Stage D
Structural & Civil Engineering
Design Report

Project Ref: 23725
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Issue KA1

Kings College Court
55 Primrose Hill Road
London
NW3 3EA

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Introduction

1.1 General

This document reports on the structural and civil engineering aspects of the proposed extension at Kings College Court in London (NW3 3EA). It describes the development since the inception of the project and explains the forms of construction which are to be adopted, with options where appropriate, and records the parameters influencing the development of the structural design.

1.2 The site and existing building

The site is located in the North-West region of London. The site is in a built up area of residential houses and apartments between 'Swiss Cottage' and 'Chalk Farm' underground stations. The existing structure is a 9 storey residential building with the bottom storey predominantly open for car parking and some closed plant enclosures. It is a reinforced concrete frame structure built in late 1960s. The existing structure will be a combination of columns and walls supporting the vertical gravity load of the concrete floor slabs and fabric. The actual arrangement of columns and walls has been estimated at this stage as a series of walls surrounding the central core areas (lifts and stairs) and outlying columns supporting the floor slabs. Some of the columns run directly down through the ground floor parking area although there is some evidence of corbelling and offsetting of the column positions through the 1st floor structure visible from below.

The lateral strength of the building will predominantly come from the stiffness of the wall configuration around the central core and stair areas. In concrete frames of this type the inherent stiffness of any continuous wall systems will almost always attract the majority of the lateral load.

Determining the exact detail of the existing structure and load paths is not straightforward. Buildings are built to construction tolerances so they are not perfectly level or vertical. Also the foundation systems are designed to settle in a limited way as load is applied. As this building has a high dead load to live load ratio, as it was constructed the foundations would have been taking up the applied dead load and settling accordingly. Equally the vertical and horizontal construction tolerances would
have been progressively realigned floor by floor causing a certain degree of lateral loading that would be distributed around the frame. These effects are accommodated in the design by allowing for global notional lateral loadings which allows a safe design without the need to understand the actual stress distribution within the frame or exact detail of the load distribution into the foundations.

1.3 The proposed extension

The proposed extension will add two storeys plus a part three storey of high specification residential accommodation to the roof of the existing building. All the plant requirements for both the existing and new Flats will be accommodated within the new structure and existing plant rooms. Additionally, new balconies are to be added to the existing Flats and an independent bicycle store constructed in front of the retaining wall to the car parking area.
The development will provide two extra floors of residential accommodation with the top flats utilised as top of the range penthouses with premium views across north-west London.

The existing frame of the building will be utilised to distribute the additional loading and use the existing piled foundations. The materials utilised for the new build parts will be primarily

light weight steel and timber to limit the increase in loading to the structural frame and piles to below 15%. Lateral loading will also need to be accommodated by the existing building due to wind loading and notional lack of fit and building tolerances inherent in the construction of the new extension. During the construction phase of the development the existing residential apartments will remain occupied with all construction works designed to cause minimal disruption to the existing residents.

Specific topics covered in this report include:

. Description of the architecture in terms of the structural engineering
. The design loads and actions
. The performance criteria
. The Codes and Standards to be used

Information is also given on construction issues, likely temporary works requirements and programme implications. In instances where investigations have not been carried out or where information from other parties is outstanding, these are highlighted.

Ground Conditions

2.1 Introduction

A preliminary site investigation was carried out in August 2012 to determine the size and impact of the existing foundations in relation to the proposed substructure. The fieldwork included the excavation of 2 trial pits (north-east and south-east corners) to depths of around 1m below existing ground level. The pile cap dimensions at the south-east and north-east corners of the site were: 2.0m x 0.8m (0.8m deep). The top face of the foundation is 240mm below ground level and the stabilising beams are 300mm wide and 500mm deep.

A provisional allowance has been made within our submission to account for differing ground conditions, which will be confirmed during the preferred bidder stage following intrusive site investigations and subsequent reports.

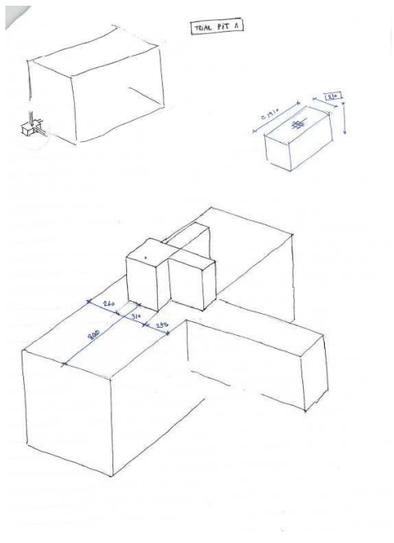

Figure 5: Sketch of trial pit 1

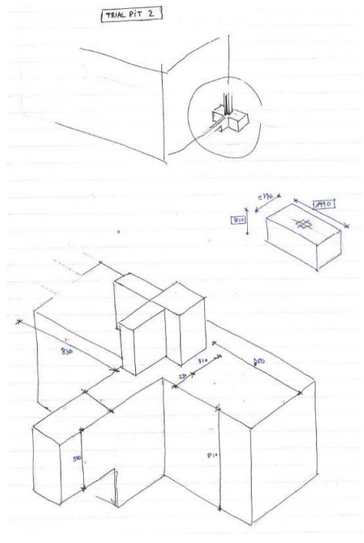

Figure 6: Sketch of trial pit 2

2.2 Geotechnical and geoenvironmental

According to historical data collected in the area, London clay has an average depth of 80m. That depth has been adopted for concept design. The preliminary investigations did not encounter any significant contamination during the excavation of the trial pits (by visual inspection). At this stage, no samples of ground have been taken neither have any laboratory tests been carried out.

2.3 Recommended future ground investigation works

The ground investigation work carried out to date has concentrated on determining the location and size of the existing pile caps. The fieldwork included a limited trial pitting exercise carried out at the north-east and south-east corners. Further investigation of the construction of the retaining wall will be required to accommodate the proposed bicycle store.

Superstructure

3.1 Design criteria & constraints

The specification for the project has been developed in-line with Building Regulations, British Standards and current best practice guidance with specific consideration to the following design criteria:

The proposed structure is to be designed as such that the impact on the existing building is minimised as much as possible; this is the simplest method to ensure the structural stability of both the old and new structures.

- Throughout the building design considerations have been made to reduce the weight and load of each structural element, this will in turn reduce the overall load on the existing foundations.

- During the construction phase of the development it is an essential requirement to restrict the effects of the construction on the existing apartments and residents. All residents will remain in the building throughout the construction process.

- Standard design criteria – such as economy, structural performance, durability, acoustics and fire resistance etc. are all required to be met.

- Services integration – The building requires the structure to integrate efficiently with M&E services, producing economy for both structure and services, and minimising the overall floor zone. The use of the new 9th floor for new plant and equipment will facilitate this integration.

- In the design and selection of materials consideration has to be given to issues such as transportation to site. Structural elements must be of a manageable size for transportation through London. In addition to this consideration has been made to utilise the simplest and most cost effective method of construction.

3.2 Concept design

The new two storey extension will be designed in light weight materials with steel and timber walls and floors. Structural steel beams and columns will be designed to supplement this structure where necessary. The construction will be braced, including an extension to the existing stair and lift core, to transfer both vertical and lateral loading to the existing concrete frame and shear walls of the existing structure and the existing piled foundations. The existing columns and piled foundations will be checked for a maximum increase in loading of 15%. New balconies are to be added utilising steel columns fixed to the existing concrete frame within the depth on the outer brickwork and new insulation to the building with cantilevered floors supplemented by the perimeter infill panels below the handrails. The bicycle store will have an independent steel frame on the base of the retaining wall of the car park and consideration will be given to utilising the support columns to remove or reduce the retaining wall buttressing.

3.3 Floor slabs

The new floors will be designed in 'Metsec' lightweight metal and timber, fully fire protected, to minimise the loading.

4 Substructure

4.1 Structural concepts / ground conditions summary

Trial pits have been used to look at the existing pile caps of the building. There has been no detailed analysis of the soil other than this to date.

4.2 Proposed foundations

The existing piled foundations will be utilised to support the additional loading and the base of the retaining wall utilised to support the bicycle store.

4.3 Crane foundations

It is anticipated that a tower crane will be used during the construction of the new floors supported on independent foundations. Cost allowance should be made for a reinforced concrete pad foundation to the tower crane. The design of the foundation is subject to information provided by the crane supplier at a later date.

5 Structural Design Parameters

5.1 Vertical load path

All vertical loads will be transferred through the existing reinforced concrete frame or beams, columns, floors and shear walls to the existing piled foundations.

5.2 Lateral stability

Wind loading and notional lack of fit and out of tolerance loading will be transferred through braced elements of the new structure, including an extension to the stair core and lift, to the existing shear walls within the existing structure and thereby down to the existing piled foundation.
The bicycle store will be independently braced or moment connections provided in its steel frame to ensure lateral stability.

5.3 Robustness and structural integrity

The proposed extension is classified as a 'class 2B' building in Part A of the building regulations, and as such the structure will require tying together to guard against disproportionate collapse. The use of framed construction throughout and the inherent provision of ties in two directions to steelwork members at various locations throughout the building generally allows the tying requirements for robustness to be met in both vertical and horizontal planes. Where removal of an individual member
such as transfer beams or columns would precipitate collapse of a large area of a building, these beams or columns are considered as 'key elements' and are designed for the 34 kN/m_2 accidental loading as stipulated in the Building Regulations. According to this, special attention will be given to the four corner concrete columns. The corner columns will be treated as key elements.

5.4 Design life

The primary structure will be designed in accordance with the relevant Codes of Practice and British Standards. We propose that a design life of 60 years minimum period, as defined in *BS7543 – Table 1*, be used. Any external galvanised steelwork will need inspection and may require maintenance after approximately 15 years.

5.5 Fire rating

The fire rating for the superstructure is to be confirmed by the architect / fire consultant. Any exposed primary steelwork elements will be sprayed with an intumescent coating to achieve the required protection. Concrete covers to reinforcement will comply with the requirements of BS 8110 to achieve the specified fire resistance.

5.6 Durability

The exposure conditions for the concrete elements are as defined in BS 8500-1:2006 and BS 8110. Generally concrete in contact with the ground will be RC35 grade, with cover adjusted to suit the ground conditions and contaminations results from the interpretive ground investigation when received. Care is required in the selection of materials for structural components in the "rain screen" zone outside the dry envelope. Fixings are required to address both general corrosion and electrolytic
corrosion induced by dissimilar metals.
Structural steelwork will either be galvanized or primed (subject to location) to achieve a life to first major maintenance of 20 years. Any steelwork that will be exposed in its final position will require extra care to protect the finished work during transport and erection and to ensure the finished work exposed to public view is of the highest visual quality.

5.7 Vertical design loading

The structure has been designed for the following Imposed floor loadings based on BS 6399-1:1996 Loading for Buildings - Part 1:

Loading Category Loading [kN/m2]
Dwelling units 1.50 kN/m2 + 1.0 kN/m2 for partitions
Balconies / Terraces 1.50 kN/m2
Corridors / Stairs / Landings 3.00 kN/m2
Plant areas 4.50 kN/m2
Roof (without access) 0.60 kN/m2

5.8 Horizontal design loading

Wind loads will be derived using *BS 6399 Part 2*:
Basic wind speed = 21 m/s
Site Altitude = 15m
Notional horizontal loads will be applied to account for imperfections in the structure. The notional horizontal load for steel structures is 0.5% of the ultimate dead and imposed load as defined in BS5950-1:2000. The notional horizontal load for concrete structures is 1.5% of the characteristic dead load as defined in BS8110-1:1997.

5.9 Standards and codes of practice

The following reference documents are used in the execution of the structural design. The latest version at the time of commencing the design will apply unless noted otherwise.
BS 8110 Parts 1-3 Structural use of Concrete
BS 5950 Parts 1-9 Structural use of Steelwork in Building
BS 6399 Parts 1-3 Design Loading for Buildings

5.10 Construction issues

Various construction issues have been outlined throughout the previous sections of this report; in addition to this the key issues are described below. It is a requirement that the building remains fully operational throughout the construction process with the current residents remaining within the building.

Therefore all construction activities must be carried out as to cause the minimal possible disruption to all residents and the surrounding local neighbourhood.
It is essential that the structural stability and integrity of the existing building is not affected by the inclusion of the additional extra floors.
The contractor is likely to use a tower crane for the construction of the new floors. This will be required to distribute materials around the site and lift structural elements such as trusses, beams and columns into position. The location of the crane will require careful coordination with the phasing of the development.
Consideration is required to establish a safe and practical site for the storage of construction plant and materials throughout the construction process.
Throughout the design process efforts must be made to limit the required depth of structural elements.

6 Design Interfaces

Structural components need to be considered in conjunction with finishes and the requirements of other disciplines which usually follow in construction programming terms. This section of the report serves to highlight the various interfaces which need to be resolved at the final proposals stage.

6.1 Building services within the building

In order to accommodate all plant requirements for the new extension and the existing building, new plant rooms are to be provided at top (11th) floor level. This will ensure that no additional noise is transmitted to the existing Flats. At the new upper floors, a flat slab soffit to the majority of the slabs has been provided to ensure
maximum flexibility for the distribution of services. Where downstands are present careful coordination of the services will be required to ensure minimal intrusion into
the clear headroom space below.

6.2 Building services/utilities serving the site

To facilitate co-ordination an integrated underground services layout should be produced for construction incorporating incoming utilities, underground drainage and substructure. Information on incoming utilities will need to be provided by the services consultant. Underground drainage will be fully coordinated with the substructure. Some diversions of services will be required in advance of the
main construction as part of enabling.

6.3 Cladding / roofing

Cladding loading points – KAAL practice is to issue schematic sketches indicating the deflection and loading parameters assumed during the primary structural frame design. These sketches should be incorporated into the performance specification for the external envelope produced by the architect to ensure that the cladding contractor is made aware of the design constraints.

6.4 Fire

Exposed steel members will require intumescent coating protection (subject to input from the fire consultant).

6.5 Acoustics

Acoustic detailing will need to be addressed as set-out in the acoustic report, and as such, guidance from Approved Document E of the Building Regulations may be used as a 'benchmark' for the detailing of the structure.

7 Health & Safety – Design Risk Issues

7.1 Construction (Design and Management) Regulations 2007

This construction project falls under the Construction (Design and Management) Regulations 2007. These regulations impose legal responsibilities on various parties involved in the procurement, design and construction of building projects, including the client. KAAL are classified as designers under the regulations. We confirm that we have the relevant experience to complete design services for projects of this type, size and nature and that adequate, competent resources have been and will be allocated to the project at the appropriate design stages.

7.2 Design risks

It is good practice, and a requirement under the CDM regulations, that competent contractors are appointed to carry out the works. It can be assumed therefore that a competent contractor will be aware of all the normal design risks involved in the construction process for projects of a similar type, size and nature. Design risks will be considered by KAAL at each stage of the design progress. Where possible these risks will be designed out of the project. Where this is not possible any residual risks will be noted on the project drawings. An engineer's risk identification sheet is included at appendix 1 which identifies the 'abnormal' design risks at this stage of the project.

7.3 Temporary works

Information about the responsibilities associated with temporary works can be found in the Institution of Civil Engineers Conditions of Contract and BS 5975:2008 temporary works procures and the permissible stress design of falsework. This requires a careful approach to temporary works design and a review undertaken by competent persons and the appointment of a Temporary Works Coordinator
to oversee the process.

Specific temporary works items (not exhaustive) as follows:
□□Crane base if required
□□Foundation excavation, propping and sequencing

Appendix 1 – Engineers Risk Identification Sheet

1.0 General introduction

This note provides evidence that there has been a process of risk identification within KAAL as a part of its civil and structural design work. This KAAL Design Report for the project should be read by the contractor and other designers as part of their communication duties under health and safety. Given the stage of work, it is likely that risks will emerge as a part of the normal design process during the
project development; this section will therefore require updating.

2.0 Site specific risks

The ground investigation work carried out to date has concentrated on determining the location and size of the existing pile caps. The fieldwork only included a limited trial pitting exercise carried out at the north-east and south-east corners. Further investigations are required prior to works commencing on site. Construction of the extension will be undertaken with the tenants living in the existing building. Detailed coordinated planning of deliveries and plant movements will be required to mitigate
the risks involved. No survey information of underground services have yet been acquired; therefore survey investigations will be required.

3.0 Building structure, specific risks

This KAAL Design Report provides background information to the design and also setting out the design duties expected of specialist designer/suppliers. The risk to be addressed here is that timely and effective design co-ordination of specialist subcontractor inputs effectively mitigates the risk of site modifications; thus minimising site work known to be higher risk than factory manufacture. The structural frame of the extension includes steelwork at height. Particular attention should be paid to the safe handling and placing of these members to avoid the associated health and safety risks.
During the construction phase of the development the existing residential apartments will remain occupied. This will require careful planning of the deliveries, security measures and storage etc to mitigate the risks to the tenants.
Particular aspects of the building relating to the structural design that might need adjustment as the work of others becomes more advanced are:

- Window cleaning and fall restraint design - provisions tbc by the Architect, not known at time of writing.
- Cladding subcontractor interfaces with the structure.
- Temporary works design – this is to be carried out by the contractor and Method Statements should be prepared in accordance with the structural concepts designed by KAAL and agreed with the design team in advance.
- Precast concrete stairs – full details to be confirmed by the specialist contractor
- Secondary structural element e.g. handrails, canopies, brise soleil, access systems,architectural metalwork, plant support – full details to be confirmed by specialist contractor
- Crane – The contractor needs to provide information on the chosen crane – crane information is to be provided in advance of the substructure design.
- Lift design – full details to be confirmed by specialist contractor.

Ken Amblin BSc (Hons) C.Eng, M.I.C.E, M.Struct.E, RMaPS, SMSTS