Detailed Basement Construction Plan

Flat 1, 9 St Georges Terrace
Primrose Hill

Author: Nick Maclean

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Engineering – materials, energy, structure, stability
8A Chamberlain St
London NW1 8XB
T: 020 7722 7525
F: 020 7722 9711
office@ecosmaclean.co.uk
www.ecosmaclean.co.uk

1.0 Introduction

1.1 The Chelmer Basement Impact Assessment concluded: *the proposed lower ground floor extension is considered acceptable in relation to the minimal anticipated groundwater flows through both the Made Ground and the London Clay* into which the lower ground floor extension will be founded.

1.2 Chelmer BIA also says *Current geotechnical design standards require use of a 'worst credible' approach to selection of groundwater pressures* but goes on to say that: *For the upslope retaining wall on the west side of the lower garden, use of weep holes and a composite drainage membrane could be considered in order to reduce groundwater pressures, subject to agreement under the Party Wall Act processes.* We have adopted a structural form that lends itself to drainage to the extent that water pressure on the back of the wall will be minimal.

1.3 Chelmer BIA also says *The lower ground floor extension's structure must be designed to resist the buoyant uplift pressures which would be generated by groundwater at ground level.* This would be the case for the structural design then proposed to them, but they have also predicted heave up to 8mm of the clay under the basement. We have chosen to revert to a more traditional design of suspended slab as advocated by NHBC guidelines where foundations are more than 1.5m below ground. The extension lower floor will not have a slab on the ground, nor be rigidly connected to the walls, thereby eliminating the risk of the Chelmer calculated heave strain of up to 8mm being transferred into the new Party Walls. We feel the circumstances of this basement are analogous to the situation covered by the NHBC.

1.4 Basements under existing buildings are normally created by underpinning in short lengths in a 'hit and miss' pattern, but excavations in open ground (and tunnels) are usually carried out progressively from at least one end. We have adopted this approach to reduce construction time and minimise disruption to the neighbours caused by lorry deliveries of many part loads of concrete.

1.5 To further expedite construction and minimise material deliveries, we are using precast concrete materials extensively which will have the multiple benefits of greater strength through being made in factory conditions, thus reducing volumes of concrete and steel needed; whole load deliveries can be made with elements being stored on site and carried manually to the extension as needed for progressive excavation without the frequent need of noisy mechanical concrete lorries and pumps; and space achieved will be maximised through reduced volumes of unsustainable materials.

1.6 To simplify and make the structure more rigid and resistant to the significant difference in levels between the upslope side and east side identified by Chelmer, and less susceptible to the creep movement of soils, especially clay, in which ground pressures rise progressively over time, and to expedite construction further, we have adopted an efficient hybrid structure with precast beams on the upslope side and steel posts on the east, downslope side, that can cope with the propping forces seen by Chelmer as not being possible in the all insitu concrete design. Then by jacking in (prestressing) earth pressure reactions during construction, we will greatly reduce subsequent horizontal deflections likely with a cantilever wall design when the earth pressures build with time and reduce the consequences of concrete creep movement.

2.0 Structural Design Forms

2.1 Three areas requiring different forms of construction have been identified by Chelmer: the near, small external terrace with a low wall adjacent to the existing building; the main room being created with a concrete deck for a roof garden that in our design is used to transfer propping reactions; the deep rear courtyard where propping at the top is not available but the upslope and downslope panels are of proportions such that they can be designed as two way spanning using standard concrete design manual tables, and to be directly propped/supported on the sides and the bottom edge, and to have a capping beam support at the top.

2.2 The near terrace has a relatively low wall and this cannot be attached to the Party Wall of the main building and is therefore detailed as a low cantilever wall using purpose made concrete blocks for earth retaining.

2.3 The upslope side of the room has been designed for a 50% increase on the standard earth retaining pressure in recognition of the increase in earth pressures that inevitably arise with time, but not with any hydrostatic pressure as effective detailing and drainage will ensure that this cannot arise. Chelmer advocated *'A surcharge , or increased [earth] pressure coefficient, to allow for the slope to the west of the lower ground floor extension's walls.'* The 50% increase in earth pressure coefficient we have adopted is significantly more than any surcharge pressure would be.

2.4 It is inevitable that the concrete roof deck will act as a prop so it has been taken into account in that respect and the forces involved resisted by the design on the down slope side. This reduces quantities of materials required and simplifies connections between elements, only pin joints are required for structural adequacy.

2.5 The downslope side of the room has an existing garden wall which was constructed in the knowledge that a basement room was likely to be subsequently constructed, with dowel bars projecting downwards to provide shear resistance to horizontal forces at the underside of the footing. By adding steel posts, the structural model becomes a vertical, simply supported beam, the support reactions being at the roof deck and the base floor, with a distributed load from the earth pressure.

2.6 The rear courtyard earth retaining panels will be propped at the sides by the new facing wall put on the exposed mews wall behind, and the steel box frame in the rear opening which is designed to resist both the horizontal earth pressures and isolate the patio doors from the forecast heave movements. The beam at the top of the new section of retaining wall at the up slope side, and under the existing brick fence wall on the downslope side, will be supported also by these two elements.

3.0 Construction Sequence and Method

3.1 Chelmer have assessed the site ground conditions and concluded that: *Water entries into the excavations for the lower ground floor extension are likely to be manageable by sump pumping (10.3.1). The clays onto which the underpins and the lower ground floor extension's slab will bear must be blinded with concrete immediately following excavation and inspection (10.3.3).*

3.2 The construction methodology is to carry out excavation progressively towards the rear, but an initial dig lowering the presently terraced garden to the same level as the downslope side, battered up to the upslope side at 1 vertically to 2 horizontally, can be carried out without temporary works.

3.3 Step 1: excavate in a heading either side, for a maximum of 2m, using trench sheeting against any loose fill (unlikely on up slope side because the time elapsed since placing of the garden fill will have allowed substantial consolidation, and also unlikely on the downslope side under the foundation of the recent fence wall), propping off the retained bund, then blind and place the unreinforced concrete footing for the retaining wall, also up to a maximum length of 2m.

3.4 Step 2: install the upslope pc beam and block wall, footed on the steel angle, place infill blocks and pea shingle/no-fines concrete drainage layer and equivalent section on the downslope side with steel posts, and the concrete deck pc beams.

3.5 Step 3: excavate 1m of bund, blind the ground, install the pc beam floor and using a Peri prop against the top of the steel posts, jack the post to create a 10mm gap between the pc beam and the capping angle to preload the ground pressures, install a steel shim to lock in preload.

3.6 Step 4: Excavate further 1m of bund and repeat Step 3.

3.7 Step 5: repeat Steps 1-4 through to the rear courtyard.

3.8 Install rear steel box frame.

3.9 Excavate rear courtyard in 1.6m strips (of 4.7m total), using trench sheeting to contain any loose ground encountered, which is only likely for the top 2m of excavation on the upslope side, concrete retaining wall base slab, and place Stepoc type blocks allowing block bonding and concrete.

3.10 Cast base slab 1.6m wide, prop walls with raking props from slab.

3.11 Excavate and cast next 1.6m strip as in 3.9 & 3.10 above.

3.12 Excavate and cast sequentially the underpinning of the mews wall.

3.13 Excavate and cast last 1.5m strip of rear courtyard slab as in 3.9 & 3.10 above.

3.14 Construct rear facing wall and concrete capping beam to side walls.

3.15 Remove wall props when concrete capping beam has achieved 14 day strength.

4.0 Whilst the Planning Condition of a Suds Report was removed, we will be providing soakaway type water storage crates under the extension floor to contain the rainwater runoff from the roof garden and ensure its ability to soakaway to the lower ground at the front. This will be by agricultural drainage pipe placed in the made ground of the existing drainage channel to the front and the street drain, to ensure the *channelled flow* in *service trenches or granular pipe bedding* envisaged by Chelmer in their section on ***Subterranean (Groundwater) Flow – Permanent Works***.