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Christopher Sallon
Chair of Quadrant Grove Residents Association
27 Quadrant Grove
London NW5

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Dear Christopher

Engineering commentary on proposed basement at 24 Quadrant Grove

As an independent and Chartered Civil Engineer, with 27 years in the field of Geotechnical Engineering, I have been asked by you to provide a commentary about the nature of engineering involved in the planning application for a basement at 24 Quadrant Grove. My commentary is provided in the form of this letter.

I have received the following information from you regarding the application:

- Application Form
- Basement Floor Plan Rev C
- Design and Access Statement
- Existing Elevation with new proposed Basement
- Existing Ground Floor Plan

From these documents I understand that a basement is proposed beneath the existing reception and hall areas of 24 Quadrant Grove. The depth of the basement is 2.85m from ground level to the finished floor level and has approximate plan dimensions of 7.5m x 4.5m. The house itself will not be demolished and is part of a terrace, with adjoining properties on either side. There are only outlines of the internal basement dimensions and no other information on the intended construction is provided in the above documents.

A basement dug beneath an existing building within a terrace is one of the riskiest situations in which to construct a basement. Because the property shares its existing foundations with its neighbours and also because it provides lateral support to its neighbours, any movement of the existing house resulting from the works will directly impact on its neighbours. Formation of the basement walls either beneath or directly adjacent to the existing foundations will cause movements of the party walls, whilst excavation of the basement space will cause further movement to the structures either side. In addition, the excavation of a basement beneath an existing property entails supporting the superstructure whilst the basement is dug out beneath. This is an additional operation which will cause movement of the superstructure above and hence has the potential to impact on the neighbouring properties since these are directly joined to the superstructure.

In the long term, the reduction in load on the ground will cause heave movements of the ground beneath the property and its neighbours which also need to be considered. The whole construction needs to be very carefully designed, planned and constructed with the aim of minimising movements at every stage.

I have been asked to comment on whether the construction of the proposed basement could be considered to be a "Building Operation", which is defined in Section 55(1)(A)(d) of the Town and Country Planning Act 1990 (TCPA) as including:
(a) demolition of buildings;
(b) rebuilding;
(c) structural alterations of or additions to buildings; and
(d) other operations normally undertaken by a person carrying on business as a builder.
I understand that "Building Operations" normally include elements of structure such as simple foundations, beams etc., which are well within the competence of a "person carrying on business as a builder".

The formation of the proposed basement at Quadrant Grove involves excavating a substantial basement space under the existing building. As clear from the description above, the insertion of a basement under a house is a significant act of civil engineering, as there are large forces to control, those acting vertically due to gravity and those acting horizontally from lateral pressures in the surrounding ground. Those forces need to be resisted both in the permanent case and also during construction in the temporary case, which is often more challenging. Both the permanent works and temporary works need to be designed by a qualified Civil Engineer to be sure that the balance of forces in both directions is clearly understood and controlled. It is not a craft that can be carried out by a well-trained operative in the absence of that fundamental engineering design. If not properly engineered, the risks are of potential collapse of the property and of its neighbours with a danger to the lives of workers and the public. The construction of the proposed basement therefore cannot be considered to be a "Building Operation" as defined in the TCPA, but rather is quite clearly a challenging engineering operation. There may be works involved in fitting out the basement which can be defined as "Building Operations", but these will come later, once the permanent basement box and its permanent structural supports are in place.

I am not aware if any other supporting documents have been or will be submitted, so I am advising on what a professional engineer would need to review at planning stage in order to understand the potential impact of the works on the adjoining and nearby properties and surrounding infrastructure and groundwater regime. My advice on what is required at planning stage for a proper review of the scheme, and why it is required, is as follows:

Desk Study

A desk study enables an understanding of the site as a whole and potential risks involved in construction. It will bring together available information on the following:

- Geology
- Ground conditions local to the development, e.g. the potential for a significant thickness of Made Ground, which is typically a weak material and will make construction considerations more complex
- Topography, to understand any imbalance of ground pressures across the proposed basement
- Any natural sources of groundwater in the vicinity, which may be dammed or diverted by the proposed basement

- Groundwater level, which makes construction considerations more complex and may be impacted by any damming effect of the basement
- History of development of the site to understand any potential construction issues
- Any information on foundations of the property and its neighbours
- Site walkaround to observe the conditions of the existing property and its neighbours
- Surrounding services or tunnels which may be affected by ground movements
- Whether the site is susceptible to surface water flooding due to struggling existing drainage measures.

Site Investigation and Interpretation

A site specific ground investigation should follow the desk study. It will be aimed at confirming the ground conditions and ground water level and will investigate any issues uncovered in the desk study. It will provide site specific soil parameters for design of the basement walls. Trial pits should be carried out to understand the depth of the party wall and other house foundations.

Preliminary design of the basement and assessment of resulting ground movements and damage assessments

The preliminary design of the basement needs to be carried out in conjunction with development of the construction methodology. A basement may be formed by underpinning the existing foundations, or it may be formed by constructing a retaining wall, typically using bored piles (mini piles given the low headroom constraints), which is situated just inside the existing foundations. Given that the available space for the basement at 24 Quadrant Grove is not large, an underpinning solution is typically adopted in these situations. The internal walls of the house can be underpinned, with the underpins forming the new basement walls, or the house can be supported by constructing beams at the base of the walls which span onto a series of piles whilst the basement is excavated out and then new supporting walls cast within the basement. Usually the engineer is trying to meet space constraints set by the architect and these dictate the construction types developed. They can also lead to complicated construction sequences which need carefully thinking through.

Each technique has different vertical and lateral ground movements associated with installation and excavation in front which need to be assessed. There will also be ground movements arising due to the transfer of load from the property to a lower level in the ground and due to the changes in load on the ground following excavation and basement construction. These impact of the resulting ground movements on the adjacent and nearby properties and surrounding infrastructure needs to be assessed and the proposed construction methodology adjusted until potential damage to third party properties falls within acceptable limits.

Both temporary and permanent lateral support measures need to be considered in the calculations to ensure stability and limit deflections of the ground retaining elements.

The vertical loads on the existing foundations need to be assessed and bearing capacity calculations carried out to establish the reasonable geometry of new load bearing elements (underpins and piles).

The design needs to be developed sufficiently to result in a robust ground movement and damage assessment for the adjacent and nearby properties and any critical infrastructure, which enables a reviewer to fully understand the implications of the proposed works.

Any impact on the groundwater flow and drainage system local to the site also needs to be evaluated to demonstrate that it is not significant.

Construction methodology

As stated above, the construction methodology needs to be developed in conjunction with the design to ensure stability of the new foundation system and retaining walls throughout construction and to limit deflections of surrounding structures. There is a critical need to support large temporary forces acting in both horizontal and vertical directions at all times. The construction sequence can often be complex, particularly if different foundation types are being used and it needs to be clear that there is a possible sequence that can be followed. There will also be a level of uncertainty. Domestic construction sites are often characterised by inadequate investigation of both the ground and the existing structures, especially those buried; plus other uncertainties like the route of buried services, which can exacerbate ground movements, if for instance a water main is broken. The construction methodology needs to be robust as it may well encounter the unexpected.

The construction methodology needs to be developed sufficiently at planning stage that a reviewer can understand that there is a robust solution which is compatible with the predicted ground movements.

Monitoring

Construction of a basement in this situation will require careful monitoring of the property itself and of the neighbouring properties, and above any critical surrounding infrastructure. There should be a commitment at planning stage to a future monitoring strategy with defined trigger levels and contingency measures in the event that trigger levels are reached. Note that the neighbours should agree the triggers in the party wall agreement process, and that they should receive an interpretation of the monitoring results as they are carried out, explaining the relevance of any trends.

In summary, consideration and evaluation of all the above is required for a clear conclusion to be reached at planning stage that the basement design and construction has been fully thought through and engineered to reduce the impact on third parties to an acceptable level.

Yours sincerely

Hilary Shields
Senior Geotechnical Engineer
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