BASEMENT CONSTRUCTION METHODOLOGY AND TEMPORARY WORKS

52 Aberdare Gardens, London, NW6 3QD

Revision	*Date*	*Description*
0	08.12.21	*First issue*

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1. GENERAL CONSIDERATIONS

Brief

Flood Engineering have been appointed as the project temporary works engineers for the proposed structural alterations and basement construction. The purpose of this document is to provide a methodology and temporary works design for the construction of the basement.

Reference documents

- Flood Engineering Drawings
  F_ENG 211119_100_P01 – Basement sequence sheet 1
  F_ENG 211119_101_P01 – Basement sequence sheet 2
  F_ENG 211119_102_P01 - Basement sequence sheet 3
  F_ENG 211119_103_P01 - Basement sequence sheet 4
- PJCE Structural Engineers Drawings
  L2630-S-08-009-02- Concept Temporary Works Lateral Basement Propping
  L2630-S-20-0090-01-General Arrangement of Basement
  L2630-S-20-0100-01-General Arrangement of Ground Floor
  L2630-S-20-0110-- General Arrangement of First Floor
  L2630-S-20-0120--General Arrangement of Second Floor
  L2630-S-20-0130--General Arrangement of Roof Plan
  L2630-S-21-0200-01-Perimeter Section Details Sheet 1
  L2630-S-22-0210--Sections & Details Sheet 1
  L2630-S-22-0211--Sections & Details Sheet 2
- Paddock Geo Engineering document
  P21-302pra – Ground Investigation Issue 1 Dated 27/10/21

2. GROUND CONDITIONS

Soil properties have been adopted from Paddock Geo Engineering document P21-302pra – Ground Investigation Issue 1 Dated 27/10/21.

4.1 Encountered Strata

The exploratory point arisings were logged by a Geotechnical Engineer generally in accordance with BS5930:2015. The geology beneath the site indicated Made Ground over London Clay Formation fine grained soils to the base of the boreholes. The strata encountered is detailed below.

A log of the exploratory holes and Exploratory Point Location Plan showing the positions investigated are presented in Appendix B.

MADE GROUND

Made Ground was encountered across the site within all exploratory holes to depths of between 1.50m and 1.70m bgl.

The Made Ground within the boreholes was found to comprise vegetation or grass over dark grey clayey gravelly SAND in WS1 to 0.40m bgl at the front of the site and dark brown to pale grey brown slightly gravelly CLAY to 1.50m bgl in WS1 and also to 1.40m in WS2 at the rear of the property. Gravel was brick, flint, concrete and ceramic.

Made Ground was noted within the foundation trial pits to a depth of 1.70m in TP1 which was formed at ground level and 0.20m to 0.40m depth in TP2 and TP3 respectively which were formed at lower ground floor level. The Made Ground in the trial pits was similar to that within the boreholes with fragments of glass, wood, brick, ceramic, metal and concrete.

Report on behalf of Eric Bensoussan
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PGE

The additional trial pits CTP1 - CTP3 were formed in garden areas and encountered Topsoil like Made Ground comprising dark brown sandy gravelly CLAY and grey clayey gravelly SAND with fragments of glass, wood, brick, concrete, metal and ceramic to depths of between 0.50m and 0.85m bgl.

LONDON CLAY FORMATION

Fine grained soils of the London Clay Formation were encountered underlying the Made Ground across the site and typically comprised firm to stiff at shallow depth to very stiff below 3.00m depth pale grey brown and blue grey CLAY. Such fine grained soils were proven to the base of the boreholes at a maximum of 6.00m bgl.

Soil parameter adopted:

Top	Description	Bulk density	Sat. density	E kN/m2	dE inc. kN/m3	Cu or C' kN/m2	dC inc. kN/m3	Phi degrees	Wall friction	Ka Kp	Kac Kpc
0.00	Made Ground	19.0	19.0	15000	0	0	0.0	30	0.50	0.29	0.00
						0	0.0	30	0.50	4.29	0.00
-1.00	CLAY	20.0	20.0	25000	4000	40	6.0	0	0.50	1.00	2.45
						40	6.0	0	0.50	1.00	2.45

3. PROPOSED CONSTRUCTION SEQUENCE

Refer Flood Engineering drawings for the proposed construction sequence.

4. TEMPORARY WORKS ANALYSIS

Surcharge allowance at existing ground level behind RC walls = 10kPa (construction machinery plant)

Excavation works must be carefully controlled to ensure the formation levels on site are in line with those specified on the structural drawings.

These calculations have been produced for the purposes of temp condition checks only and therefore undrained conditions have been adopted for the clay strata. Permanent works design for retaining structures remains with the structural engineer.

The computer program 'CADs' has been used to undertake the analysis to determine the temporary propping forces.

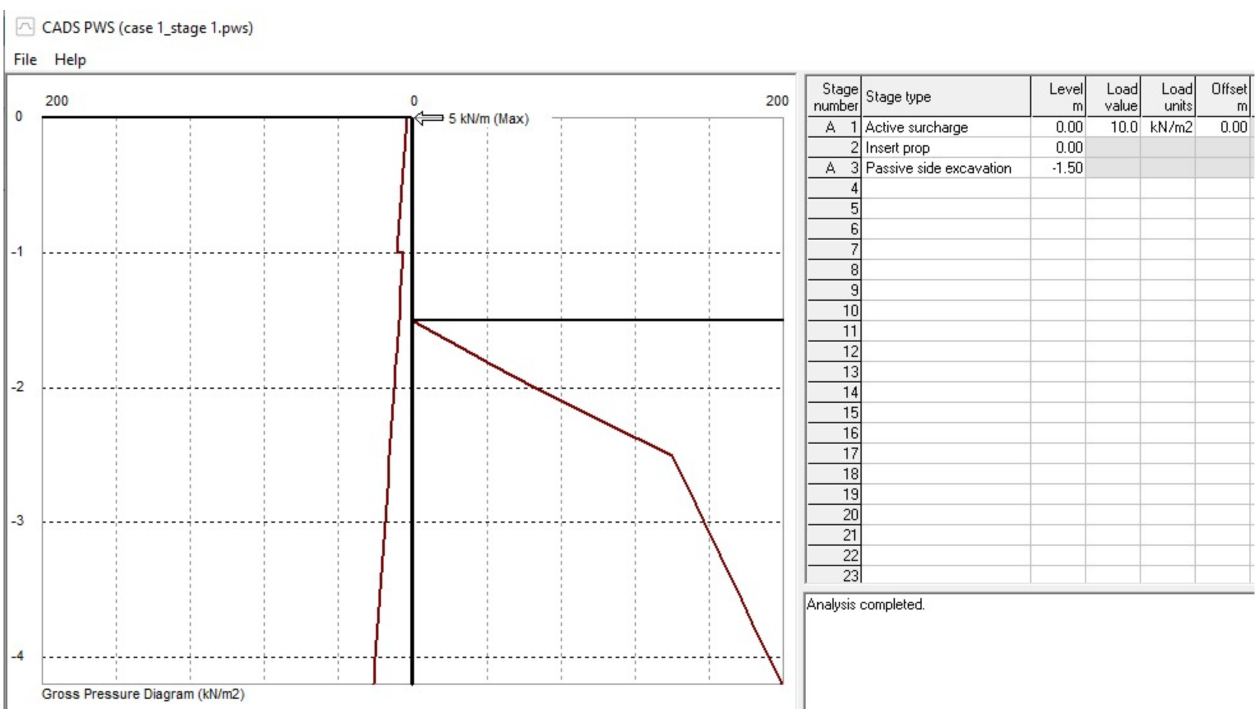
There are two stages to the temporary propping:

Stage 1

Provide a lateral restraint to the existing walls prior to the removal of the existing ground floor structure.

Maximum retained height at this stage = 1.5m

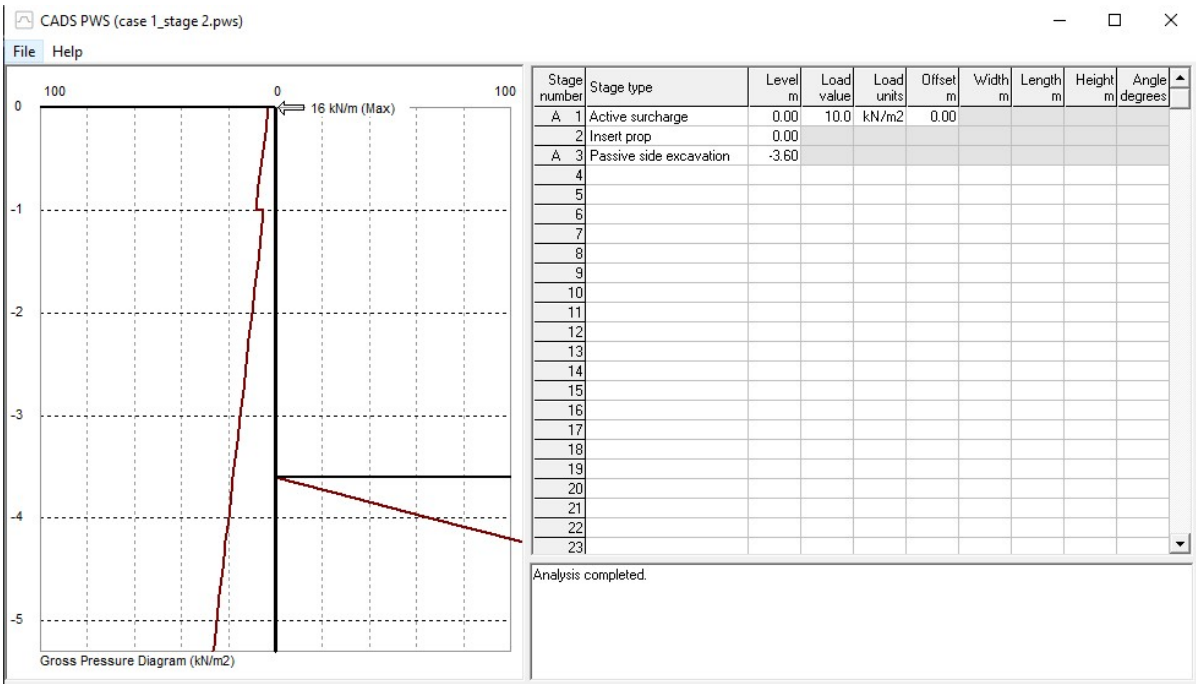
From CADs software outputs the maximum prop force = 5kN/m (SLS)



Stage 2

Provide a lateral restraint to the proposed underpin walls prior to the reduction of the existing ground level down to the proposed formation levels. Maximum retained height at this stage = 3.6m

From CADs software outputs the maximum prop force = 16kN/m (SLS)



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5. TEMPORARY PROPPING ANALYSIS/DESIGNS

Stage 1

RMD SuperSlim propping section adopted

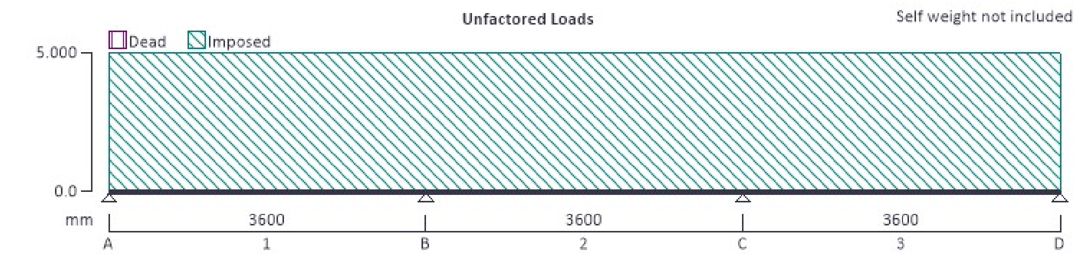
Tedds structural design software have been used to analysis the propping

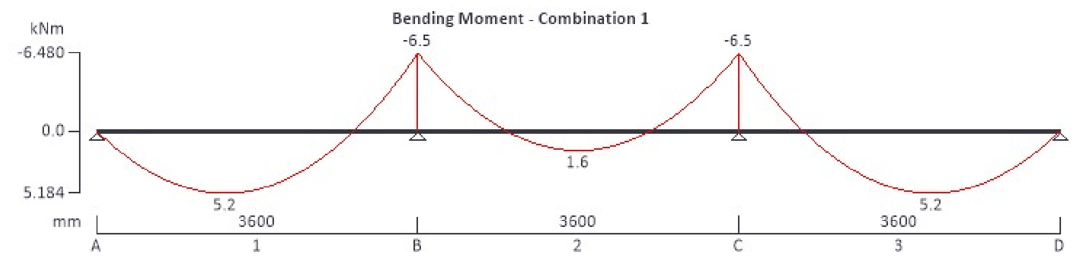
Maximum bending moment = 6.5kNm

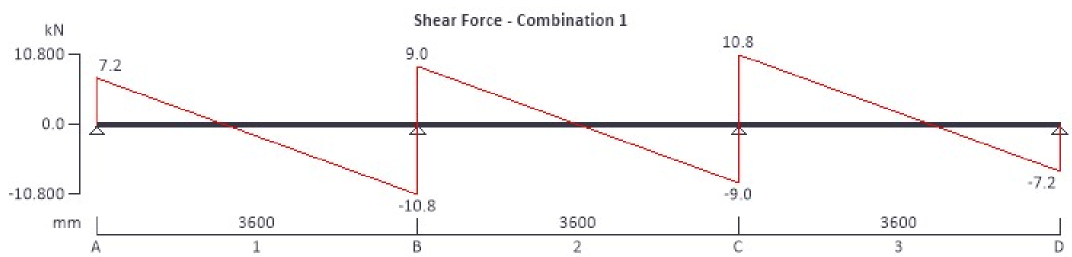
Maximum prop force = 19.8/cos40 = 26kN

Maximum prop length = 4.7m

Therefore RMD SuperSlim props considered acceptable







CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A;	Max react = **-7.2** kN	Min react = **-7.2** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support B;	Max react = **-19.8** kN	Min react = **-19.8** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support C;	Max react = **-19.8** kN	Min react = **-19.8** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support D;	Max react = **-7.2** kN	Min react = **-7.2** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;

Beam Max/Min results - Combination Summary

Maximum shear = **10.8** kN

Minimum shear; F_{min} = **-10.8** kN;

Maximum moment = **5.2** kNm

Minimum moment = **-6.5** kNm;

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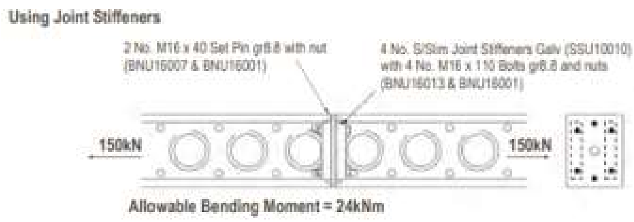
Stage 2

RMD SuperSlim propping section adopted

Tedds structural design software have been used to analysis the propping

Maximum bending moment = 20.7kNm

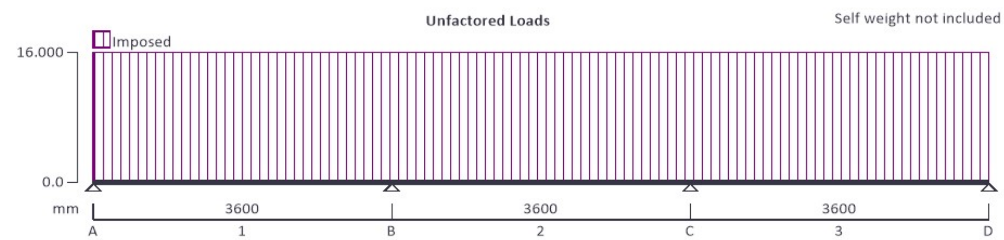
Note stiffened joint needed to connect RMD sections as per below detail

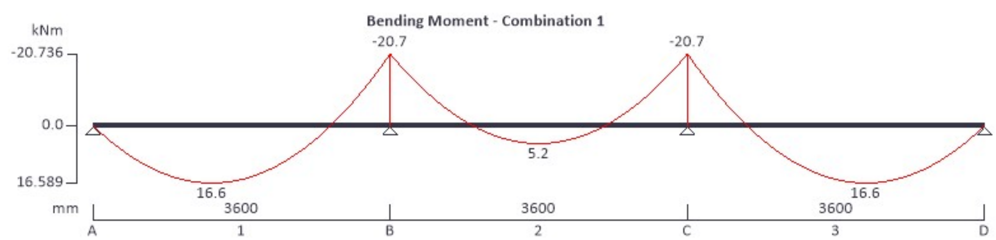


Maximum prop force = 63.4/cos40 = 82kN

Maximum prop length = 4.7m

Therefore RMD SuperSlim props considered acceptable





CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A;	Max react = **-23.0** kN	Min react = **-23.0** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support B;	Max react = **-63.4** kN	Min react = **-63.4** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support C;	Max react = **-63.4** kN	Min react = **-63.4** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;
Support D;	Max react = **-23.0** kN	Min react = **-23.0** kN;	Max mom = **0.0** kNm;	Min mom = **0.0** kNm;

Beam Max/Min results - Combination Summary

Maximum shear = **34.6** kN   Minimum shear;F_{min} = **-34.6** kN;

Maximum moment = **16.6** kNm   Minimum moment = **-20.7** kNm;

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RMD SuperSlim Prop technical Information:

SUPERSLIM SOLDIER

MODULAR STRUCTURAL SYSTEM

R·M·D KWIKFORM

Section Properties

Soldier Characteristics

Area: Gross	26.06 cm²
Area: Nett	19.64 cm²
I xx	1916 cm⁴
I yy	658 cm⁴
r xx	9.69 cm
r yy	5.70 cm
Z xx	161 cm³
Z yy	61 cm³
EI xx	4020 kNm²
EI yy	300 kNm²
GA xx	17350 kN
Vmax y (parallel to webs)	88kN min*
M max x	40 kNm
M max y	6.24 kNm
Mean Self weight for Analysis	0.235 kN/m run**

* limited by the value at the 100mm diameter porthole.
** Self weight varies depending on makeup / length - see sheet 9.

Bolted Joint Characteristics in X-X Axis - see sheet 19 for location of bolts

Number of Bolts	Maximum Moment	Maximum Shear	Maximum Tension
2 M16 gr 8.8 Bolts	9kNm	76kN	90kN
4 M16 gr8.8 Bolts	12kNm	88kN*	100kN
6 M16 gr 8.8 Bolts	18kNm	88kN*	140kN
6 M16 gr 8.8 Bolts & Joint Stiffeners	24kNm	88kN*	150kN

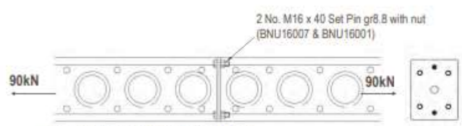
SUPERSLIM SOLDIER

MODULAR STRUCTURAL SYSTEM

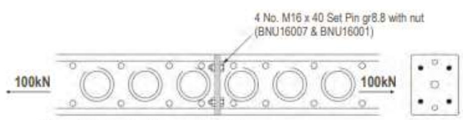
R·M·D KWIKFORM

Bolted Joints

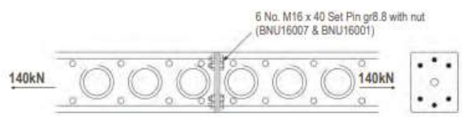
Various arrangements and capacities of bolted joints are available:



Allowable Bending Moment = 9kNm

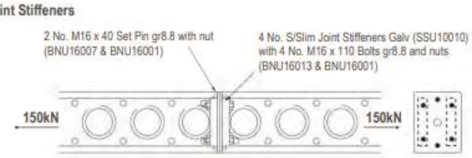


Allowable Bending Moment = 12kNm



Allowable Bending Moment = 18kNm

Using Joint Stiffeners



Allowable Bending Moment = 24kNm

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SUPERSLIM SOLDIER

MODULAR STRUCTURAL SYSTEM

Vertical Struts – Buckling About the Y Axis

The Superslim Soldier has different loading characteristics about its two axes due to its asymmetric shape. The arrangement of the strut when erected may also dictate the method of bracing to obtain the required capacity. The lateral stability of the strut in each direction requires consideration, and graphs of safe load capacity against effective strut length are given below. The effective length of a strut is defined in BS 5975 table K1.

When using the rocking head the load is axial in one plane, but dependant upon site accuracy for the degree of eccentricity in the other plane. In the following graphs the permissible loads are given allowing for eccentricity due to assembly tolerance and a load eccentricity of 10mm, 25mm and 38mm.

A load restriction of 100kN is placed on the soldier when the load is to be released through the Slimshor jack. Where the load is not to be released through jacks, the maximum allowable load can be increased to 150kN.