \frac{85.2}{80.4} = 1.06 \text{ m}$$



Pressure at base =

$$\frac{80.4}{1.06} \times \frac{2}{3} = 51 \text{ kN/m}^2$$

Say conservative SLS = 37 kN/m²

BS8110-2
Table 7.2

Take modulus of elasticity of 40N/mm² concrete as = 28 N/mm²

Consider deflection of cantilevered wall using uncracked short-term stiffness in the first instance:

$$= 37 \times 2800^4 \times 12 / (30 \times 28 \times 10^3 \times 1000 \times 330^3) = 1.15 \text{ mm}$$

Increase this deflection to allow for creep and cracked section:

Cracked section factor, say = 1.7

Creep factor, say = 1.4

Estimated deflection = 2.7 mm

Plus say an additional 1mm during installation, $\Rightarrow$ total = 3.7 mm - horiz.

From IStructE's 'Soil Structure Interaction', the settlement profile behind the wall will approximately equal the deflected shape of the wall, but with reference to figure 6.17 (C760), figures are halved.

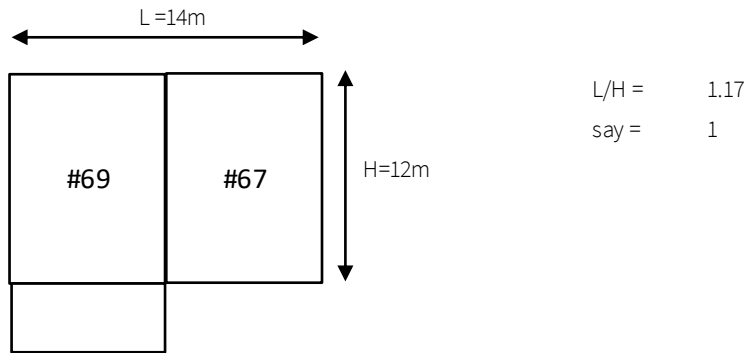
Horizontal movement is : - 0.13% of wall height

Halving the horizontal movement gives = 0.07% of wall height (as a vertical cross-check)

=> about right, where most of the case study data sits on figure 6.16

Damage Assessment:

For the front elevation, consider the below section:



And relative settlement:



Deflection ratio = $\Delta / L =$ 0.04%

Horizontal strain = $\partial_x / L =$ 0.03%

With reference to the interaction diagram on page DA-6, this equates to:

Predicted Damage Category 1 - Very Slight

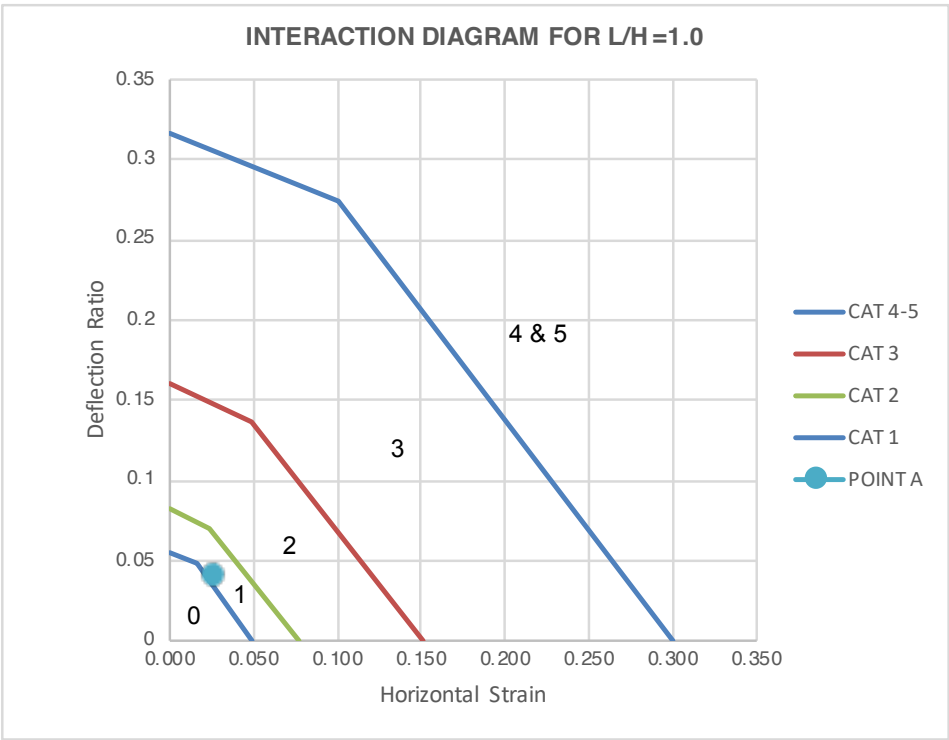
=> Fine cracks that can be easily be treated during normal decoration. Typically $\leq 1\text{mm}$.

Point A

Horizontal Strain = 0.03 %

Deflection ratio = 0.04 %

Category of Damage = 1



Case 1B - Against #67, where no existing basement is present - cross wall

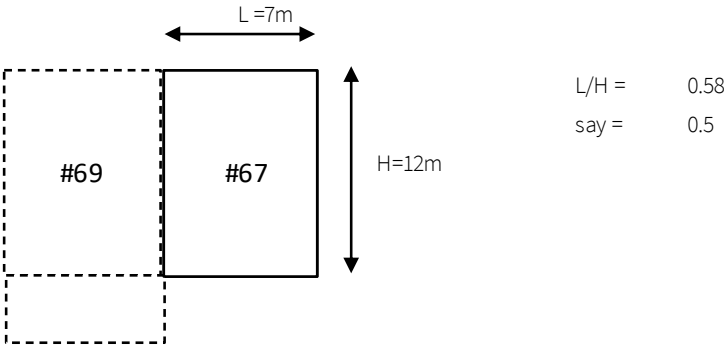
Conservatively considering #67 as a stand alone building, such as how a cross wall may behave

Vertical deflection (page DA-4) = 5.6 mm

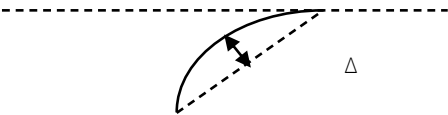
Horizontal deflection (page DA-4) = 3.7 mm

Damage Assessment :

Consider the below for a cross-wall:



And relative settlement:



Conservatively, say $\Delta = 0.45 \times 5.6 = 2.5 \text{ mm}$

Deflection ratio $= \Delta / L = 0.04\%$

Horizontal strain $= \Delta / L = 0.05\%$

With reference to the interaction diagram on page DA-8, this equates to:

Predicted Damage Category 1 - Very Slight

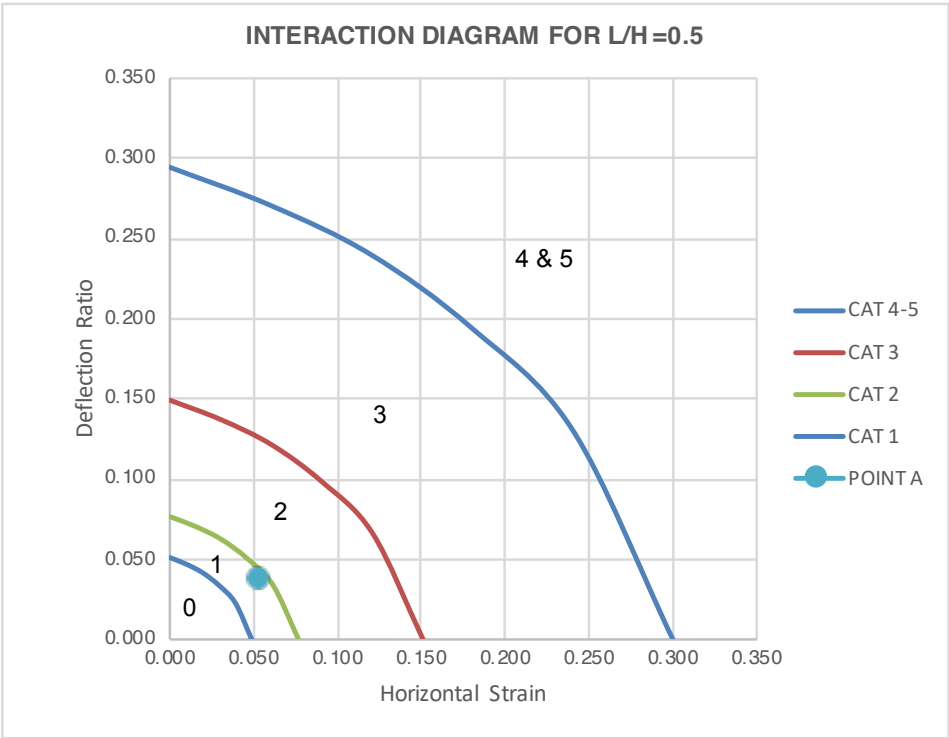
=> Fine cracks that can be easily be treated during normal decoration. Typically $\leq 1\text{mm}$.

Point A

Horizontal Strain = 0.05 %

Deflection ratio = 0.04 %

Category of Damage = 1



Case 2 - Against #71, where no existing basement is present

Closest distance is around 2m (although this is not representative, as it can be seen on sheet DA-2 that this distance increases).

Distance = $\frac{2\text{m}}{2.8\text{m}}$ = 0.71

Max excavation depth

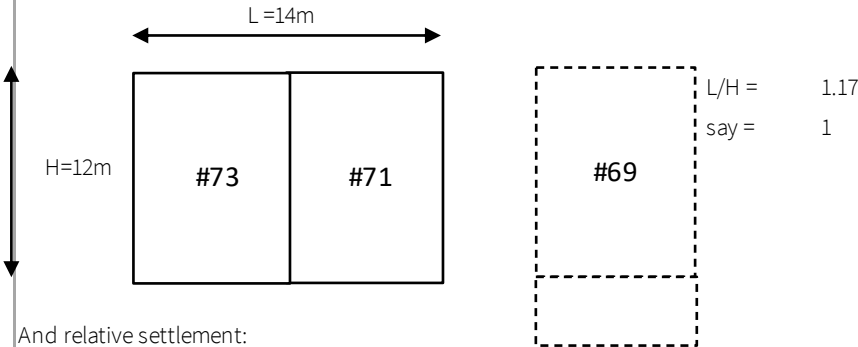
From figure 6.16, take conservative (settlement) / (max excavation depth) of: 0.10%

Vertical deflection = 2800 x 0.10% = 2.8 mm

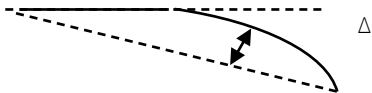
From previous calc, maximum wall deflection = 3.7 mm
(conservatively ignoring ground floor propping effects, return walls and taking a 2m high water pressure from an accidental drain leak)

Conservatively saying horizontal ground movements reduce linearly to zero at a distance of 5.6m
=> estimated horizontal deflection at #71 = 2.4 mm

Damage Assessment:
Consider the below:



And relative settlement:



Conservatively, say $\Delta = 0.55 \times 2.8$ = 1.5 mm

Deflection ratio = Δ / L = 0.01%

Horizontal strain = Δ / L = 0.03%

With reference to the interaction diagram on page DA-10, this equates to:

Predicted Damage Category 0 - Negligible

Point A

Horizontal Strain = 0.03 %

Deflection ratio = 0.01 %

Category of Damage = 0

