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Basement Construction Plan

Document Ref: MJW/581197/PLW
Revision: 2
Date: March 2016

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Project Revision Sheet

Revision No	Date	Status	Changes	Author	Approved
0	05/02/16		Draft issue for comment	PW	GDW
1	11/03/16		Adjustments to Clauses 1.4, 2.2, 2.3, 5.7,	PW	GDW
2	21/03/16	Final	Amendments throughout. Final Issue.	PW	GDW

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Appendices

1 Introduction

1.1 MLM Consulting Engineers were appointed in November 2015 by Pegasus Life Development Ltd to provide structural and civil engineering design services for the development at 79 Fitzjohn's Avenue, Hampstead, London NW3 6PA. Pegasus Life Development Ltd is the Owner for the project, which constitutes the construction of a six storey self-contained apartment development. The buildings are concrete framed and are to be supported over a two level basement structure on piled foundations.

1.2 The basement comprises a complex split-level structure in two distinct parts. A 'lower ground floor' area forms the first basement level occupying the full footprint of the building and contains habitable accommodation. Below that a deeper basement of considerably smaller plan size under the central area of the building contains a mechanised car parking system. The basement structure is described more fully later in this report and is illustrated in detail on the enclosed drawings.

1.3 During the installation of the new basement, the works are to include the removal of the existing basement forming part of the previous building on the site, involving extensive temporary ground works. Again, this work is fully described and illustrated elsewhere in this report.

1.4 A Basement Impact Assessment (BIA) was submitted in support of the original planning application in December 2014 and an updated report was submitted in March 2015 to suit a revised basement layout. The BIA contained comprehensive information on the project, design intent and site characteristics, and included a hydrogeological and ground movement report, flood risk assessment and ground investigation report.

1.5 The revised scheme incorporating adjustments to the two level basement has been approved but further adjustment of the depth of lower basement has been found necessary during detailed design of the scheme which is incorporated in the revised s.73 planning application.

1.6 This document provides a plan that sets out information relating to the design and construction of the basement and is hence referred to as the Basement Construction Plan (BCP). The aim of the BCP process is to formulate a safe and robust design and methods of construction that minimise any impact on neighbouring properties.

2 Design responsibilities

2.1 The project comprises separate Contracts, each with their own documents and designers. Separate aspects of the works are:

- A demolition contract package comprising demolition of the works down to ground floor slab level.
- An enabling works contract package comprising the installation of temporary steel sheet piling and king post walls and the provision of the piling platform.

- An enabling works Reduced level dig, temporary propping of steel sheet piled / king post walls and construction of the permanent works.

2.2 Responsibilities for the design of each phase of the work and the preparation of supporting documents are:

- The scope of the demolition and enabling works is shown on drawings prepared by Card Geotechnics Ltd and is included in Appendix A.

- The shape of the building and typical architectural sections have been prepared by Sergison Bates Architects and are included in Appendix B.

- The Basement Impact Assessment (BIA) and associated hydrogeological assessment have been prepared by Card Geotechnics Ltd on behalf of Pegasus Life Development Ltd and are included in Appendix C. It should be noted that the original BIA was prepared in December 2014 with an Amendment issued in March 2015. A further adjustment has been prepared to accommodate the increased depth of the lower basement as referred to in the Section 73 Minor Amendment to the Planning approval.

- Condition surveys of the adjoining buildings required for compliance with Clause 2.8.2 (d) of the Section 106 agreement have been prepared by the Party Wall Surveyor, Finlay Harrison Surveyors. Enabling works drawings and designs have been prepared by Card Geotechnics Ltd. and are included in Appendices C and D. This information includes sequencing drawings for the temporary works to inform the detailed method statement required by 2.8.2 (d) of the Section 106 agreement.

- This Basement Construction Plan (BCP) has been prepared by MLM Consulting Engineers with assistance from other designers to meet the requirements of Clause 2.8 of the Section 106 agreement forming part of the Planning Approval.

- The BIA and BCP are submitted principally to obtain clearance of Planning conditions and Section 106 requirements. In addition to this work, an Approval in Principle (AIP) application is required for Clearance of clause 2.6 of the Section 106 agreement forming part of the Planning Approval.

- The permanent works with the exception of the secant and loadbearing piling have been designed by MLM Consulting Engineers. The design of the Secant walling and Loadbearing piles will be by specialists to meet the performance standards determined by the design team. Drawings and designs for the permanent works are included in Appendices E and F.

- The AIP submission has been prepared by Card Geotechnics Ltd in conjunction with both the Temporary works and permanent works designers. This was submitted to the Council's Highways team on 4 March 2016

- Extensive co-ordination has taken place within the various parties involved in design, along with the preferred Permanent works contractor to see that each aspect of the design has considered the constraints resulting from the various phases and stages of design and construction. A series of sketches were prepared by MLM to demonstrate the interfaces between the permanent and temporary works. This sketch information has been included in the Temporary works sequencing drawings included in Appendix C.

- The Temporary works design has considered the various stages of construction at each of the design cases and has prepared designs which co-ordinate with design dig levels, locations of permanent works and adjustments to temporary works during construction of the permanent works.

- The permanent works design has considered the constraints imposed by the Temporary works design along with loads applied by the Temporary works to the permanent works during the construction process.

- Monitoring proposals for detection of ground movement and details of trigger levels for action, along with ground water monitoring proposals have been prepared by Card Geotechnics Ltd. and are included in Appendix H.

- Pegasus Life Development Ltd have appointed two Basement Design Engineers

  - Card Geotechnics Limited as the "Basement Design Engineer" for the Temporary works.
  - MLM Consulting Engineers as the "Basement Design Engineer" for the Permanent works.

  Both appointments are as referred to in Clause 2.8.1 of the Section 106 agreement forming part of the Planning Approval. A copy of the Appointment document for the Basement Design Engineer as required by Clause 2.8.1 of the Section 106 agreement is included as Appendix J.

- The Basement Design Engineer's report and confirmation that the detailed measures set out in sub-Clauses (d) to (j) of 2.8.2 have been met is included as Appendix K.

- Pegasus Life Development Ltd have appointed

  - Card Geotechnics Ltd as the "Certifying Engineer".

  referred to in Clause 2.8.3 of the Section 106 agreement forming part of the Planning Approval. A copy of the Appointment document for the Certifying Engineer is included as Appendix L.

2.3 The following documents have been used as guidance to complete this Basement Construction Plan:

a) *Camden Planning Guidance: Basements and Lightwells*
b) *Camden geological, hydrogeological and hydrological study – Guidance for subterranean development*
c) *North London Strategic Flood Risk Assessment – Mouchel*
d) *Legal Agreement for Planning Conditions by London Borough of Camden reference "Planning / CJ/1781.238"*
e) *Basement Impact Assessment dated December 2014 with Amendment dated March 2015 and further amendment dated March 2016*

3 Co-ordination of the design

3.1 In view of the fact that different designers are involved in the preparation of the BIA, Hydrological survey, temporary works design and permanent works design, design workshops have been undertaken which have involved all designers and the permanent works preferred Contractor.

3.2 The temporary works design has carefully assessed the stability and expected movements of the ground at all key locations around the site and the effects of the works on the neighbouring properties. The designs have resulted in the need to retain part of the existing structures during the early stages of the temporary works installation in order to maintain effective support to adjoining properties and site boundaries.

3.3 Drawings have been prepared showing the scope of demolition to be carried out prior to commencement of the temporary works on site and have been made available to the Demolition Contractor. The demolition constraints drawing is included at Appendix A.

3.4 The various design cases of the temporary works design are based on excavation depths resulting from the permanent works design. These depths have been co-ordinated between permanent and temporary works designers.

3.5 The temporary works design in the main adopts propping systems from waling to waling such that the temporary walls support each other. Loads behind each of the walls are shown generally to be able to resist horizontal movements at propping levels.

3.6 Where propping of the temporary works walls to within the site is required, the resultant loads from propping systems have been provided by the temporary works designers and incorporated into the permanent works as a temporary design case. This avoids the need for extensive temporary thrust blocks within the working area for the permanent works that would otherwise result in further constraints to the construction process and an increased risk of movement of the temporary retaining walls.

3.7 The proposed permanent and temporary works for the development have been designed in accordance with the relevant British Standards and Eurocodes. The temporary works design has been prepared in line with the design requirements and specified movement allowances included within the BIA. The temporary works installation is considered to be the stage at which the greatest potential for movement of adjoining properties will occur.

3.8 The permanent works design has considered the potential for movement during construction and shows the principles of support required at each stage of the construction process. Loadings resulting from the temporary propping cases have been provided to the permanent works designers to ensure adequate support is provided at all times to minimise movement of adjoining properties.

3.9 Detailed method statements for the various stages of the enabling and permanent works will be provided by the Contractors and their Temporary works designers to meet the requirements of the BIA, this BCP and both temporary and permanent works designs. These method statements will be agreed with the Basement Design Engineers and Party Wall Surveyors.

4 Demolition works

4.1 The demolition contract is being undertaken separately from the enabling works and permanent works. As referred to elsewhere, parts of the substructures to existing buildings on the site are considered to be providing support to boundary wall and are preventing movement from occurring to adjoining properties and the Highway. Accordingly these existing structures have been left undisturbed during the demolition works.

4.2 The temporary works design has taken account of the need to maintain the support provided by the existing structures. A drawing showing the extent of demolition permitted to avoid movement of existing retaining structures, adjoining properties and the Highway has been prepared by the Temporary works designers and provided to the Demolition Contractor. The drawing is included at Appendix A.

5 Enabling works

5.1 The enabling works includes establishing the extent of demolition that can be carried out without causing movement or damage to adjoining properties or the adjoining Highways. The design itself has considered the maximum movements referred to in the BIA.

5.2 The main part of the enabling works design is the design of the temporary retaining structures (the temporary works) which extend around the perimeter of the site and allow the installation of the piling mat for the permanent works piles.

5.3 Ground levels around the site vary considerably. In order to allow safe installation of the permanent piling works, a flat piling platform is required which is free of obstructions for the full area of the proposed buildings and sub-structures. At this site the decision has been made to provide a piling platform at two levels with a graded slope between and ramped access from one level to the other to allow the piling rig to move between.

5.4 The split level platform permits the use of proprietary steel sheet piling or kingpost walls of a manageable size to be installed such that expected movements are restricted to acceptable levels that do not place adjoining properties or highways at risk. For the initial stage of the permanent works, the temporary steel sheet piles and king post walls are designed to cantilever above pile mat levels.

5.5 It is a requirement of the permanent piling works that all existing obstructions, foundations and floor slabs within the building footprint are removed to allow installation of the permanent piles. As a result of the support provided by the existing building substructures, several stages of work are required to install the temporary works, remove remaining elements of the existing substructures and install the piling mats.

5.6 The temporary works design has considered the various processes and works required for each of the design situations and includes a stage by stage set of drawings, demonstrating the processes needed to provide effective support at all times until the piling mat is installed. These stage by stage drawings are included in Appendix C.

5.7 The ground modelling and temporary works design has adopted a conservative approach and accounted for the condition of neighbouring properties. The construction of the basement will be undertaken without any structural impact on the Integrity of the neighbouring properties beyond "slight" from the Burland Category of Damage.

6 Permanent works

6.1 The permanent works are wholly contained within the temporary works and in most cases are required to be constructed in stages whilst allowing for the alteration of temporary works during / between stages.

6.2 The permanent works commence with the installation of the secant piling and loadbearing piles from the pile mat levels referred to in 5.2 to 5.4 above. On completion of the piling, localised excavation to lower ground floor level, cutting down of piles and construction of capping beams and pile caps needed to provide support to temporary walls will be constructed.

6.3 The capping beams, pile caps etc used for support to temporary works will make allowance for loads from temporary props, with loadings provided by the Temporary works designers.

6.4 Once the temporary works are fully braced, general excavation to formation for lower ground floor is to be carried out along with construction of the lower ground floor walls. When all capping beams to secant piling is completed, propping between capping beams will be installed to allow excavation of the basement.

6.5 The permanent works design generally will not affect the temporary works, other than at key stages where propping needs to be installed or adjusted to allow the staged construction of the permanent works. The permanent works will however be required to provide support to the temporary works in some areas of the project.

6.6 Loadings applied from temporary works have been considered as a temporary design case for the permanent works and checks have been included to see that loads can be adequately resisted at all stages of the work. This results in the need for a detailed construction method statement to see that enough of the permanent works is constructed at any stage to provide full restraint to the temporary works.

6.7 During later phases of the permanent works construction, backfilling and hardening up between the permanent and temporary works is required to allow the phased removal of the propping to the temporary retaining walls.

6.8 All temporary loads applied to the permanent structure are effectively resisted by the diaphragm action of the lower ground and upper ground floor slabs. The loads are then transferred to foundations etc by vertical shear walls which have been checked for adequacy of support at key stages. The checks have taken a conservative assessment of applied loads and material stresses to allow an element of redundancy in the design.

6.9 Lower ground floor walls cannot economically be designed as stiff cantilevers to provide support to the temporary works at the key design support level of 103 metres due to the significant loads involved and the excessive section thickness that would be required to maintain acceptable deflections.

6.10 Lower ground floor walls are therefore designed to span between lower ground floor and upper ground floor levels to resist horizontal loads resulting from earth pressures, resultant loads from neighbouring structures, hydrostatic loads where appropriate and Highway loads along Fitzjohn Avenue and Prince Arthur Road.

6.11 The permanent works design has been carried out in accordance with the design intent of the Basement Impact Assessment, including technical design reviews in compliance with ISO 9001. The drawings and design for the permanent structural and civil engineering works are enclosed in Appendices C and D.

6.12 Foul and storm water drainage for the site has taken account of the phased permanent and temporary works design and has avoided drain installations that adversely affect the temporary works design. The approach adopted has contained as much of the drainage as possible in areas where deep excavations will not be required for future maintenance and repair which would otherwise affect the stability of neighbouring properties or boundary walls. The works have been designed in accordance with statutory guidance for the 1 in 100 year storm and the associated attenuation required to meet Planning requirements.

6.13 Ground water levels recorded in the soils investigation report (included as Appendix I) show that water strikes were not encountered above of 95.5 metres which is well below the level of the lower ground floor. The permanent works design has however followed good engineering practice and considered the possibility of groundwater rising during extreme conditions to with 1 metre of ground level (in this case 106.6 metres).

6.14 Given the approach adopted it is considered unlikely that the temporary and permanent works will encounter significant quantities of groundwater during the construction period but the possibility of this occurrence cannot be discounted. Whilst the design of the temporary works will not ensure that the walls will be watertight, the level of seepage through these walls is unlikely to be significant. As such any minor leaks can be sealed up as the work progresses to avoid loss of ground to adjoining properties and Highways.

6.15 The permanent works have been designed as waterproof structures with full details of the waterproofing system to be developed by a specialist waterproofing Contractor. The specialist is not yet appointed but full details of their construction and maintenance proposals can be obtained once appointed.

6.16 Groundwater monitoring points at agreed locations will be established and monitoring undertaken at intervals to be agreed before construction commencement and extending up to Practical Completion of the works.

7 Monitoring during site works

7.1 Monitoring of site conditions will be ongoing during the construction works by the Contractors in conjunction with the designers and Basement Design Engineer, including movement of the neighbouring properties and Highways, compliance of ground conditions with those predicted in the site investigation report and assumed for the ground modelling.

7.2 The structural stability of the surrounding/adjacent properties and Highways will be monitored at regular intervals as agreed with the Party Wall surveyors. A plan of monitoring locations and types of control point required has been prepared by Card Geotechnical Limited (the authors of the BIA) and is included in Appendix H.

7.3 Monitoring points (targets) will be firmly attached, to allow 3D position measurement, for the duration of the work, to a continuous and uninterrupted accuracy of -/+ 1mm. A suitable remote reference base/datum unaffected by the works will be adopted, one located at least 50m from the site. The Contractor will monitor the position and movements of the control stations as defined on the monitoring plan.

7.4 Points/targets will be measured for 3D positioning. Before any works commence a base reading will be taken, then further measurement will be taken weekly during the period of basement excavation/construction and monthly during the course of the remainder of the works. A final reading is to be undertaken 6 months after the completion of all construction works.

7.5 All measurements will be plotted graphically, to clearly indicate the fluctuation of movement with time. The survey company will submit the monitoring results to the Basement Design Engineer and to the Adjoining Owners Party Wall Surveyors/Engineer within 24 hours of measurement, graphically and numerically.

7.6 The following trigger levels for movement are proposed for agreement. In the event of a trigger value being reached the Contractor will immediately stop any work that might cause further movement, assess the situation and propose alternative methods for proceeding, with definitive further movement limits for those later steps.

Trigger movement limits are proposed as follows:

Facades Horizontal movement/Facades Vertical or horizontal movement

• Green	Less than +/-5mm	
• Amber	+/-7mm	All parties notified
• Red	+/-7-10mm	Works reviewed

Garden walls and excavation

• Green	Less than +/-7mm	
• Amber	+/-10mm	All parties notified
• Red	+/-15mm	Works reviewed

Highways

• Green	Less than +/-15mm	
• Amber	+/-20mm	All parties notified
• Red	+/-25mm	Works reviewed

8 Basement Design Engineer

8.1 Pegasus Life Development Ltd have appointed a Basement Design Engineer in accordance with the requirements of the Section 106 agreement attached to the Planning Approval. The Basement Design Engineers have independently checked the design plans and their report is included in Appendix K.

8.2 A Letter of Professional Certification by the Basement Design Engineer confirming the Basement Construction Plan is an approved form and is in accordance with the Legal Agreement for Planning Conditions by London Borough of Camden reference "Planning / CJ/1781.238" is included as Appendix K.

8.3 The appointed engineer will review all temporary works, contractors' method statements and calculations for these works, prior to the works starting. The permanent works designs will also be submitted to Building Control and the necessary Party Wall Surveyors for approval prior to the works commencing on site.

9 Certifying Engineer

9.1 Pegasus Life Development Ltd have appointed a Certifying Engineer in accordance with the requirements of the Section 106 agreement attached to the Planning Approval. The Certifying Engineer has reviewed the design plans and their report is included in Appendix M.

9.2 A Letter of Professional Certification by the Certifying Engineer confirming the Basement Construction Plan is an approved form and is in accordance with the Legal Agreement for Planning Conditions by London Borough of Camden reference "Planning / CJ/1781.238" is included as Appendix M.

10 Summary

10.1 The basement at the development known as 79 Fitzjohns Avenue has been designed in accordance with robust structural principles and methods of construction that are widely used and known. The work has been undertaken and fully co-ordinated between the responsible designers to comply with the Basement Impact Assessment using conservative modelling of ground conditions, the water environment and the structural condition and applied loads from neighbouring properties.

10.2 Certification of the suitability of the works by the Basement Design Engineer and Certifying Engineer have been provided.

Appendices

Appendix A
Scope of demolition and enabling works

Appendix B
Permanent Works plans and sections

Appendix C
Drawings of Proposed Temporary Retaining Works

Appendix D
Structural Calculations for Temporary Works

Appendix E

Permanent works foundation and substructure drawing

Appendix F

Structural Calculations for Permanent Works (to follow)

Appendix G
Not used

Appendix H
Monitoring proposals

Appendix I
Soils investigation report

Appendix J
Basement Design Engineer appointment details

Appendix K
Basement Design Engineers Certificate

Appendix L
Certifying Engineer appointment details

Appendix M
Certifying Engineers Certificate