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PROJECT:	69 KENTISH TOWN ROAD
	LONDON
	NW1 8NY
Section:	HEAVE ASSESSMENT
Job No:	16063
Calculations:	DR
Date:	AUGUST 2015 Page No: 01

Proposals

It is proposed to construct a new three and two storey rear extension containing a basement set slightly higher than the existing 4 storey mid terrace's basement. Allowing for a new basement floor slab, insulation and screed finish the excavated depth will therefore be similar to the existing building, thus avoiding the need for underpinning.

The new extension is to be set across the full width of the site and will abut similar rear extensions to the period properties on either side.

The works will also incorporate a sunken terrace across the rear of the two storey extension, all as shown on the cross section shown over.

Subject to trial pit information the adjoining rear extensions may need underpinning. Initially if underpinning is required there will be a small increase in load where the London Clay will be replaced with

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concrete. This increase in load will induce downward settlement over the long term. The second phase will be to bulk excavate for the proposed basement. The removal of the London clay to depth will trigger long term upward movement, termed elastic heave.

These two effects will be considered and their cumulative effect gauged against the guidlines laid down by Burland. Movement should not be greater than Category Slight, i.e. less than 5mm

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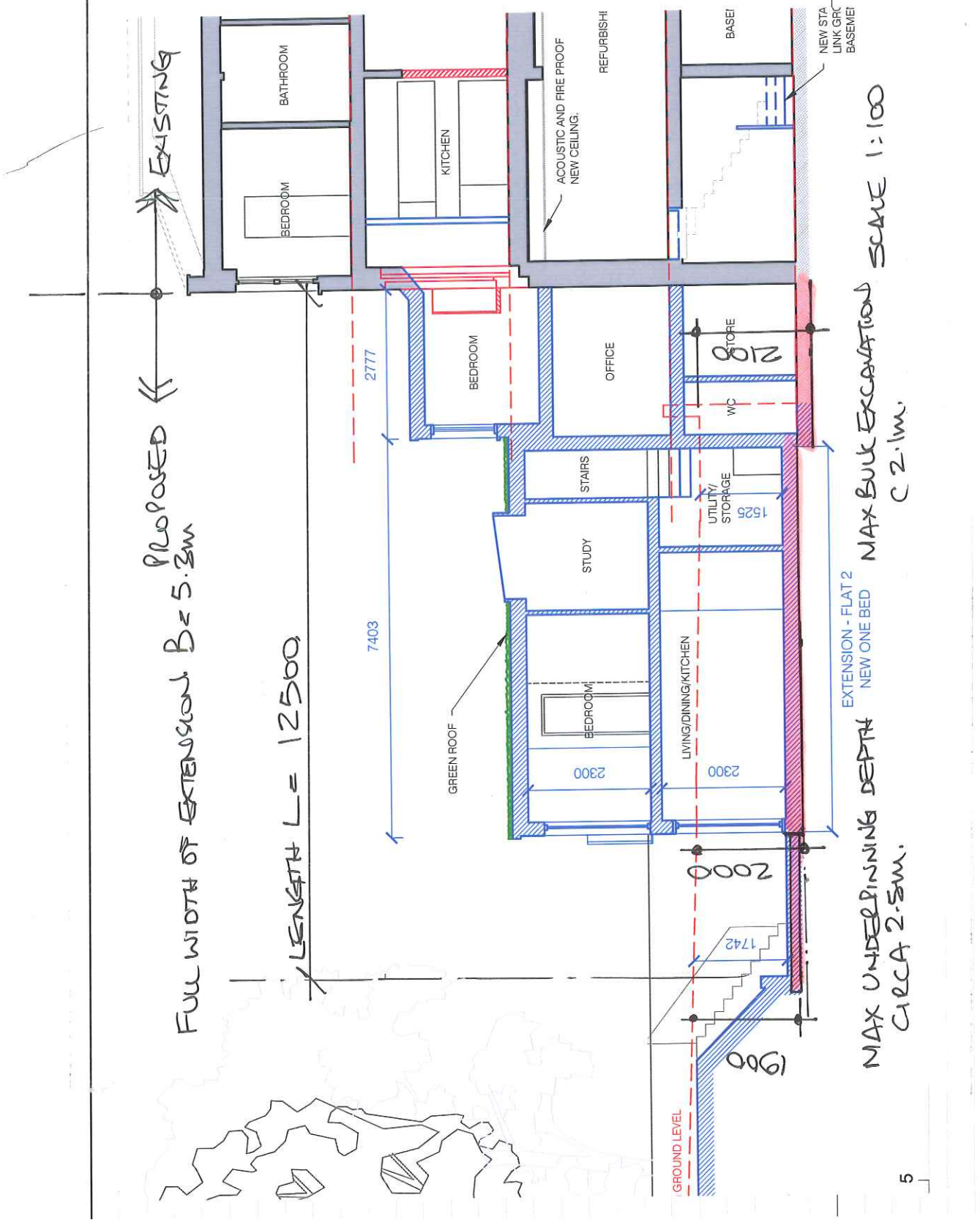
CROSS SECTION SHOWING PROPOSED WORKS



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PARAMETERS

Bulk density of London clay $\gamma_c = 1900 kg/m^3$

Bulk density of mass concrete $\gamma = 2400 kg/m^3$

Nett increase in load when replacing London clay with mass concrete, $2400 - 1900 = 500 kg/m^3$

OR $4.9 kN/m^2$

PHASE I.

Worst case if adjacent properties underpinned

Extra over load to be carried by London clay

$4.9 \times 0.6 \text{ wide} \times 2.5 = 7.4 kN/m$ which is very low.

short term consolidation, ie undrained or immediate settlement

Depth to sands and gravels from BGS borehole ref. TQ28SE5 c 52m

Refer to figure 3:6 over. with pins 600 wide

$H/B = 52/0.6 = 87.$ $\mu_0 = 0.76.$

$D/B = 2500/600 = 4.2.$

$L/B = 12500/600 = 21.$ $\mu_1 = 2.1.$

Foundation pressure (additional) $q = 4.9/0.6 = 8.2 kN/m^2$

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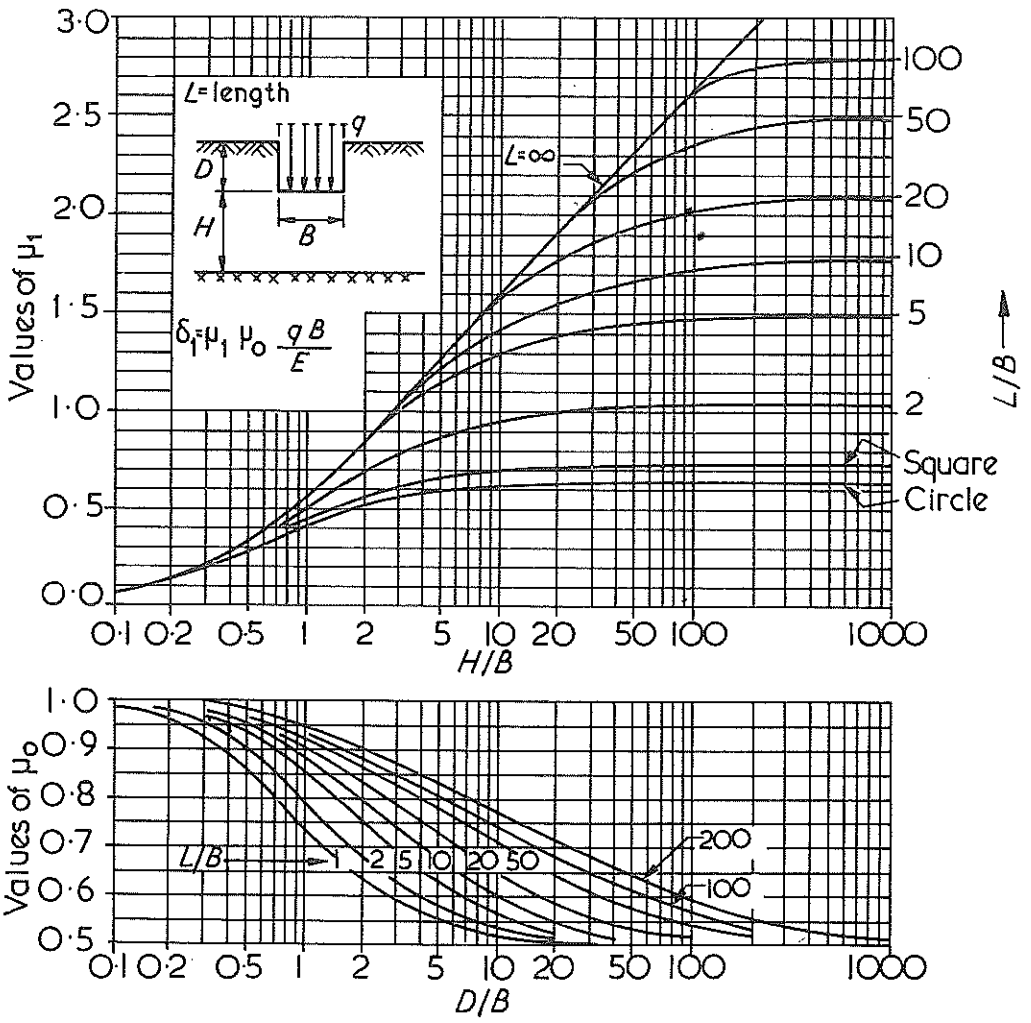

Fig.3.6 Diagrams for the factors μ_0 and μ_1 used in the calculation of the immediate average settlement of uniformly loaded flexible areas on homogeneous isotropic saturated clay, after Janbu, Bjerrum and Kjaernsli (1956)

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Hence undrained settlement given by:-

$$\delta = qBI_v/E_r.$$

$$= \frac{8.2 \times 0.6 \times 0.76 \times 2.1}{35} = 0.22mm$$

Where Youngs modulus for London clay typically falls in the range of 20-50 Mpa for an overconsolidated clay.

Average value :- 35 Mpa

Thus small short term settlement due to consolidation is entirely predictable and will be overcome by elastic recovery within the clay during and after bulk excavations and the creation of the proposed basement.

PHASE II

Heave assessment following construction of proposed basement

The technique used to determine the extent of elastic recovery in the overconsolidated London clay due to a reduction in pore water pressure is to use the formula for immediate settlement, but this acts in reverse.

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Total excavation, maximum condition 2.1m

Consider conservative load appraisal :-

Self wt of clay removed $2.1 \times 19 = -39.9$

Add basement slab 0.2×24	=	4.8
Screed and insulation	=	1.7
Dead load from ground floor	=	0.5
Dead load from roof ignoring green roof build up	=	0.5.

Allowance for new external walls.

$2.0 \times 4.8 \text{ht} \times 2 \text{no} \div 5.3 \text{(B)} \text{ say}$ = 3.6

Allowance for internal walls say $2 @ 0.5$. = 1.0.

Ignore new elevation for now.

27.8 kN/m²

Hence nett reduction in bearing pressure once building erected

For the footprint of the building and the sunken garden

Take Length L = 12.5m

Take width B = 5.3m

Consider the system as flexible as the clay heave recovery will tend to create a "dumpling" between the neighbouring properties.

Work undertaken by Terzaghi also recommends that calculated thickness H

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should not exceed 4B. This represents an upper bound.

Since H = 52m and 4B < 4x5.3 < 21.2m

use H < 21.2m

$H/B = 21.2/5.3 = 4.0$ $\mu_1 = 0.9$

$L/B = 12.5/5.3 = 2.4$ $\mu_2 = 0.94$

$D/B = 2.1/5.3 < 0.4$

Hence predicted heave given by:-

$$\delta_{heave} = \frac{27.8 \times 0.9 \times 0.94 \times 5.3}{35.} \geq 3.6mm < 5.0mm.$$

The effect of this heave will be experienced by the subject property and the neighbouring properties

Work undertaken by Burland considers the effect of angular distortions as the cause of potential structural damage. If all the properties were to rise by 3.6mm there would be no damage. In reality this is not the case as the influence of removing the clay diminishes with distance the further you move away from the excavated area.

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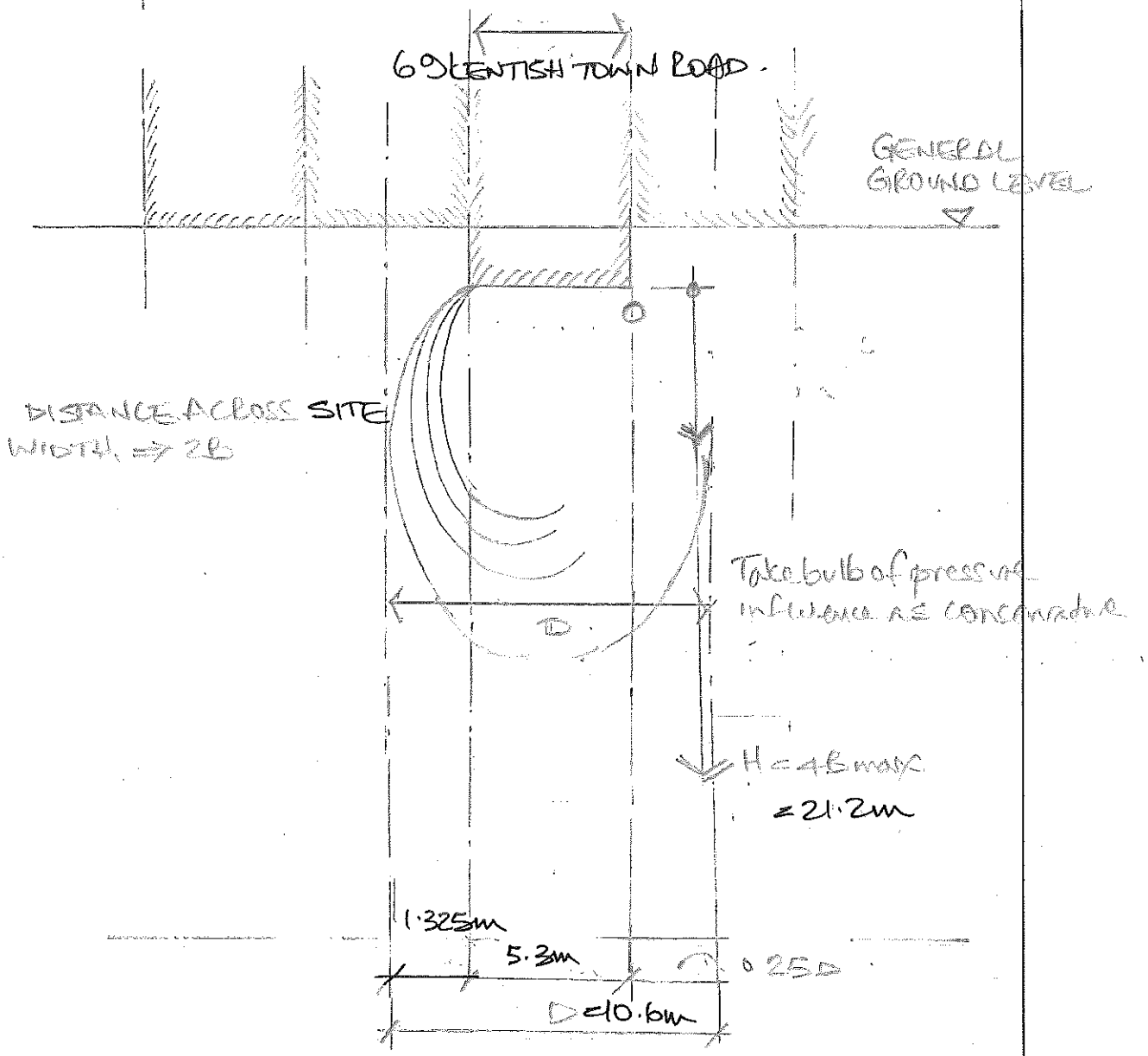

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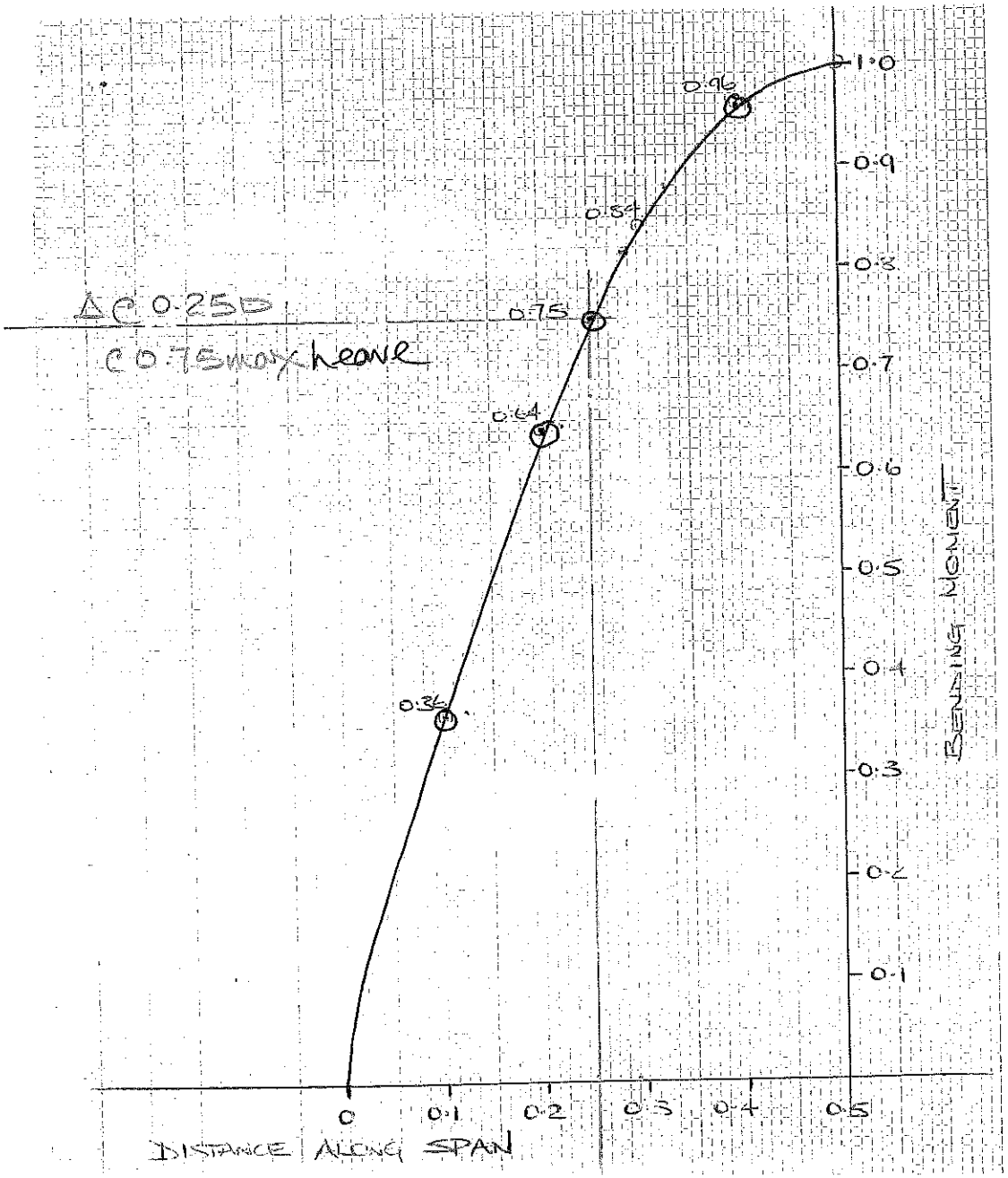

Hence predicted heave recovery at Party Wall positions causing angular distortion in neighbouring properties @ 0.75δ. = 0.75x3.6mm = 2.7mm

Since 2.7mm < 5.0mm

BURLAND CLASSIFICATION SLIGHT