17 WADHAM GARDENS, NW3
LONDON

STRUCTURAL ENGINEER'S
CONSTRUCTION METHOD STATEMENT

INDEX

P2 - 2015-10-06 - Includes
- Temporary and permanent piling remarks (item 2)
- Sequence for rear wall drawing (appendix A)
- Design of underpins (appendix B)
- Design of props to rear wall (appendix B)
- Pile design notes (appendix B)

Prepared by	Issued
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1.0 INTRODUCTION

1.1 Axiom Structures Limited have been asked to provide construction method statement, sequence of construction works and temporary works details surrounding the proposed basement extension and refurbishment works at the address.

1.2 The proposed development comprises construction of a new retrofit basement under the existing building and part of the front and rear gardens, general refurbishment works to the existing structure in line with GPAD Architects and Pringuer-James Consulting Engineers proposals.

1.3 A ground investigation survey, Basement Impact Assessment and associated ground movement analysis were carried out by specialist ground investigation companies. Refer to reports by other for details.

1.4 Permanent structural engineering proposals are as per Pringuer-James Consulting Engineers drawings and details.

1.5 We have visited site to assess the existing structure for alteration works. The finishes are generally stripped out and the existing structure is exposed.

1.6 The borehole site investigation was carried out in February 2015 by Soil Consultants Ltd. The borehole confirmed London CLAY with 'undisturbed' stiff clays from 3.5m below ground level and becoming very stiff CLAY with further depth.

1.7 Following Soil Consultants field investigations, the ground water was recorded as an inflow at the interface of the made ground and the underlying impermeable London Clay at about 1.1m.

1.8 As part of our walk round and visual investigation survey of the property, we have not recorded signs of ongoing or historical movement to suggest any subsidence or other foundation problems in existing and adjacent properties. There are a few hedges, trees and other vegetations in the rear garden.

2.0 DETAILS OF PROPOSED CONSTRUCTION

2.1 The proposed development involves the construction of the basement with swimming pool under footprint of existing house and part of front and rear gardens. Generally the excavation is to be up to about 3.5m below existing ground floor level.

Ground Water

2.2 The record information indicated the ground water as an inflow from the surface at depth of 1m below ground level and sits just above the level of stiff clays and above formation level of the basement. Obstruction of below ground water courses is not considered an issue with this development as the site is not within the line or close to underground rivers, refer to BIA for further details.

2.3 During construction of underpins, the ground water will be controlled using mechanical pumps and close placed sheets as necessary. When the perimeter underpins and piling are completed than we would expect that as built underpins would stop ground water ingress to the excavation. We consider that some residual perch ground water would be pumped out from temporary sump chambers.

Drainage

2.4 The subterranean development is to extend to the rear and front garden, whilst the existing drainage system will require upgrading or replacement possibly with the addition of pumps, the development will not impact on any public drainage or existing surface water drainage systems.

Construction Method to Minimise Risk of Movement and Damage to Adjacent Structures

2.5 The existing walls and new perimeter basement walls are to be constructed in short sections in hit and miss sequencing. The existing structure is to be back propped to unload the excavation as necessary. The actual process of underpinning can cause some minor cracking in the wall being underpinned and intersecting walls, although if carried out in accordance with the specification and back-propped on completion to minimise the risk of horizontal movement, such movement normally goes undetected.

2.6 The permanent structural proposals as detailed by Pringuer-James Consulting Engineers will involve the construction of reinforced concrete walls in short sections. New reinforced concrete walls will be monolithically connected to the new reinforced concrete basement slab to provide robust and watertight construction. The underpinning will be constructed in a hit and miss sequence to minimise ground movements. The new basement is a naturally rigid structure and will be designed to accommodate the horizontal ground forces imposed via the underpins to the perimeter, potential for upwards and lateral water pressures as well as the vertical loads from above. This has been explained in more details by Pringuer-James Consulting Engineers Basement Impact Assessment and drawings.

2.7 Neighbouring houses at 15 and 19 Wadham Gardens surcharge the excavation and increased lateral pressure is considered in prop and shores calculations. Multi-stage vertical underpinning is to be adopted along this boundary lines as per details in Appendix A. Additional horizontal shores maybe required to minimise risk of localised movement in the adjacent structure during excavation. Depth of basements and foundations in the adjacent sites is to be confirmed as part of the next stage of the project and Party Walls agreements.

2.8 Contiguous piled wall in the front garden is to be propped at head at all times during construction and in permanent case to minimise horizontal ground movements.

Temporary and Permanent Piling

2.9 Structural Engineers proposal includes basement wall to be formed with embedded and propped contiguous piles in the front garden. These piles are to be propped by capping beam at ground floor and basement levels and are to be embedded in stiff clays below formation of the basement.

2.10 During construction, the piles are to be designed as embedded in soil below basement formation level and propped by the capping beams at ground level. Horizontal shores to the capping beams are proposed to provide stiff system and minimise deflection at head of piles. As the piled ground beams are to be constructed before bulk excavation commences, the piles are to perform as propped at all times.

2.11 The specialist piling subcontractor is to be employed to design and construct piles as standard practice. Based on similar projects and ground conditions, there should not be an issue to achieve proposed depths of basement using conventional mini- or medium size piling rigs.

3.0 METHOD STATEMENT

This method statement is to be read in conjunction with Pringuer-James Consulting Engineers structural drawings and Axiom sequence of construction 15011 / TW / sketches and drawings.

It may be that we adjust this proposal in certain areas to accommodate what may be found, as the building work progresses. For ease of understanding the work sequence is as follows (reproduced for TW-200):

<u>SUPERSTRUCTURE AND ENABLING WORKS:</u>

1. Soft strip out and install timber cross braces to all windows and doors that are to be retained (at all floor levels).

2. Install high level 1st floor beams in the kitchen and support chimney stack of existing external and main internal walls.
- prop existing structure over in conventional needle and super props manner. Props to be supported on solid existing slab via timber sleeper spreaders, place back props in the cellar and strut props with scaffold tubes and fittings. Refer to TW-201 for details.

3. Install permanent restraint strapping to first floor structure to restrain all walls that are to be retained.

4. Break existing ground floor slab, level and prepare area for temporary piling in the middle of the house and permanent piling to front garden.

5. Install horizontal cross props in the existing cellar as per plan A.

6. Install temporary piles inside the house and permanent in the front garden as noted on SE plans.

7. Install enabling full drive (basement formation level) deep underpins to critical locations where noted (EW).
- Leave individual pin to cure for at least 48h before excavation for adjacent pin commences.
- Excavate in fully shored shafts as per 'shaft shoring table'.
- Allow to prop structure over on long spreader needles and support on solid slab/bases away from shaft excavation (front elevation).
- Back prop adjacent door openings to unload excavated area.

8. Install enabling needles and props from temporary piles and enabling works underpins (EW) to open up the space at ground floor. Place needles at underside of 1st floor as per plan B.
- High level needles and props are to be braced with scaffold tubes.

<u>- Existing cellar notes = keep horizontal cross props and vertical RMD at all times.</u>

<u>BASEMENT CONSTRUCTION:</u>

<u>First level dig</u>
9. 1st stage underpinning = 2no first stage u/pins and 1no to formation level as per plan.

- Works to be carried out in shaft excavation in 1.0m sections, 1 to 5 'hit and miss' sequence as per SE drawings.
- 1st stage pins to be about 2.5m depth
- Provide temporary toe as per section

9.1 Install trench sheeting, struts and walings as excavation proceeds in small shafts. Refer to 'shoring table' for details.
9.2 Cast RC base and stem in sections to suit concrete profile.
9.3 Dry pack between existing wall and concrete.
9.4 Individual pins to be back-propped with Acrows jacks on completion. Shafts to be protected from falling into, refer to 'shoring construction notes' for details

10. Prop remaining structure at ground floor level
- Install remaining needles and props at ground floor level onto as built piles and prepare area for bulk excavation.

11. Reduce central earth mount to about 1.8m below external ground level and as work progresses from rear of the property to front (towards skip or grab lorry) install WB01 & TW01 in localised excavation trenches to maintain sliding resistance as follows:

11.1 WB01 walling beams in currently excavated and propped trenches and then install TW01 cross props in localised transverse trenches to maintain sliding stability at all times.

11.2 Permanent ground floor beams as per plan TW-100

11.3 Install shores against piled ground beams at the front and against rear RC walls or cast permanent slabs to be agreed with the contractor.

11.4 Batter back ground towards front and rear garden to safe angle of repose.

- Ensure that all connections are fully tied.

- Mega shores / mild steel universal columns cross props to be mechanically or hydraulically tightened (via base jacks or similar) to ensure no movement.

12. Reduce ground level to about 500mm above formation of 1st stage u/pins and create berm.

13. Carry out 2nd stage underpinning in similar manner as 1st stage u/pins (item 9).

- Works to be carried out in shaft excavation in 1.0m sections, 1 to 5 'hit and miss' sequence as per SE drawings.
- 2nd stage pins to be driven to formation level of main basement
- provide permanent = temporary toe as per se drawings

13.1 Install trench sheeting, struts and walings as excavation proceeds in small shafts. refer to 'shoring table' for details.

13.2 Cast RC base and stem in sections to suit concrete profile

13.3 Cast concrete in 'letter box' to ensure that air pockets are not left along width of concrete thickness between existing wall and concrete.

13.4 Individual pins to be back-propped with Acrows jacks on completion. shafts to be protected from falling into, refer to 'shoring construction notes' for details.

<u>Second level dig (to formation)</u>

14. Reduce central earth mount to basement formation level and as work progresses from rear of the property to front (towards skip or grab lorry) install WB02 & TW02 in localised excavations to maintain sliding resistance temporary works as follows:

14.1 WB02 walling beams in currently excavated and propped trenches and then install TW02 cross props in localised transverse trenches to maintain sliding stability at all times.

14.2 Batter back ground under rear and front garden as necessary or reduce down to formation level.

- Ensure that all connections are fully tied

- Mega shores waling beams and cross props to be mechanically or hydraulically tightened to ensure no movement.

15. Reduce ground level to basement formation level.

16. Blind the ground at formation level and control short term heave effects. Cast raft slab.

- Leave starter bars to sub-basement (pool) walls and raft slab to achieve full tension laps.

Sub-basement and Pool Construction

17. Install 3rd stage u/pins to pool area in sequence as item 9.

- Back prop individual pins on completion.

18. Install RMD S/slim cross props at 1.5m crs. in localised excavations to maintain sliding resistance at all times.

19. Reduce central earth mount and blind the ground at formation level.

20. Cast remaining sections of sub-basement rafts, foundation bases and walls.

21. Remove low level of propping about 14 days after basement rafts were cast. Subject to SE approval.

Remaining Basement Construction Works

22. Erect steel columns and remaining ground floor beams under existing walls, cast ground floor slabs. When these are in place remove temporary basement shores, break temporary piles and make good all temporary works holes.

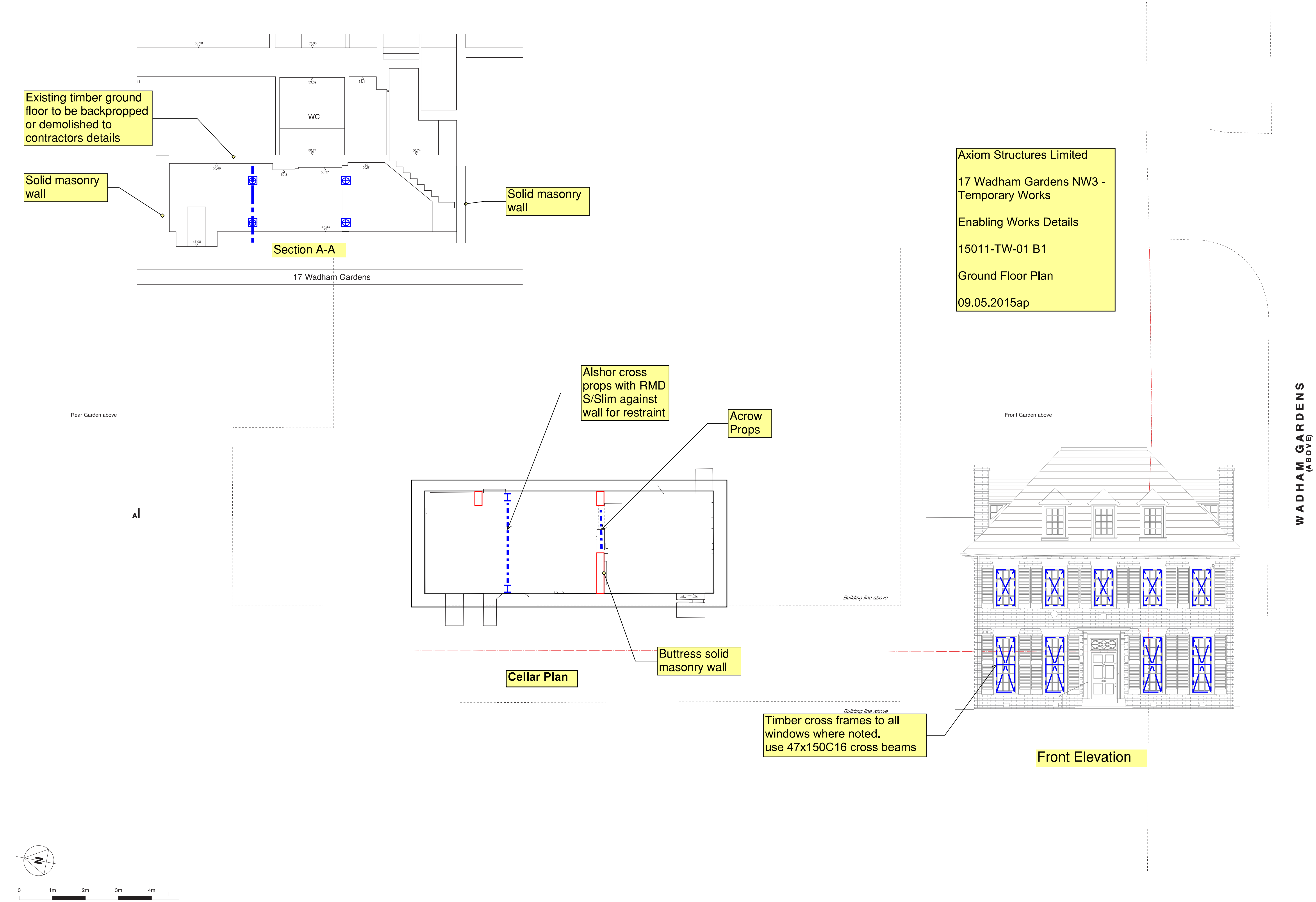
Remaining Superstructure Works

23. Install remaining 1st floor structure, support the existing structure over in conventional needle and props matters to builders details. allow for back-propping ground floor off basement raft.

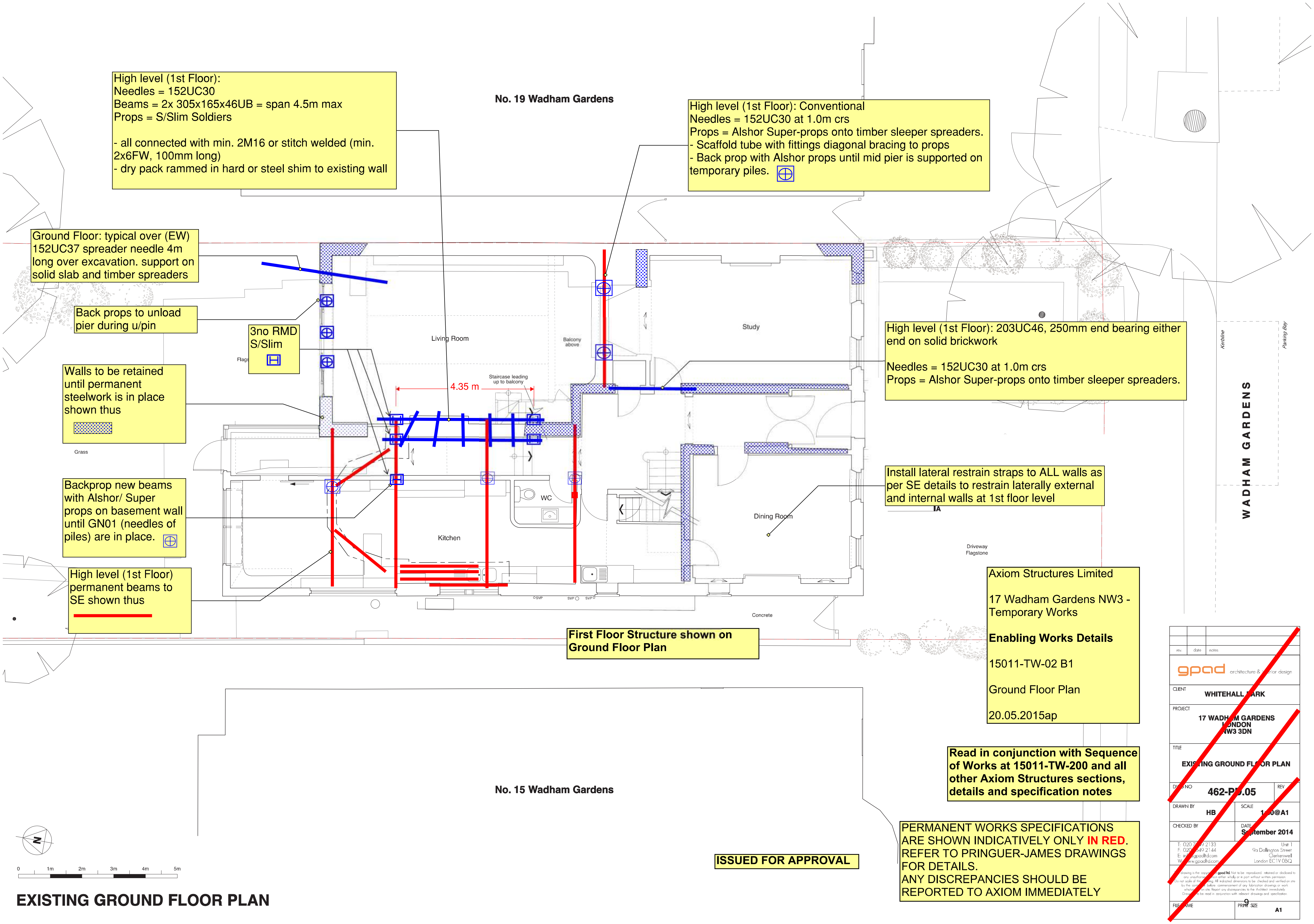
APPENDIX A

SEQUENCE OF BASEMENT CONSTRUCTION SKETCHES, DRAWINGS AND BASEMENT TEMPORARY WORKS

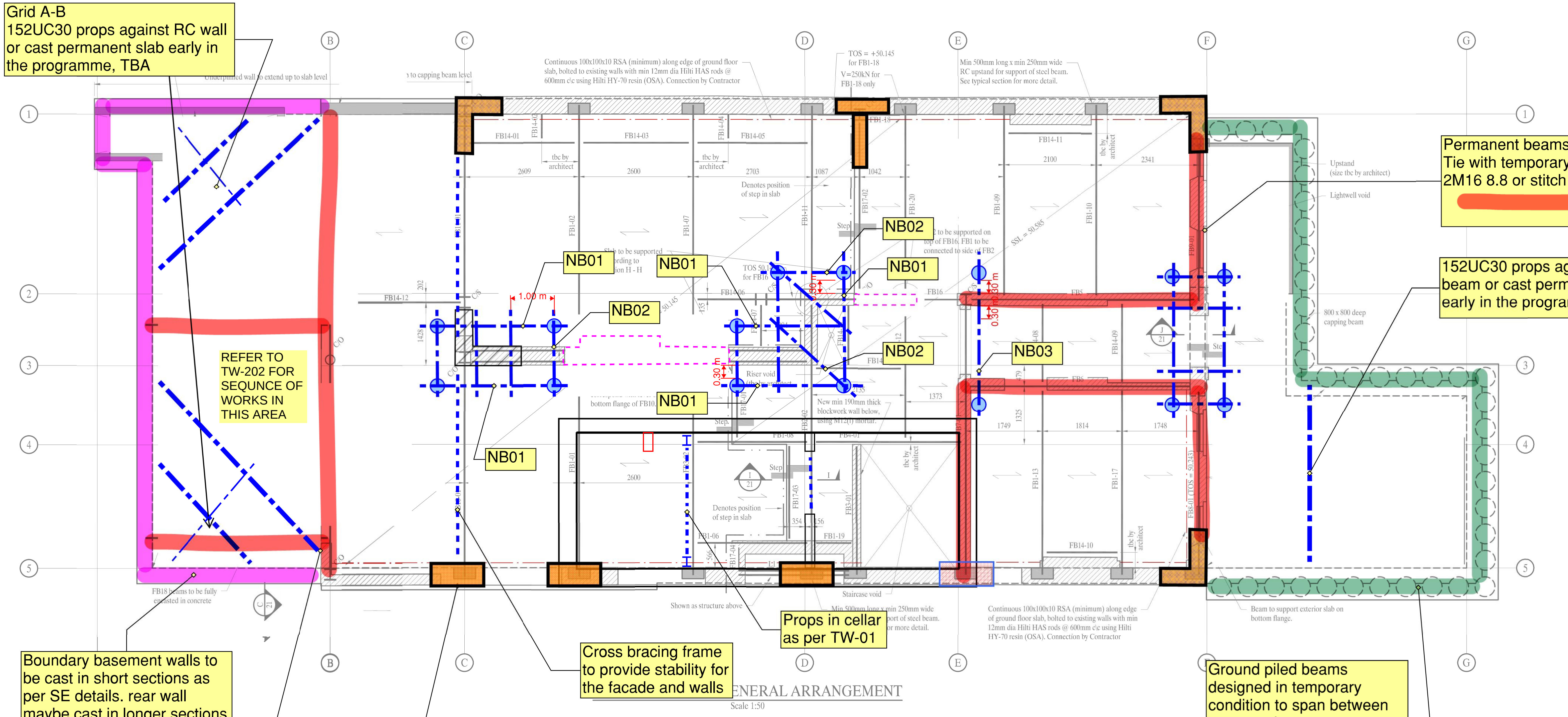
15011 TW



EXISTING BASEMEN



High level (1st Floor):
Needles = 152UC30
Beams = 2x 305x165x46UB = span 4.5m max
Props = S/Slim Soldiers
- all connected with min. 2M16 or stitch welded (min. 2x6FW, 100mm long)
- dry pack rammed in hard or steel shim to existing wall
No. 19 Wadham Gardens
High level (1st Floor): Conventional
Needles = 152UC30 at 1.0m crs
Props = Alshor Super-props onto timber sleeper spreaders.
- Scaffold tube with fittings diagonal bracing to props
- Back prop with Alshor props until mid pier is supported on temporary piles.
Ground Floor: typical over (EW) 152UC37 spreader needle 4m long over excavation. support on solid slab and timber spreaders
Back props to unload pier during u/pin
3no RMD S/Slim
Living Room
Balcony above
Study
Staircase leading up to balcony
4.35 m
High level (1st Floor): 203UC46, 250mm end bearing either end on solid brickwork
Needles = 152UC30 at 1.0m crs
Props = Alshor Super-props onto timber sleeper spreaders.
Walls to be retained until permanent steelwork is in place shown thus
Grass
WADHAM GARDENS
Kerbline
Parking Bay
Install lateral restrain straps to ALL walls as per SE details to restrain laterally external and internal walls at 1st floor level
Backprop new beams with Alshor/ Super props on basement wall until GN01 (needles of piles) are in place.
WC
Kitchen
Dining Room
Driveway Flagstone
High level (1st Floor) permanent beams to SE shown thus
Concrete
Axiom Structures Limited
17 Wadham Gardens NW3 - Temporary Works
Enabling Works Details
15011-TW-02 B1
Ground Floor Plan
20.05.2015ap
First Floor Structure shown on Ground Floor Plan
Read in conjunction with Sequence of Works at 15011-TW-200 and all other Axiom Structures sections, details and specification notes
No. 15 Wadham Gardens
PERMANENT WORKS SPECIFICATIONS ARE SHOWN INDICATIVELY ONLY IN RED.
REFER TO PRINGUER-JAMES DRAWINGS FOR DETAILS.
ANY DISCREPANCIES SHOULD BE REPORTED TO AXIOM IMMEDIATELY
ISSUED FOR APPROVAL
0 1m 2m 3m 4m 5m
N
EXISTING GROUND FLOOR PLAN
gpad architecture & interior design
CLIENT WHITEHALL PARK
PROJECT 17 WADHAM GARDENS LONDON NW3 3DN
TITLE EXISTING GROUND FLOOR PLAN
DWG NO 462-PD.05
DRAWN BY HB
SCALE 1:50@A1
DATE September 2014
9
PRINT SIZE A1



Permanent beams to act as props

		(kN)	SPLICE MOMENT (kNm)	END MOMENT (kNm)	GRADE	Comments
FB1	203 x 203 UC 46	100	-	-	S355	-
FB2	610 x 229 UB 125	900	-	-	S355	-
FB3	203 x 203 UC 60	250	-	-	S355	-
[illegible]	[illegible]	[illegible]	[illegible]	-	S355	-
[illegible]	[illegible]	[illegible]	[illegible]	-	S355	-
[illegible]	[illegible]	[illegible]	[illegible]	-	S355	-
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[illegible]	[illegible]	[illegible]	[illegible]	-	S355	-
FB14	152 x 152 UC 37	30	-	-	S355	-
FB15	610 x 228 UB 101	700	-	-	S355	-
FB16	305 x 305 UC 283	1150	-	-	S355	-
FB17	457 x 152 UB 52	100	-	-	S355	-

(All loads are factored ultimate limit state)
(All steelwork to have min 1 hour fire protection - details by architect)

(EW) - Enabling works underpins in critical locations. Cast to basement formation level (4m deep).

- back prop existing structure adjacent to shaft excavation to unload underpinned pier.

B1	150mm x 650mm DP RC upstand beam (depth to be confirmed by architect)
	150mm DP concrete on Comflor 60 x 1.2 deck, using C25/30 concrete and reinforced with a single layer of A193 mesh (30mm cover)
	250mm DP flat slab, using C32/40 concrete
C/S	Column stops
C/O	Column over
	Existing load bearing masonry walls
	Proposed RC concrete
	Continuous 100x100x10 RSA (minimum) along edge of ground floor slab, bolted to existing walls with min 12mm dia Hilti HAS rods @ 600mm c\c using Hilti HY-70 resin (OSA). Connection by Contractor

Note:
All concrete to be grade 32/40, unless noted otherwise.

Note:
All connections of steel beams connected directly to columns to be designed for a design tensile force of 75kN, without applying any other forces.

Lintel Schedule

Lintel number	Type	Comment
L1	1 No. box 140 & 1 No. box 200 IG lintel	Box 200 lintel to have additional bottom plate and to be positioned towards exterior with bottom plate pointing towards exterior (both to be propped during installation)

ISSUED FOR APPROVAL

Read in conjunction with Sequence of Works at 15011-TW-200 and all other Axiom Structures sections, details and specification notes

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REFER TO PRINGUER-JAMES DRAWINGS FOR DETAILS.
ANY DISCREPANCIES SHOULD BE REPORTED TO AXIOM IMMEDIATELY

Axiom Structures Limited

17 Wadham Gardens NW3 - Temporary Works

Temporary Works Details

15011-TW-100 B2

Ground Floor Plan

18.08.2015ap

Notes :

1 General
All Structural Engineering drawings are to be read with the specification and with all relevant Architects drawings and specifications.

Do not scale from any Structural Engineers drawing. All dimensions are in millimetres and levels in metres.

All waterproofing (DPM & DPC) works to Architects details.

All fire protection works to Architects details unless specifically noted otherwise.

Abbreviations:
...nished floor level
...lumn Capped
...r Approved

...llation and maintenance ...ength and stability of the ...wings and calculations ...the Engineer for

The existing structural information shown on these drawings is based on visual inspection of the building and upon limited opening up works. All details of the existing construction are subject to confirmation by the

...S EN 10025. (UNO)

...s 2 (EXC2). It is highly recommend that the Steel Contractor(s) / Fabricator(s) appointed for the project are members of the BCSA. Otherwise, the Main Contractor or Client should complete the detailed design for those elements shown on the design drawings and produce co-ordinated drawings showing all connection details etc.

The steelwork fabricator shall produce and submit two copies of dimensioned fabrication drawings to the Engineer for comment. The Engineer requires ten working days to return and comment.

All bolted connections are to include a minimum of two M16 bolts per member unless specifically indicated otherwise on details. All connection details to be designed by Contractor.

All bolts are to be grade 8.8 sheradized to BS 4921, class1. All bolts, nuts and washers are to be to BS 5950: Part 2 clause 2.2. Washers are to be placed beneath rotated item.

All welds to be minimum 6mm leg length continuous fillet welds unless specifically noted otherwise.

All steelwork coatings to be as specification and below. Coatings to be provided by Sherwin Williams Protective & Marine Coatings or similar approved. All coatings to be light grey in colour; red oxide is NOT to be used.

LOCATION	CATEGORY	PAINT SYSTEM
Internal damp/cavities	C2 - Low	C400V3 Exoxy Zinc Phosphate coating (125 microns DFT) - Functional
Internal dry	C1 - Very Low	C400V3 Exoxy Zinc Phosphate coating (75 microns DFT) - Functional
External	C4 - High	Galvanized in accordance with BS EN ISO 1461 to achieve a minimum mean coating thickness of 140 microns

3 Concrete
Concrete to be in accordance with BS EN 206-1 and as follows :
Blinding - C16/20
Mass concrete - C25/30
Reinforced concrete - C32/40

4 Masonry
All loadbearing blockwork to have a minimum characteristic strength of 7.3N/mm². All loadbearing brickwork is to have a minimum characteristic strength of 20N/mm².

5 Timber
All timber members to be grade C16 to BS EN 1995 unless noted otherwise. Timber to be pressure impregnated with preservative and cut ends brush treated.

6 Padstones
All padstones to be concrete, min grade C20/25 using max 20 mm aggregate. All steel beams supported on padstones to bolted to padstones with min 2 No. Hilti M10 HAS rod with HY 200 resin. (O.S.A.)

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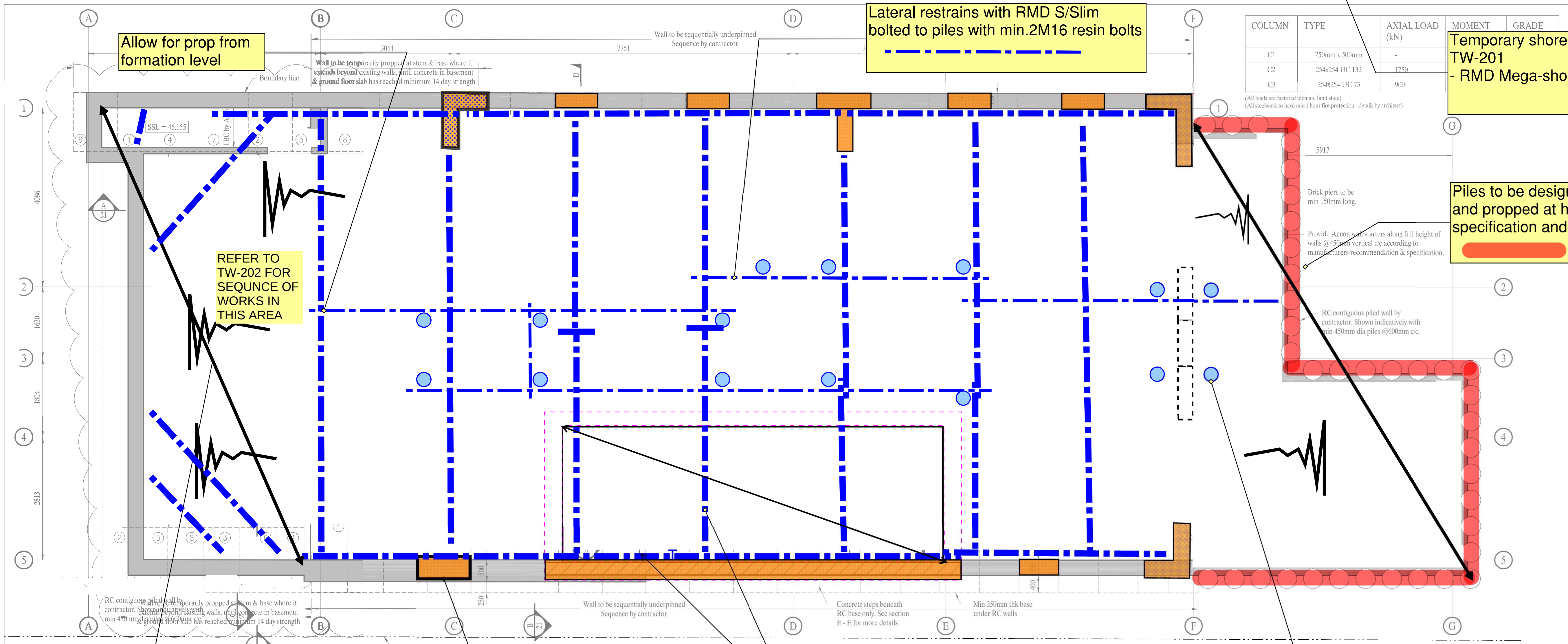
WHITEHALL PARK

17 WADHAM GARDENS
LONDON NW3 3DN

GA OF GROUND FLOOR



Batter back ground to safe angle of repose. consider Top down construction at front and rear.

(EW) - Enabling works underpins in critical locations. Cast to basement formation level (4m deep).

- back prop existing structure adjacent to shaft excavation to unload underpined pier.

Temporary cross shores as per sections TW-201 = TW01 & TW02
- RMD Mega-shore system or 203UC

Temporary Bearing Piles to be designed by piling contractor as embeded in earth and restrained at head. Refer to TW-200 for specification and loading conditon.
- settlement to be limited to 5mm under full load

PILING GENERAL NOTES:

TYPICAL CONTIGUOUS PILE WALL LOADINGS

Read in conjunction with Sequence of Works at 15011-TW-200 and all other Axiom Structures sections, details and specification notes

PERMANENT WORKS SPECIFICATIONS ARE SHOWN INDICATIVELY ONLY IN RED. REFER TO PRINGUER-JAMES DRAWINGS FOR DETAILS.
ANY DISCREPANCIES SHOULD BE REPORTED TO AXIOM IMMEDIATELY

ISSUED FOR APPROVAL

Axiom Structures Limited

17 Wadham Gardens NW3 - Temporary Works

Temporary Works Details

15011-TW-101 B2

Basement Shores

18.08.2015ap

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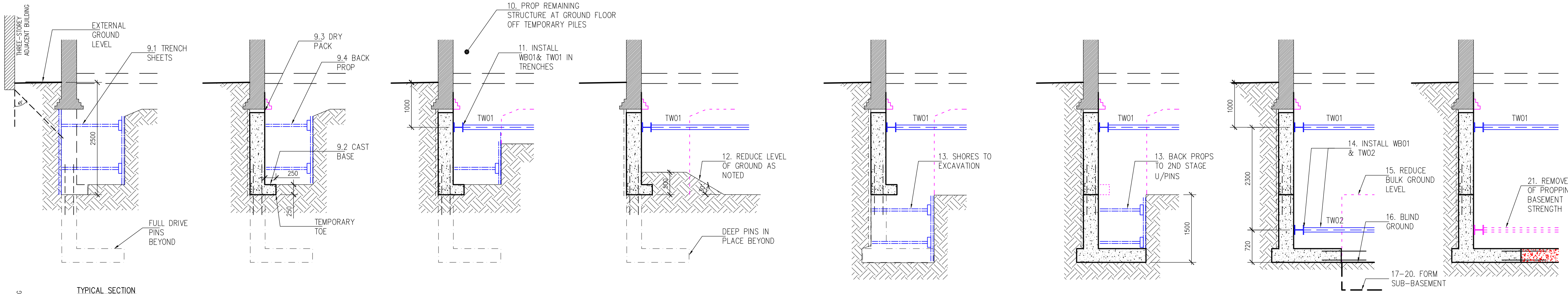
WHITEHALL PARK

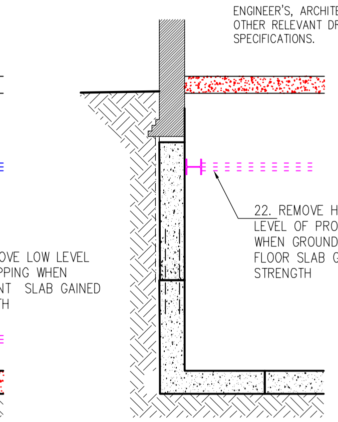
17 WADHAM GARDENS
LONDON NW3 3DN

GA OF BASEMENT

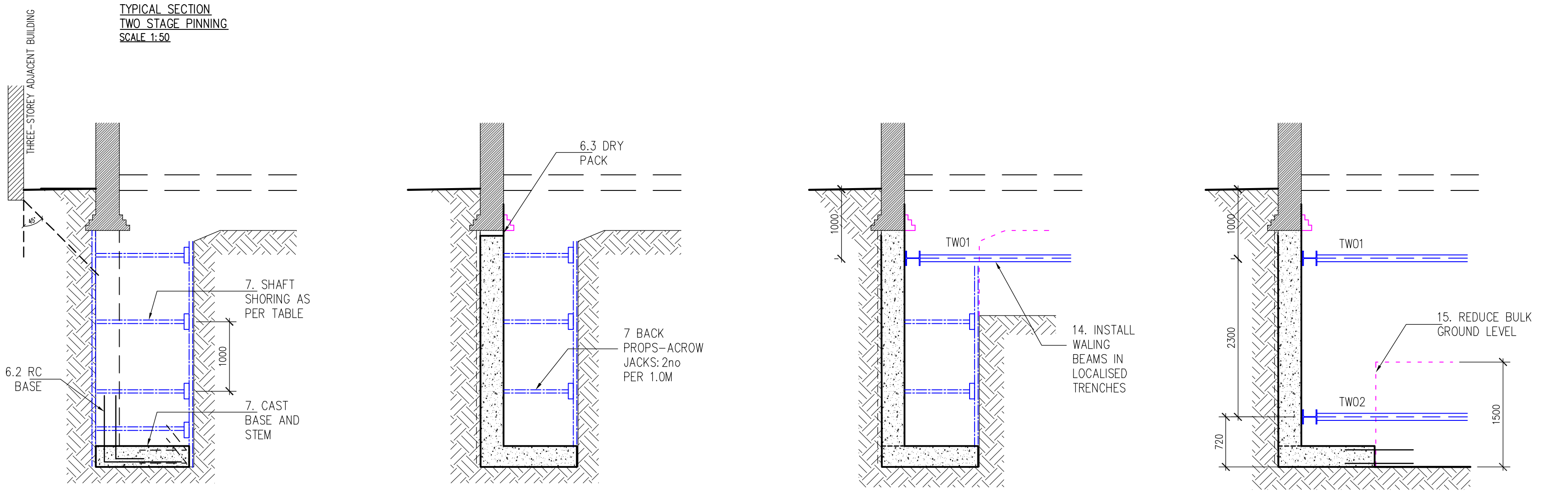
IF IN DOUBT PLEASE ASK

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.





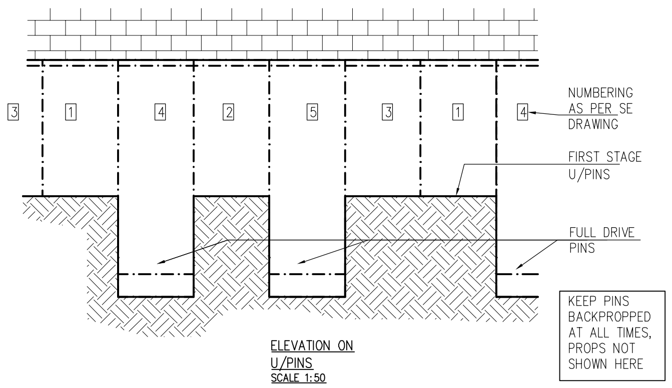
TYPICAL SECTION
TWO STAGE PINNING
SCALE 1:50



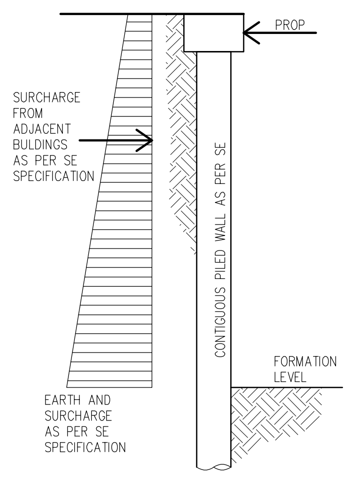
TYPICAL SECTION
FULL DRIVE PIN
SCALE 1:50

TW02 WILL BE INSTALLED BEFORE THE FINAL 1.5M OF EXCAVATION, (IN LOCALISED TRANSVERSE TRENCHES), TO MAINTAIN RESISTANCE TO RETAINING WALL SLIDING IN TEMPORARY STATE

TW01 AND TW02 PROPS HAVE SCREW JACKS TO PRE-LOAD THE PROPS AND THEY ARE TO BE PERIODICALLY CHECKED BY THE CONTRACTOR AND RE-TIGHTEDED AS NECESSARY.



ELEVATION ON U/PINS
SCALE 1:50



TEMPORARY PILES DESIGN CASE WITH INCREASED HEIGHT AND PROPPED BY TEMPORARY PROPS AT HEAD

PILE DESIGN IS SUBJECT TO TEMPORARY WORKS ENGINEER REVIEW AND COMMENT BEFORE WORKS ARE COMMENCED ON SITE

PILING SPECIFICATION NOTES (TEMPORARY WORKS):

1. READ IN CONJUNCTION WITH SE SPECIFICATION AND ICE GUIDANCE.
2. SE = PROJECT STRUCURAL ENGINEER.
3. FACTOR OF SAFETY FOR ALL TEMPOARY PILES = 2.6
4. IGNORE TOP 5m CLAY IN PILE DESIGN (DEPTH OF BASEMENT).
5. COHESION VALUES TO BE TAKEN FROM GROUND INVESTIGATIONS, REFER TO SE INFORMATION FOR DETAILS.
6. PILE DIAMETERS TO SUIT SPECIALIST CONTRACTOR DESIGN, ALLOW FOR 350 DIA MM OR TO SUIT PERMANET WORKS REQUIREMENTS.
7. PILE LOAD = 250KN – (UNFACTORED LOAD). PILES SHALL BE DESIGNED BY THE PILING SPECIALIST IN ACCORDANCE WITH THE REQUIREMENTS OF THE PROJECT SPECIFICATION AND ASSOCIATED DOCUMENTS USING RECOGNIZED EMPIRICAL FORMULA AND THE SATISFACTION OF THE CHECKING AUTHORITY.
8. SETTING OUT OF TEMPORARY PILES IS AS PER TW–100 DRAWINGS.
9. ALL PILES TO BE DESIGNED FOR A LATERAL LOAD OF 15KN (SLS) AND BENDING FROM ECCENTRIC LOADS.
10. BOTTOMS OF ALL FOUNDATION EXCAVATIONS SHALL BE TRIMMED, LEVELED AND PROTECTED FROM INCLEMENT WEATHER.
11. BOTTOMS OF EXCAVATIONS TO RECEIVE REINFORCED CONCRETE, SHALL BE BLINDED WITH NOT LESS THAN 50MM OF DESIGNATED CONCRETE GEN1 TO BS8500–1 2005
12. FOUNDATION EXCAVATIONS AND THE SURROUNDING SITE SHALL BE KEPT FREE OF WATER
13. THE CONTRACTOR IS RESPONSIBLE AND LIABLE FOR ENSURING THE STABLITY OF THE WORKS AND SERVICES AT ALL STAGES OF CONSTRUCTION. UNLESS NOTED ON THE PROJECT DRAWINGS, WE HAVE NO KNOWLEDGE OF EXISTING UNDERGROUND SERVICES OR OBSTRUCTIONS. NOTE THAT THERE IS CELLAR ADJACENT AND PILING RIG WILL LOAD THIS AREA. PROVIDE NECESSARY HORIZONTAL SHORES AS PER TW–100 AND TO BUILDERS DETAILS.
14. PILE REINFORCEMENT TO BE TURNED INTO GROUND BEAMS CAGES AND LAPPED WITH TOP REINFORCEMENT AS SHOWN ON THE SE DRAWINGS.
15. PILE SUPPORTS HAVE BEEN DESIGNED ON A MAXIMUM DEVIATION POSITION OF 75MM. ANY PILES OUT OF POSITION GREATER THAN 75MM TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
16. ANY UNEXPECTED SITE CONDITIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY SO THE DESIGN CAN BE REVIEWED AND ALTERED IF NECESSARY.
17. INTEGRITY TESTING TO BE CARRIED OUT TO ALL PILES AS PER SE SPECIFICATION.
18. REDUNDANT PILES TO BE CUT BELOW FORMATION LEVEL AND 50mm OF COMPRESSIBLE MATERIAL IS TO BE PLACED ON TOP TO AVOID HARD SPOTS UNDER RAFT SLAB.
19. PILING MAT TO BE DESIGNED BY SPECIALIST PILING SUB-CONTRACTOR.

SHAFT SHORING DESIGN NOTES:
TRADA 1990
SUBJECT TO REVIEW OF GROUND CONDITIONS ON SITE
– TIMBER STRUTS = 2X50X150C24 AT MAX. 1.0M VERTICAL CRS, SPACING(HORIZ) = 1.2M
– TIMBER WALING = 225X75C24 AT MAX. 1.0M VERTICAL CRS
– 18MM THICK PLY-BOARD OR 225MM WIDE X 38MM THICK TIMBER BOARDS OR MGF TRENCH SHEETS INSTALLED AT CLOSE SHEETING TO THE FULL WIDTH OF THE 1.2M WIDE EXCAVATION.

SUPERSTRUCTURE AND ENABLING WORKS:

1. SOFT STRIP OUT AND INSTALL TIMBER CROSS BRACES TO ALL WINDOWS AND DOORS THAT ARE TO BE RETAINED (AT ALL FLOOR LEVELS).

2. INSTALL HIGH LEVEL 1ST FLOOR BEAMS IN THE KITCHEN AND SUPPORT CHIMNEY STACK OF EXISTING EXTERNAL AND MAIN INTERNAL WALLS.
– PROP EXISTING STRUCTURE OVER IN CONVENTIONAL NEEDLE AND SUPER PROPS MANNER. PROPS TO BE SUPPORTED ON SOLID EXISTING SLAB VIA TIMBER SLEEPER SPREADERS, PLACE BACK PROPS IN THE CELLAR AND STRUT PROPS WITH SCAFFOLD TUBES AND FITTINGS. REFER TO TW–201 FOR DETAILS.

3. INSTALL PERMANENT RESTRAINT STRAPPING TO FIRST FLOOR STRUCTURE TO RESTRAIN ALL WALLS THAT ARE TO BE RETAINED.

4. BREAK EXISTING GROUND FLOOR SLAB, LEVEL AND PREPARE AREA FOR TEMPORARY PILING IN THE MIDDLE OF THE HOUSE AND PERMANENT PILING TO FRONT GARDEN.

5. INSTALL HORIZONTAL CROSS PROPS IN THE EXISTING CELLAR AS PER PLAN A.

6. INSTALL TEMPORARY PILES INSIDE THE HOUSE AND PERMANENT IN THE FRONT GARDEN AS NOTED ON SE PLANS.

7. INSTALL ENABLING FULL DRIVE (BASEMENT FORMATION LEVEL) DEEP UNDERPINS TO CRITICAL LOCATIONS WHERE NOTED (EW).
– LEAVE INDIVIDUAL PIN TO CURE FOR AT LEAST 48H BEFORE EXCAVATION FOR ADJACENT PIN COMMENCES.
– EXCAVATE IN FULLY SHORED SHAFTS AS PER 'SHAFT SHORING TABLE'.
– ALLOW TO PROP STRUCTURE OVER ON LONG SPREADER NEEDLES AND SUPPORT ON SOLID SLAB/BASES AWAY FROM SHAFT EXCAVATION (FRONT ELEVATION).
– BACK PROP ADJACENT DOOR OPENINGS TO UNLOAD EXCAVATED AREA.

8. INSTALL ENABLING NEEDLES AND PROPS FROM TEMPORARY PILES AND ENABLING WORKS UNDERPINS (EW) TO OPEN UP THE SPACE AT GROUND FLOOR. PLACE NEEDLES AT UNDERSIDE OF 1ST FLOOR AS PER PLAN B.
– HIGH LEVEL NEEDLES AND PROPS ARE TO BE BRACED WITH SCAFFOLD TUBES.

– EXISTING CELLAR NOTES = KEEP HORIZONTAL CROSS PROPS AND VERTICAL RMD AT ALL TIMES.

SHORING CONSTRUCTION NOTES:

CHECKING REGIME
COMPETENT AND TRAINED CONTRACTOR'S SITE PERSONNEL TO CONDUCT REGULAR EXCAVATION INSPECTIONS. INSPECTIONS ARE RECORDED AND ANY SAFETY CONCERNS IMMEDIATELY REPORTED TO THE CONTRACTS MANAGER

SHORING
NO SACRIFICIAL TIMBER SHORING TO BE INSTALLED UNDER THE PARTY/BOUNDARY WALLS. SHOULD SHORING BE NECESSARY THEN USE MGF TRENCH SHEETS OR EQUIVALENT TO FORM CLOSE SHEETING AT REAR OF UNDERPINNING EXCAVATION

EDGE PROTECTION
EDGE PROTECTION MUST BE INSTALLED TO A MINIMUM HEIGHT OF 1M ABOVE EXISTING GROUND LEVEL

HAND RAILS TO BE AT SPACING NOT EXCEEDING 450MM

TOE BOARDS TO BE INSTALLED WITH A MINIMUM OF HEIGHT OF 150MM ABOVE EXISTING GROUND LEVEL.

BASEMENT CONSTRUCTION:

FIRST LEVEL DIG
9. 1ST STAGE UNDERPINNING = 2NO FIRST STAGE U/PINS AND 1NO TO FORMATION LEVEL AS PER PLAN.

– WORKS TO BE CARRIED OUT IN SHAFT EXCAVATION IN 1.0M SECTIONS, 1 TO 5 'HIT AND MISS' SEQUENCE AS PER SE DRAWINGS.
– 1ST STAGE PINS TO BE ABOUT 2.5M DEPTH
– PROVIDE TEMPORARY TOE AS PER SECTION

9.1 INSTALL TRENCH SHEETING, STRUTS AND WALINGS AS EXCAVATION PROCEEDS IN SMALL SHAFTS. REFER TO 'SHORING TABLE' FOR DETAILS.
9.2 CAST RC BASE AND STEM IN SECTIONS TO SUIT CONCRETE PROFILE.
9.3 DRY PACK BETWEEN EXISTING WALL AND CONCRETE.
9.4 INDIVIDUAL PINS TO BE BACK-PROPPED WITH ACROWS JACKS ON COMPLETION. SHAFTS TO BE PROTECTED FROM FALLING INTO, REFER TO 'SHORING CONSTRUCTION NOTES' FOR DETAILS

10. PROP REMAINING STRUCTURE AT GROUND FLOOR LEVEL
– INSTALL REMAINING NEEDLES AND PROPS AT GROUND FLOOR LEVEL ONTO AS BUILT PILES AND PREPARE AREA FOR BULK EXCAVATION.

11. REDUCE CENTRAL EARTH MOUNT TO ABOUT 1.8M BELOW EXTERNAL GROUND LEVEL AND AS WORK PROGRESSES FROM REAR OF THE PROPERTY TO FRONT (TOWARDS SKIP OR GRAB LORRY) INSTALL WB01 & TW01 IN LOCALISED EXCAVATION TRENCHES TO MAINTAIN SLIDING RESISTANCE AS FOLLOWS:

11.1 WB01 WALLING BEAMS IN CURRENTLY EXCAVATED AND PROPPED TRENCHES AND THEN INSTALL TW01 CROSS PROPS IN LOCALISED TRANSVERSE TRENCHES TO MAINTAIN SLIDING STABILITY AT ALL TIMES.

11.2 PERMANENT GROUND FLOOR BEAMS AS PER PLAN TW–100

11.3 INSTALL SHORES AGAINST PILED GROUND BEAMS AT THE FRONT AND AGAINST REAR RC WALLS OR CAST PERMANENT SLABS TO BE AGREED WITH THE CONTRACTOR.

11.4 BATTER BACK GROUND TOWARDS FRONT AND REAR GARDEN TO SAFE ANGLE OF REPOSE.

– ENSURE THAT ALL CONNECTIONS ARE FULLY TIED.

– MEGA SHORES / MILD STEEL UNIVERSAL COLUMNS CROSS PROPS TO BE MECHANICALLY OR HYDRAULICALLY TIGHTENED (VIA BASE JACKS OR SIMILAR) TO ENSURE NO MOVEMENT.

12. REDUCE GROUND LEVEL TO ABOUT 500MM ABOVE FORMATION OF 1ST STAGE U/PINS AND CREATE BERM.

13. CARRY OUT 2ND STAGE UNDERPINNING IN SIMILAR MANNER AS 1ST STAGE U/PINS (ITEM 9).

– WORKS TO BE CARRIED OUT IN SHAFT EXCAVATION IN 1.0M SECTIONS, 1 TO 5 'HIT AND MISS' SEQUENCE AS PER SE DRAWINGS.
– 2ND STAGE PINS TO BE DRIVEN TO FORMATION LEVEL OF MAIN BASEMENT
– PROVIDE PERMANENT = TEMPORARY TOE AS PER SE DRAWINGS

13.1 INSTALL TRENCH SHEETING, STRUTS AND WALINGS AS EXCAVATION PROCEEDS IN SMALL SHAFTS. REFER TO 'SHORING TABLE' FOR DETAILS.

13.2 CAST RC BASE AND STEM IN SECTIONS TO SUIT CONCRETE PROFILE

13.3 CAST CONCRETE IN 'LETTER BOX' TO ENSURE THAT AIR POCKETS ARE NOT LEFT ALONG WIDTH OF CONCRETE THICKNESS BETWEEN EXISTING WALL AND CONCRETE.

13.4 INDIVIDUAL PINS TO BE BACK-PROPPED WITH ACROWS JACKS ON COMPLETION. SHAFTS TO BE PROTECTED FROM FALLING INTO, REFER TO 'SHORING CONSTRUCTION NOTES' FOR DETAILS.

SECOND LEVEL DIG (TO FORMATION)

14. REDUCE CENTRAL EARTH MOUNT TO BASEMENT FORMATION LEVEL AND AS WORK PROGRESSES FROM REAR OF THE PROPERTY TO FRONT (TOWARDS SKIP OR GRAB LORRY) INSTALL WB02 & TW02 IN LOCALISED EXCAVATIONS TO MAINTAIN SLIDING RESISTANCE TEMPORARY WORKS AS FOLLOWS:

14.1 WB02 WALLING BEAMS IN CURRENTLY EXCAVATED AND PROPPED TRENCHES AND THEN INSTALL TW02 CROSS PROPS IN LOCALISED TRANSVERSE TRENCHES TO MAINTAIN SLIDING STABILITY AT ALL TIMES.

14.2 BATTER BACK GROUND UNDER REAR AND FRONT GARDEN AS NECESSARY OR REDUCE DOWN TO FORMATION LEVEL.

– ENSURE THAT ALL CONNECTIONS ARE FULLY TIED

– MEGA SHORES WALING BEAMS AND CROSS PROPS TO BE MECHANICALLY OR HYDRAULICALLY TIGHTENED TO ENSURE NO MOVEMENT.

15. REDUCE GROUND LEVEL TO BASEMENT FORMATION LEVEL.

16. BLIND THE GROUND AT FORMATION LEVEL AND CONTROL SHORT TERM HEAVE EFFECTS. CAST RAFT SLAB.

– LEAVE STARTER BARS TO SUB-BASEMENT (POOL) WALLS AND RAFT SLAB TO ACHIEVE FULL TENSION LAPS.

SUB-BASEMENT AND POOL CONSTRUCTION

17. INSTALL 3RD STAGE U/PINS TO POOL AREA IN SEQUENCE AS ITEM 9.

– BACK PROP INDIVIDUAL PINS ON COMPLETION.

18. INSTALL RMD S/SLIM CROSS PROPS AT 1.5M CRS. IN LOCALISED EXCAVATIONS TO MAINTAIN SLIDING RESISTANCE AT ALL TIMES.

19. REDUCE CENTRAL EARTH MOUNT AND BLIND THE GROUND AT FORMATION LEVEL.

20. CAST REMAINING SECTIONS OF SUB-BASEMENT RAFTS, FOUNDATION BASES AND WALLS.

21. REMOVE LOW LEVEL OF PROPPING ABOUT 14 DAYS AFTER BASEMENT RAFTS WERE CAST. SUBJECT TO SE APPROVAL.

REMAINING BASEMENT CONSTRUCTION WORKS

22. ERECT STEEL COLUMNS AND REMAINING GROUND FLOOR BEAMS UNDER EXISTING WALLS, CAST GROUND FLOOR SLABS. WHEN THESE ARE IN PLACE REMOVE TEMPORARY BASEMENT SHORES, BREAK TEMPORARY PILES AND MAKE GOOD ALL TEMPORARY WORKS HOLES.

REMAINING SUPERSTRUCTURE WORKS

23. INSTALL REMAINING 1ST FLOOR STRUCTURE, SUPPORT THE EXISTING STRUCTURE OVER IN CONVENTIONAL NEEDLE AND PROPS MATTERS TO BUILDERS DETAILS. ALLOW FOR BACK-PROPPING GROUND FLOOR OFF BASEMENT RAFT.

TEMPORARY WORKS CO-ORDINATOR = KNOWLES BASEMENTS
PERMANENT WORKS ENGINEER = SE = PRINGUER JAMES CONSULTING ENGINEERS

Rev	Date	Amendment
B2	18/08/2015	ISSUED FOR COMMENT
B1	20/05/2015	ISSUED FOR COMMENT

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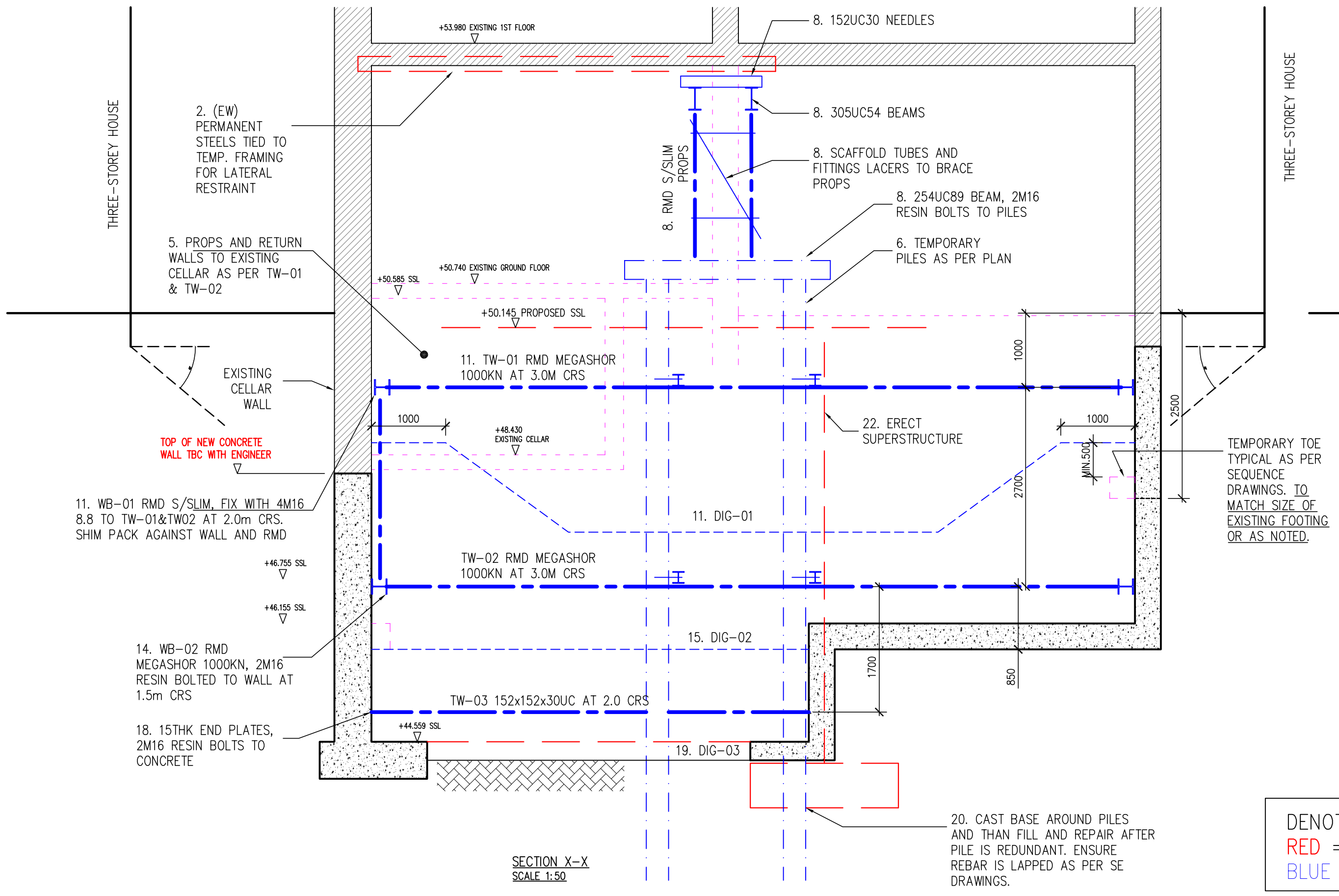
SITE
17 WADHAM GARDENS NW3

DRAWING TITLE
TEMPORARY WORKS SEQUENCE OF WORKS

DATE	SCALE
MAR '15	1:50 AT A1 1:100 AT A3
DRAWN	DRAWING STATUS
AP	FOR APPROVAL
DRAWING No.: 15011/TW/200	REV B2

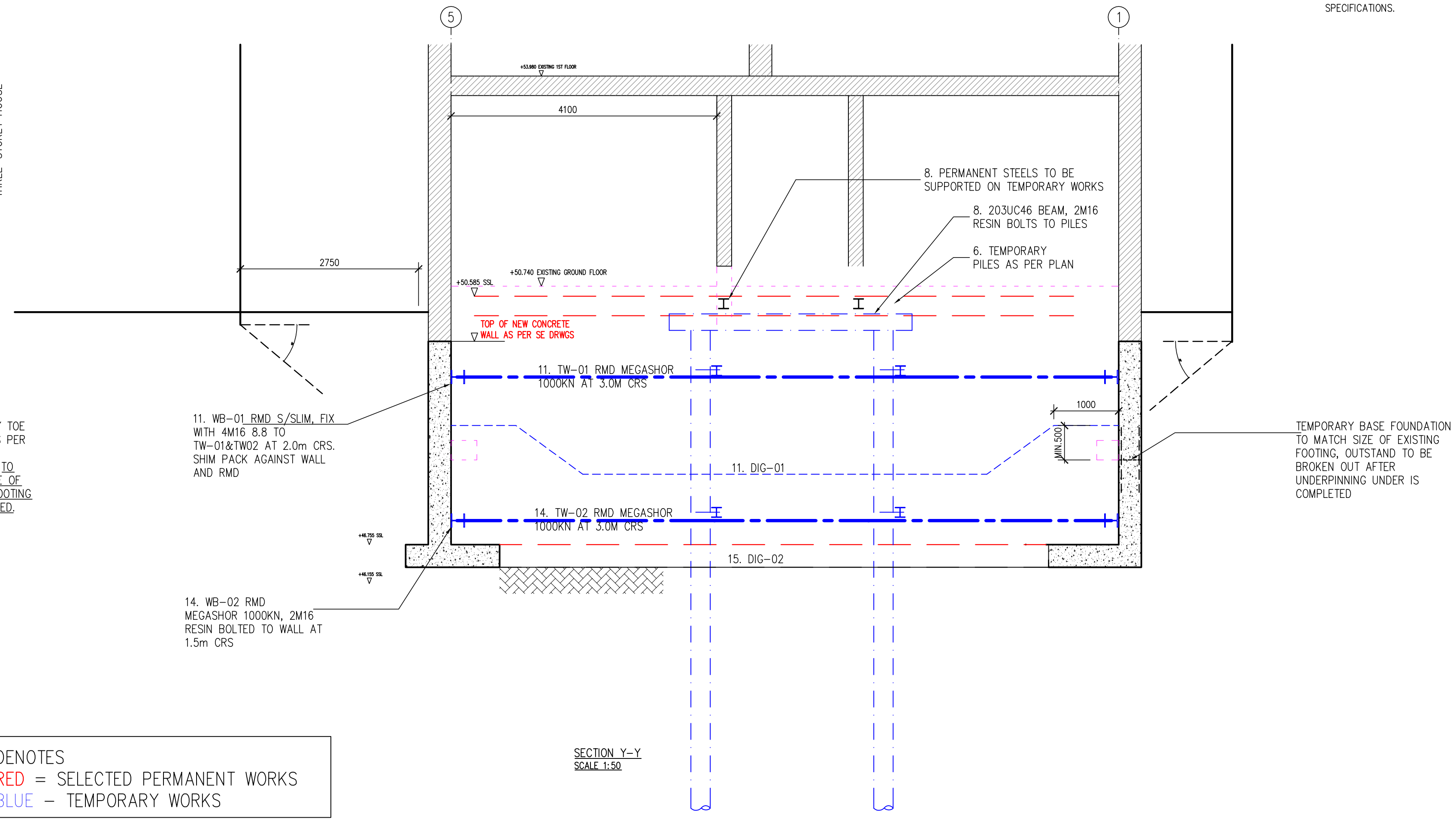
IF IN DOUBT PLEASE ASK

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.



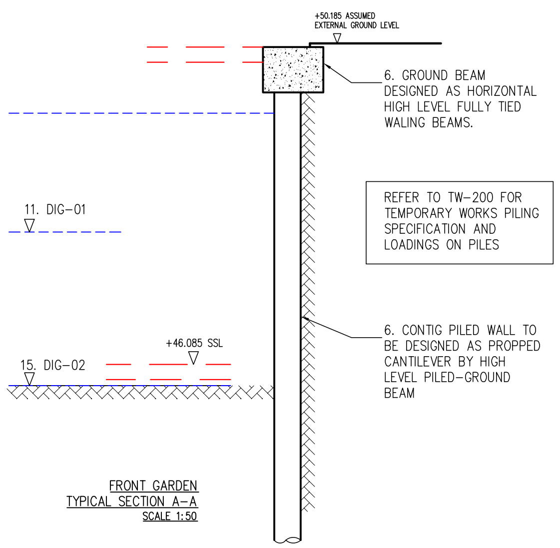
SECTION X-X
SCALE 1:50

DENOTES
RED = SELECTED PERMANENT WORKS
BLUE – TEMPORARY WORKS



SECTION Y-Y
SCALE 1:50

NOTE: ALTERNATIVE TO USE OF RMD MEGASHOR IS 203UC60 AND SUBJECT TO APPROVAL WITH TW ENGINEER BEFORE CONSTRUCTION



REFER TO TW-200 FOR TEMPORARY WORKS PILING SPECIFICATION AND LOADINGS ON PILES

FRONT GARDEN
TYPICAL SECTION A-A
SCALE 1:50

REFER TO TW-200 FOR PROPOSED SEQUENCE OF WORKS

TEMPORARY WORKS CO-ORDINATOR = KNOWLES BASEMENTS
PERMANENT WORKS ENGINEER = SE = PRINGUER JAMES CONSULTING ENGINEERS

Rev	Date	Amendment
B2	06/10/2015	ISSUED FOR COMMENT. TEMPORARY PIN SIZES ADDED
B1	20/05/2015	ISSUED FOR COMMENT

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SITE
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DRAWING TITLE
TEMPORARY WORKS

DATE: MAR '15	SCALE: 1:50 AT A1, 1:100 AT A3
DRAWN: AP	DRAWING STATUS: FOR APPROVAL
DRAWING No.: 15011/TW/201	REV: B2

IF IN DOUBT PLEASE ASK

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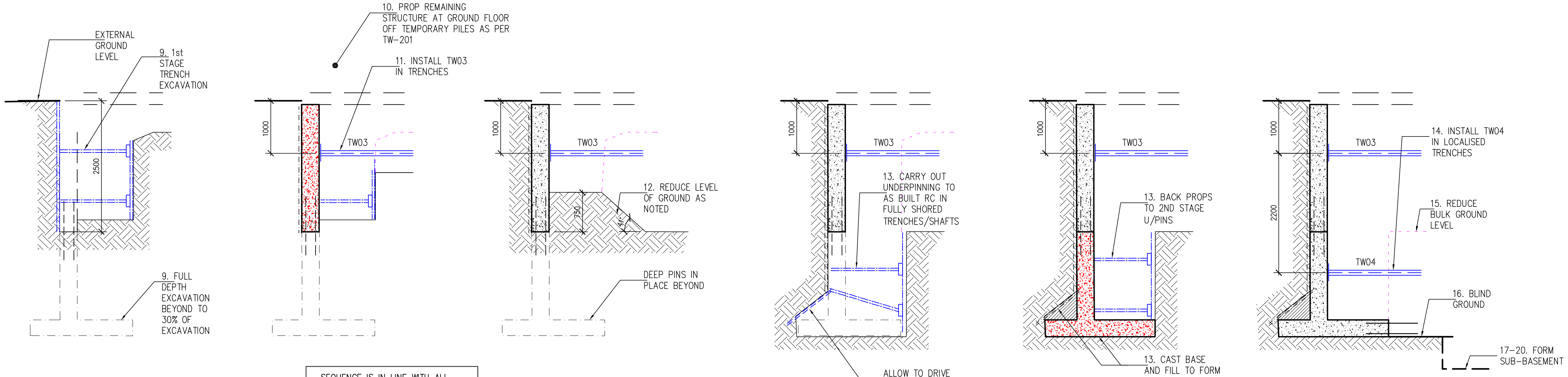
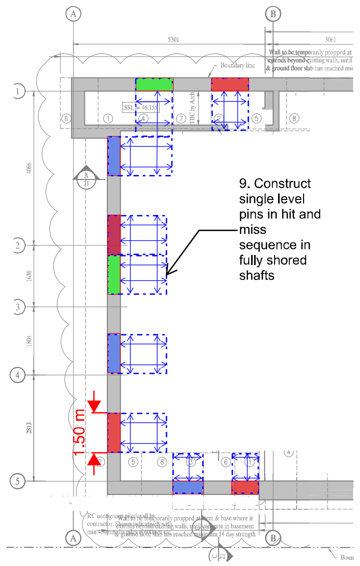
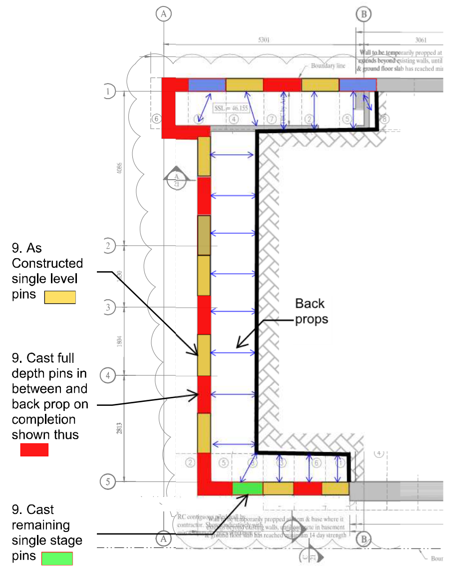


SEQUENCE IS IN LINE WITH ALL OTHER DRAWINGS AND GENERAL SEQUENCE OF WORKS INCLUDED IN TW-200

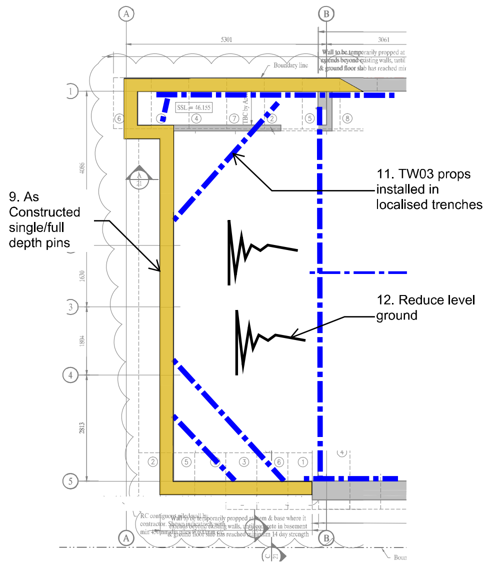
TYPICAL SECTION TWO STAGE BASEMENT WALL CONSTRUCTION IN REAR GARDEN
SCALE 1:50



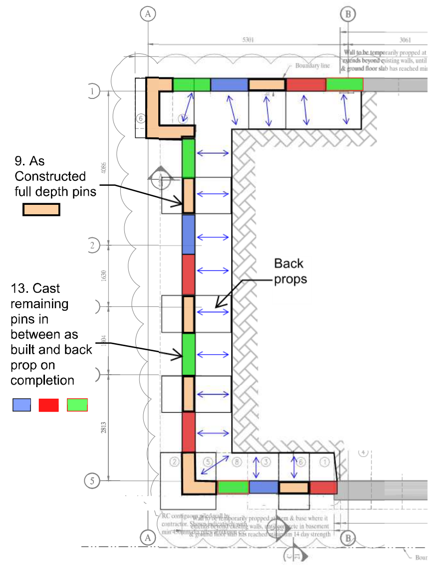
HIGH LEVEL REAR WALL PLAN



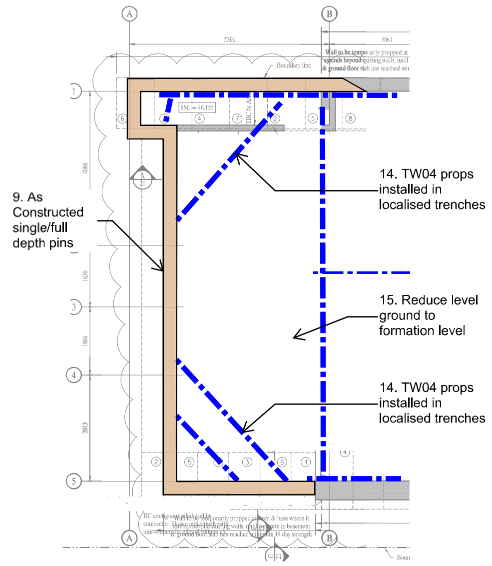
HIGH LEVEL REAR WALL PLAN



HIGH LEVEL REAR WALL PLAN



LOW LEVEL PROPS REAR WALL PLAN



LOW LEVEL PROPS REAR WALL PLAN

REFER TO TW-200 FOR PROPOSED SEQUENCE OF WORKS

TEMPORARY WORKS CO-ORDINATOR = KNOWLES BASEMENTS
PERMANENT WORKS ENGINEER = SE = PRINGUER JAMES CONSULTING ENGINEERS

Rev	Date	Amendment
B1	06/10/2015	ISSUED FOR COMMENT

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SITE
17 WADHAM GARDENS
NW3

DRAWING TITLE
TEMPORARY WORKS
REAR BASEMENT

DATE	SCALE
MAR '15	1:50 AT A1 1:100 AT A3
DRAWN AP	DRAWING STATUS FOR APPROVAL
DRAWING No. 15011/TW/202	REV B1

APPENDIX B

OUTLINE CALCULATIONS FOR TEMPORARY WORKS

15011 TW

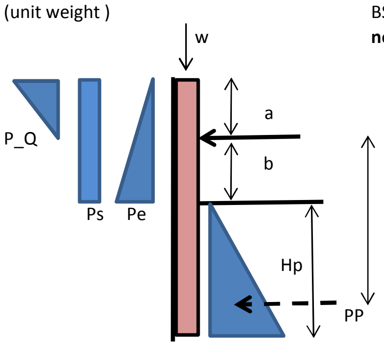
Introduction - Stage 1

The worst case surcharge/lateral loading is applied from boundary of 19 Wadham due to existing building
Stage 1 of underpinning with hit and miss full depth pins to resist sliding of the base
High Level Shores are to be either Mega Shores RMD or mild steel 203UC as noted below

Basement wall with surcharge from the adjacent building.

Temporary horizontal strut design (unit weight) BS8002
not critical

g = 18 kN/m3
fi = 20 degree
Ka = 0.5
a = 1 m
b = 1.5 m
H = 2.5 m
Hp = 1.5 m

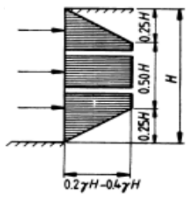


L = b+2/3Hp =
2.5 m

Active Pressures on Wall

Earth:
Pe at H = ka x g x H = 22.5 kN/m/m
Pe T = PeH x H x 0.5 = 28.1 kN/m BS8002: 1994

Surcharge
S = 2.5 kN/m2
Ps = S x ka = 1.25 kN/m/m
Ps T = Ps x H = 3.125 kN/m



d)

Stiff clay

Water:
not considered in temporary condition

For Tri Load = max. Pe + Ps 23.8 kN/m/m
Force = For Tri Load = max PeT + PsT 31.3 kN/m

Surcharge from point load - Empirical method by Terzaghi

QL = DL+IL 71 kN/m
Pn = QL x (Ka)^0.5 50.2 kN/m
A = 1.5 m
fi' = 20 degree
45+fi'/2 55 degree
Dtop = A*tg(fi') 0.55 m
D = A*tg(45+fi'/2)-Dtop = 1.60 m

pn = 2Pn / D = 63 kN/m/m

From Analysis RC pin design

Check bending of pins:
Muls max = u/pin span 13.5 kNm/m
not critical for 2m spacing between props
As prov min = B785, cover 50, 350thk = Mc = 90kNm / m ..... OK

Loads in struts:
From Analysis = Fa = 57 kN /m
Fb = 10 kN /m

Spacing of struts = **3 m**

Load to raking strut A at angle =	90	degree
R = Rake = Fa x Ls / cos(90-angle) =	**171**	**kN**
V =Upwards parallel to face = Fa x Ls x tan(90 - angle) =	0.0	kN

Check Sliding of U/pins

Load to strut B
Axial = Fb x Ls = 30 kN <== resisted by passive resistance

Passive force resistance =

Kp x red factor (1.0) =	2.04			
Hp =	1.5 m			
g =	18 kN/m3			
PP = 0.5 x g x Hp^2 x Kp =	41.3 kN/m/m	= P x 1width at 3m =	41.3 kN	

Resistance due to friction to soil from self-weigth of wall

Existing Wall Swt = 225thk wall x 6m (h) =	30 kN/m	(low value dead load of wall only, conservative)
350thk RC x 2m h =	17	
Fmin =	47 kN/m	

φ' = 20 Clay

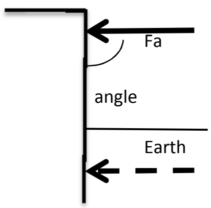
Base friction = Fmin x tan (2/3*20deg) =	11.1 kN / m	B x 3 width =	33 kN
		total =	75 kN

Sliding check = Factor of Safety FOS = R / Hb = 2.49
> 1.5 OK

Design of High Level Strut A = at 3m CRS

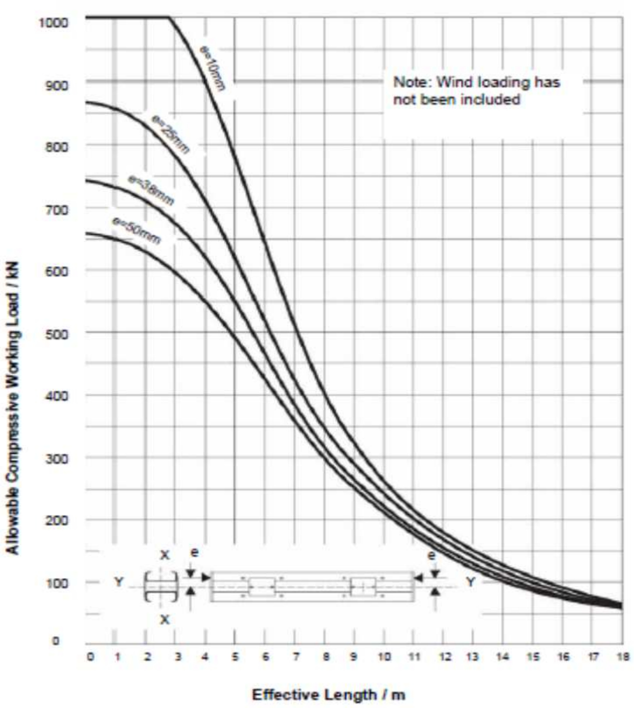
L effective =	6.0 m	
Fsls A =	205 Kn <= continous span of waling beam	
Fuls A =	308 kN	(γf = 1.5)

Lateral Restraint Strut A by Scaffold Tube - not required



MEGASHOR
1000kN SUPPORT SYSTEM

1.1.6.4. Horizontal Megashor (MK1 & MK2) Axial AWL YY Axis (Web vertical plane)



Pcx SWL = 400 kN
Pcy SWL = 400 kN for e=10mm, Le=5m (low level prop) > Fb = sls 205 kN OK 0.51

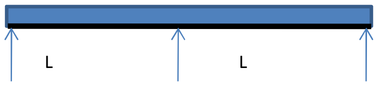
Use RMD MEGA SHORE Props at max 3m crs

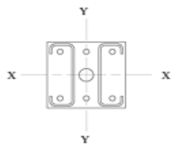
End RMD Jack Base = AWL = 450kN > Fb = sls 205 kN OK

Alternative Mild Steel Section = 203UC46

Pcy (Le=6) = 592 kN > > Fb = uls 308 kN OK 0.52

Check Walling beam
L = 3 m
w= sls = 57 kN/m
Msls = wl^2/9 57 kNm
Ixx req = 3524.31 cm4 use => RMD mega shor

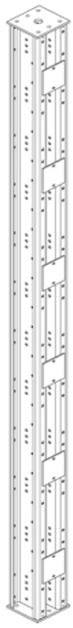




Area	58.45 cm^2
I xx	5981 cm^4
I yy	4289 cm^4
r xx	10.14 cm
r yy	8.56 cm
Z xx	443 cm^3
Z yy	306 cm^3
EI xx	12560 kNm^2
EI yy	5085 kNm^2
M max x	102 kNm
M max y	68 kNm
Shear max XX	450 kN
Mean compressive yield stress	370 N/mm^2
Self weight	0.542 kN/m run
Max Joint bending moment X-X axis	66 kNm (6 Bolt connection)
Max Joint bending moment Y-Y axis	52 kNm (6 Bolt connection)
Max Joint bending moment X-X axis	*44 kNm (4 Corner Bolt connection)*
Max Joint bending moment Y-Y axis	*35 kNm (4 Corner Bolt connection)*
Axial Shortening	8.14 x 10^{-4} mm/m/kN

All capacities are unfactored allowable loads, having a minimum factor of safety of 1.7 on yield and 2.0 on failure.

For higher load or stiffness requirements a small fleet of Megashor Plus Shafts are available.
Megashor Plus has a maximum axial load capacity of 1400kN.
For further details contact UK Head Technical Office.



Mawl = 102 kNm
Ixx = 5981 cm4
OK

deflection for continuous
defl = 3.4 mm
span/882 OK

Alternative is to use waling beam as fully tied underpinning together over 1.0m, horiz. H12 at 200crs NF+FF
= 5H12 at 200 crs = Mc uls = 210kNm / Mc sls = 140kNm

Alternative is to use 203UC60 =	Ixx =	6130 cm4	def=	3.32	mm
	Mb = L=3m =	169 kNm	M/Mb =	0.34	

Design Waling Beam = from Analysis = for 203UC46

Mmax uls = 1.4x62	86.8 kNm	Mb= Le=3m =	153 kNm	0.57	OK
Nmax uls = 1.4 x 208 =	291.2 kN	Pcx = Le=3m =	1930 kN	0.15	OK

Combined check = Mmax/Mb + Nmax / Pc = 0.72 < 1.0 OK

Vuls= 1.4 x 113 158.2 kN Pv = 312 kN

Ra = 194 kN /m
Rb = 208 kN /m

Load to raking strut B (Critical) at α = 45 degree
Axial = Fa x Ls / cos(angle) = 294.2 kN
Upwards parallel to face = Fa x Ls x tan(90 - angle) = 208.0 kN (critical)

Web bearing and buckling on struts - continuous support
Pw=C1+b1C2 = 655 kN OK
Px= K(C4Pw)^0.5 = 511.2 kN OK no stiffeners required > 295x1.4 = 412 kN

Deflection Check =
deflection = 3.6 mm L1/250 = 4.8 mm OK

Use 203UC60 to suit cross props and limit deflection to less than 3mm

conservatively stiffness of RC pins ignored in assessment.

Description:

Units: Consistent

Beam Properties:

X	EI	Disp	Rotation	V Spring	R Spring
0	71450				
1		0			
3.5		0			

Point Loads:

X	PLoad	Moment

Uniform Loads:

XStart	XEnd	UStart	UEnd
0	2.5	-2	-24
0.6	1.6	-63	0

Analysis Data:

Beam Length = 3.5
Number of Nodes = 205
Number of Elements = 204
Number of Degrees of Freedom = 410

Reactions:

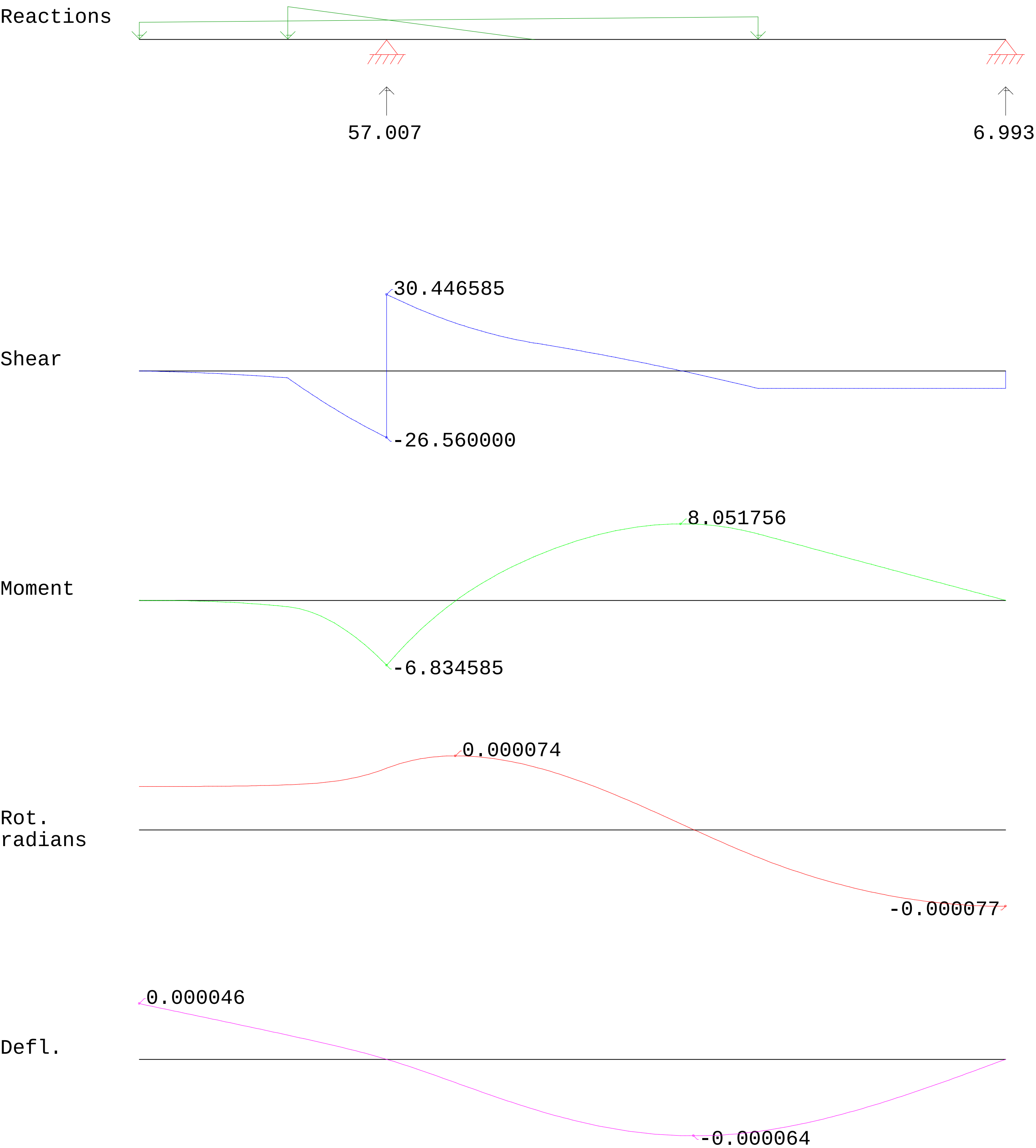
X	Vert	Rot
1.000000	57.007	
3.500	6.993	

Equilibrium:

	Force	Reaction	Diff
Vert	-64.000	64.000	0.000
Rot	81.483	-81.484	-0.000

Min & Max values:

```
Min Shear      =    -26.560 at    1.000000
Max Shear      =     30.447 at    1.000000
Min Moment     =     -6.835 at    1.000000
Max Moment     =      8.052 at       2.188
Min Rotation   = -7.65e-005 at       3.500
Max Rotation   = 7.401e-005 at       1.278
Min Deflection =-6.383e-005 at       2.240
Max Deflection = 4.644e-005 at           0
```


Reactions
57.007
6.993
Shear
30.446585
-26.560000
Moment
8.051756
-6.834585
Rot.
radians
0.000074
-0.000077
Defl.
0.000046
-0.000064

Introduction - Stage 2

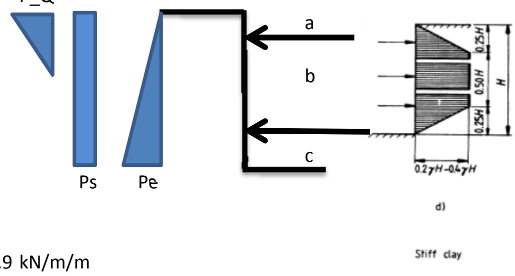
The worst case surcharge/lateral loading is applied from boundary of 19 Wadham Gardens
Stage 2 of underpinning is completed and high and low level props are in place
High Level Shores are to be either Mega Shores RMD or mild steel 203UC as noted below

Refer to MS TW-200 for sequence of works.

Basement wall with surcharge from the adjacent building.

Temporary horizontal strut design

g =	18	kN/m3	(unit weight)	BS8002
fi =	20	degree		**not critical**
Ka =	0.5			
a =	1	m		
b =	2.3	m		
c=	0.8	m		
H =	4.1	m		
0.25H =	1.03	m		



Active Pressure on Wall

Earth:

Pe at H =	ka x g x H =	36.9	kN/m/m	
Pe T =	PeH x H x 0.5 =	75.6	kN/m	BS8002: 1994

Surcharge

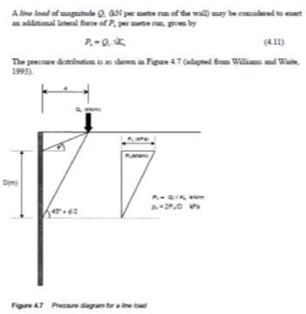
S =	2.5 kN/m2		
Ps =	S x ka =	1.25	kN/m/m
Ps T =	Ps x H =	5.125	kN/m
he =		0.07	m

Water:
not considered in temporary condition

For Tri Load = max. Pe + Ps	38.2	kN/m/m	(short term temporary works)
Force = For Tri Load = max PeT + PsT	80.8	kN/m	(long term temporary works)

Surcharge from point load - Empirical method by Terzaghi

QL = DL+IL	71	kN/m
Pn = QL x (Ka)^0.5	50.2	kN/m
A =	1.5	m
fi' =	20	degree
45+fi'/2	55	degree
Dtop = A*tg(fi')	0.55	m
D = A*tg(45+fi'/2)-Dtop =	1.60	m
pn = 2Pn / D =	63	kN/m/m

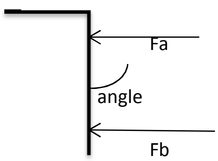


Ciria C580

Loads in struts:

From Analysis =	Fa =	56	kN /m
	Fb =	59	kN /m

Spacing of struts = 3 m



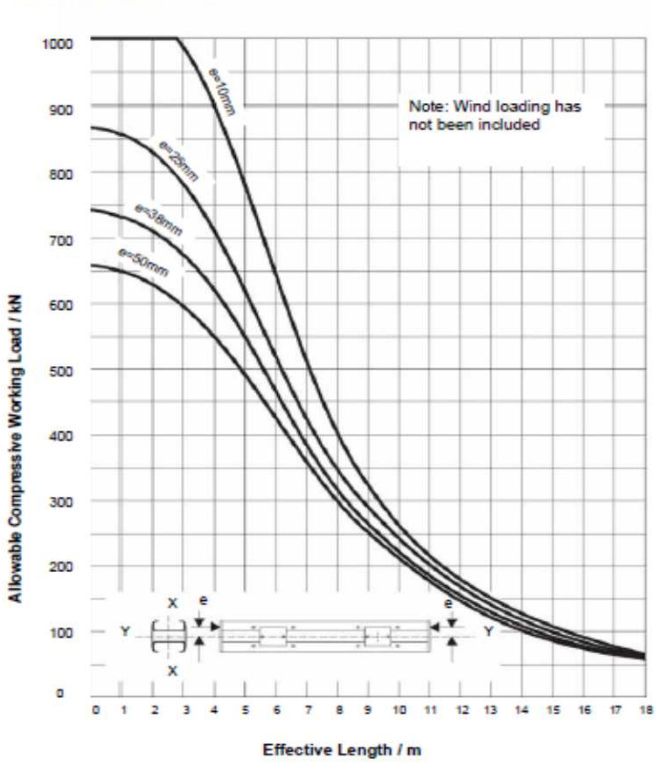
Load to raking strut A at angle = 90 degree
R = Rake = Fa x Ls / cos(90-angle) = 168.0 kN
V =Upwards parallel to face = Fa x Ls x tan(90 - angle) = 0.0 kN

Load to raking strut B
Axial = Fb x Ls = 177 kN

MEGASHOR

1000kN SUPPORT SYSTEM

1.1.6.4. Horizontal Megashor (MK1 & MK2) Axial AWL YY Axis (Web vertical plane)



Pcx SWL = 400 kN

Pcy SWL = 400 kN for e=10mm, Le=5m (low level prop > Fb = 168 kN OK 0.42

Use RMD MEGA SHORE Props at max 3m crs

End RMD Jack Base = AWL = 450kN > Fb = 168 kN OK

BY INSPECTION OF STAGE 1, WALING BEAMS ALTERNATIVES ARE 203UC60

Description:

Units: Consistent

Beam Properties:

X	EI	Disp	Rotation	V Spring	R Spring
0	71450				
1		0			
3.3		0			
4.1					

Point Loads:

X	PLoad	Moment

Uniform Loads:

XStart	XEnd	UStart	UEnd
0	4.1	-2	-38.2
0.6	1.6	-63	0

Analysis Data:

Beam Length = 4.1
Number of Nodes = 205
Number of Elements = 204
Number of Degrees of Freedom = 410

Reactions:

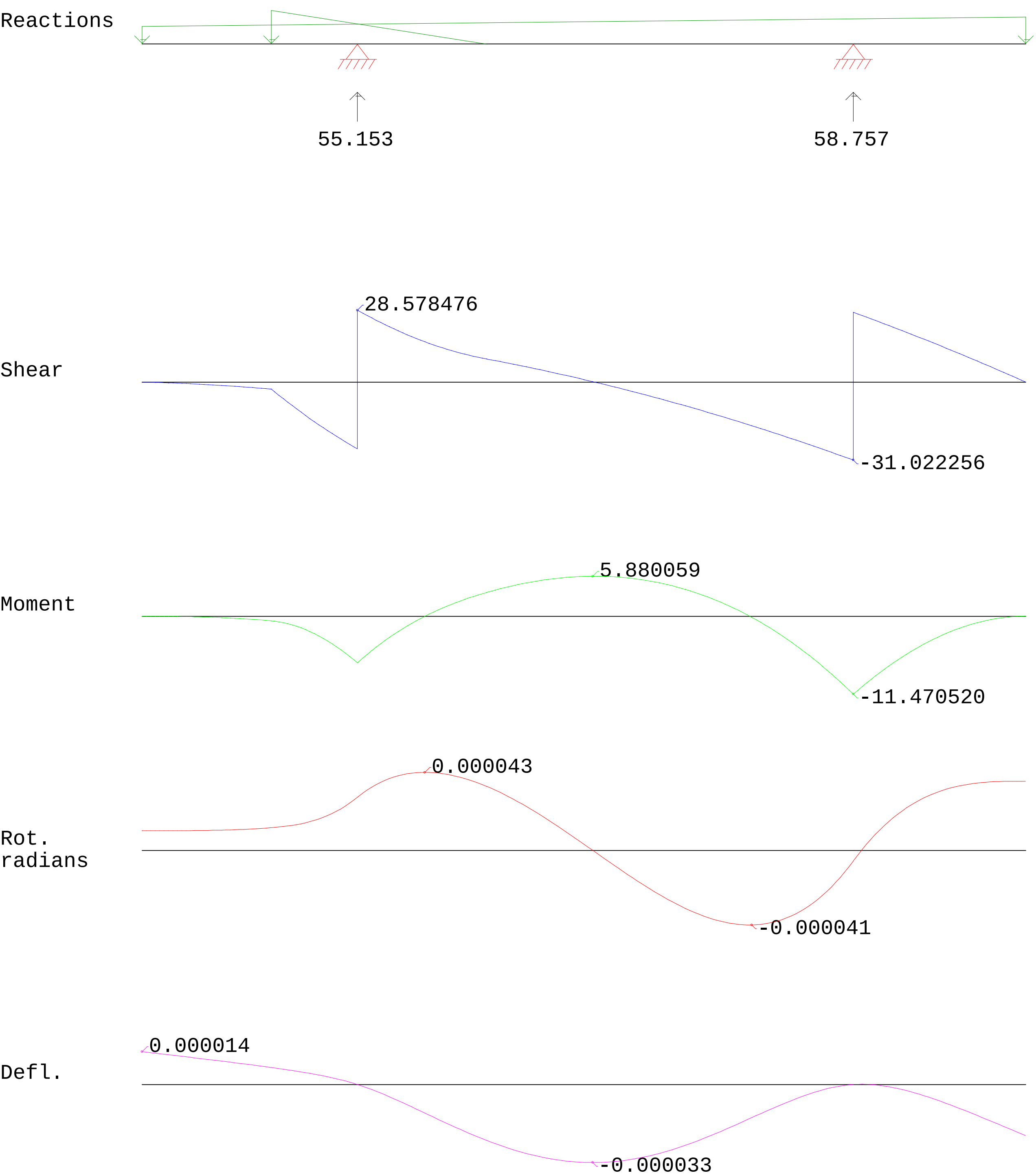
X	Vert	Rot
1.000000	55.153	
3.300	58.757	

Equilibrium:

	Force	Reaction	Diff
Vert	-113.910	113.910	0.000
Rot	249.051	-249.051	-0.000

Min & Max values:

```
Min Shear      =    -31.022 at       3.300
Max Shear      =     28.578 at    1.000000
Min Moment     =    -11.471 at       3.300
Max Moment     =      5.880 at       2.091
Min Rotation   =-4.062e-005 at       2.829
Max Rotation   = 4.252e-005 at       1.312
Min Deflection =-3.263e-005 at       2.091
Max Deflection = 1.376e-005 at           0
```



Reactions
55.153
58.757
Shear
28.578476
-31.022256
Moment
5.880059
-11.470520
Rot.
radians
0.000043
-0.000041
Defl.
0.000014
-0.000033

Introduction - Stage 3

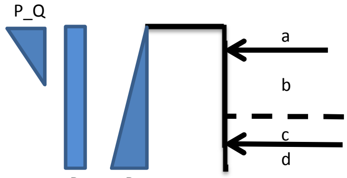
The worst case surcharge/lateral loading is applied from boundary of 19 Wadham due to existing building
Stage 2 of underpinning is completed and basement slab, high and low level props are in place
Sub basement shores are to be either Mega Shores RMD or mild steel 203UC as noted below

Refer to MS TW-200 for sequence of works.

Basement wall with surcharge from the adjacent building.

Temporary horizontal strut design

g =	18	kN/m3	(unit weight)	BS8002
fi =	20	degree		**not critical**
Ka =	0.5			
a =	1	m		
b =	3.7	m		
c=	0.7	m		
d=	0.7	m		
H =	6.1	m		
0.25H =	1.53	m		

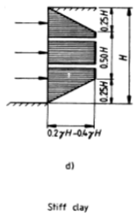


Active Pressure on Wall

Earth:

Pe at H =	ka x g x H =	54.9	kN/m/m
Pe T =	PeH x H x 0.5 =	167.4	kN/m

BS8002: 1994



Surcharge

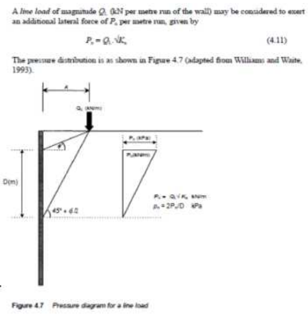
S =		2.5	kN/m2
Ps =	S x ka =	1.25	kN/m/m
Ps T =	Ps x H =	7.625	kN/m
he =		0.07	m

Water:
not considered in temporary condition

For Tri Load = max. Pe + Ps	56.2	kN/m/m	(short term temporary works)
Force = For Tri Load = max PeT + PsT	175.1	kN/m	(long term temporary works)

Surcharge from point load - Empirical method by Terzaghi

QL = DL+IL	71	kN/m
Pn = QL x (Ka)^0.5	50.2	kN/m
A =	1.5	m
fi' =	20	degree
45+fi'/2	55	degree
Dtop = A*tg(fi')	0.55	m
D = A*tg(45+fi'/2)-Dtop =	1.60	m
pn = 2Pn / D =	63	kN/m/m


A *line load* of magnitude Q_L (kN per metre run of the wall) may be considered to exert an additional lateral force of P_n per metre run, given by

$$P_n = Q_L \sqrt{K_a} \qquad (4.11)$$

The pressure distribution is as shown in Figure 4.7 (adapted from Williams and Waite, 1993).

Figure 4.7 Pressure diagram for a line load

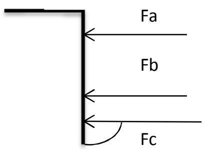
Check bending of pins:

Muls max = u/pin span 24 kNm/m
not critical for 2m spacing between props
As prov min = B785, cover 50, 350thk = Mc = 90kNm / m ….. OK

Loads in struts:

	Fa =	67	kN /m	<==mega shores as previously
From Analysis =	Fb =	97	kN /m	<==as constructed basement raft
	Fc =	46	kN /m	

Spacing of struts = 2 m



Load to raking strut C at angle = 90 degree
R = Rake = Fa x Ls / cos(90-angle) = 92.0 kN
V =Upwards parallel to face = Fa x Ls x tan(90 - angle) = 0.0 kN

Load to raking strut C

Axial = Fb x Ls =	92	kN
Axial = ULS =	138	kN
Ley =	6	m

Mild Steel Section = 152UC30

Pcy (Le=6) = 243 kN > > Fb = uls 138 kN OK 0.57

Description:

Units: Consistent

Beam Properties:

X	EI	Disp	Rotation	V Spring	R Spring
0	71450				
1		0			
3.7					
4.4		0			
5.4		0			
6.1					

Point Loads:

X	PLoad	Moment

Uniform Loads:

XStart	XEnd	UStart	UEnd
0	6.1	-2	-56.2
0.6	1.6	-63	0

Analysis Data:

Beam Length = 6.1
Number of Nodes = 207
Number of Elements = 206
Number of Degrees of Freedom = 414

Reactions:

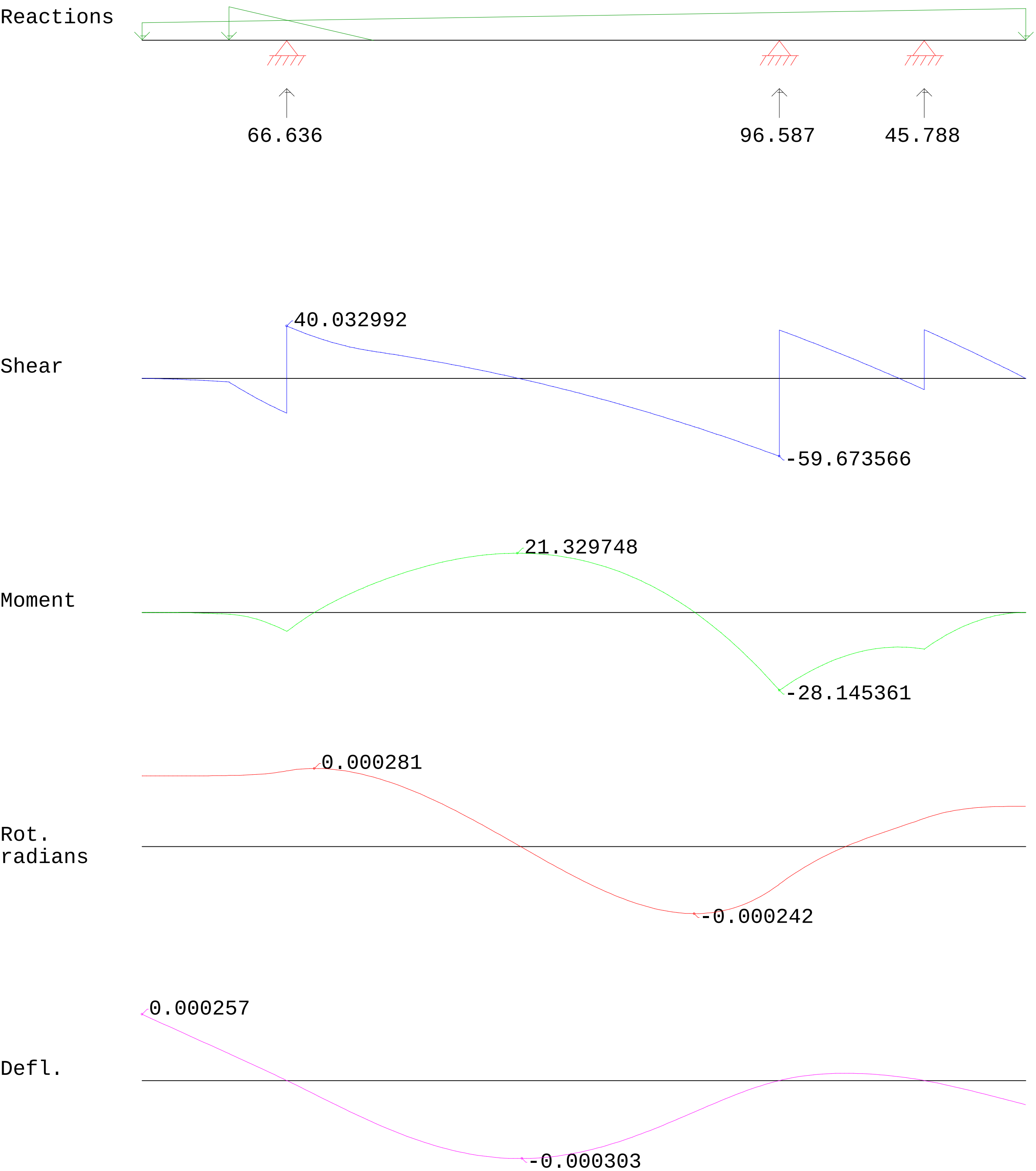
X	Vert	Rot
1.000000	66.636	
4.400	96.587	
5.400	45.788	

Equilibrium:

	Force	Reaction	Diff
Vert	-209.010	209.010	-0.000
Rot	738.871	-738.871	-0.000

Min & Max values:

Min Shear	=	-59.674	at	4.400
Max Shear	=	40.033	at	1.000000
Min Moment	=	-28.145	at	4.400
Max Moment	=	21.330	at	2.592
Min Rotation	=	-0.000242	at	3.812
Max Rotation	=	0.000281	at	1.189
Min Deflection	=	-0.0003029	at	2.623
Max Deflection	=	0.0003569	at	0

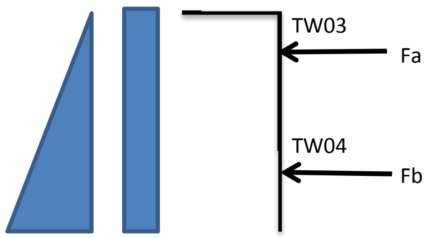

Reactions
66.636
96.587
45.788
Shear
40.032992
-59.673566
Moment
21.329748
-28.145361
Rot.
radians
0.000281
-0.000242
Defl.
0.000257
-0.000303

Introduction - REAR WALL

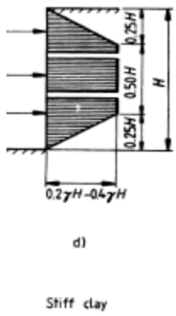
High and low level propping is required to retain rear wall until permanent structure is in place, refer to TW-202 for sequence of works

Temporary Struts to Rear Garden - Retaining Wall

g =	18	kN/m3	(unit weight)
fi =	20	degree	(Angle of internal friction)
Ka =	0.5		
a =	1	m	
b =	2.3	m	
c=	0.8	m	
H =	4.1	m	
0.25H =	1.03	m	



BS8002
not critical



Active Pressure on Wall

Earth:

Pe at H =	ka x g x H =	36.9	kN/m/m	
Pe T =	PeH x H x 0.5 =	75.6	kN/m	(conventional triangular shape)

Surcharge

S =	5		kN/m2	
Ps =	S x ka =	2.5	kN/m/m	
Ps T =	Ps x H =	10.3	kN/m	
he =		0.14	m	

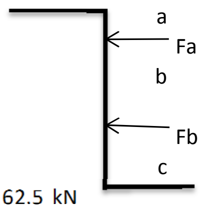
Water:
not considered in temporary condition

at 0	2.5	kN/m/m	
Pe+Ps at H=	39.4	kN/m/m	(short term temporary works)

Loads in line of struts:

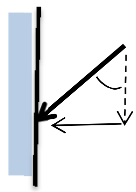
From Analysis =	Fa =	25	kN /m
	Fb =	63	kN /m

Spacing of struts = 2.5 m



Load to raking strut A at angle = 45 degree
Axial = Fa x Ls / cos(90-angle) = **88.4** kN
sideway to face = Fa x Ls x tan(90 - angle) = 62.5 kN

=== horizontal angle



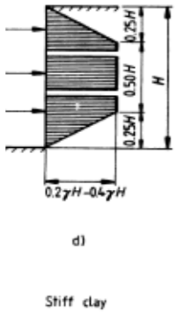
Load to raking strut B at angle = 45 degree
Axial = Fb x Ls / cos(90-angle) = **222.7** kN
sideway to face = Fb x Ls x tan(90 - angle) = 157.5 kN

Design of Cross Strut A = Worst Case High Level, apply to TW03

Apply a single prop at top

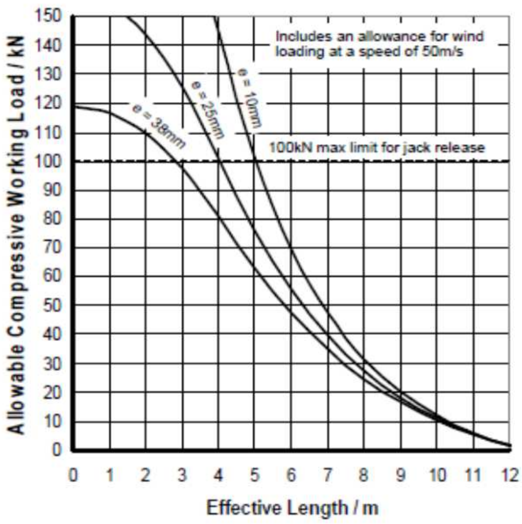
L effective = 5.0 m
Fsls A = 88 kN
Fuls A = 133 kN (γf = 1.5)

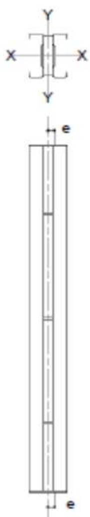
Load to struts BS 8002 when rectanural distribution:
0.4x(18)x2/3x (a+b)/2 x 4.1 x 2.5= 81.18 kN
similar but less than triang



Lateral Restraint Strut A by Scaffold Tube - not required

Extract from RMD S/Slim Buckling About the Y Axis





Pcx SWL = 150 kN
Pcy SWL = 100 kN for e=10mm, Le=4m (high lev. prop) > Fb = 88 kN OK 0.88

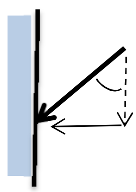
Use single RMD S/SLIM Soldier Props at max 2.5m crs top

End Pin and R Clip Connectors of RMD = AWL = 100kN > Fb = 88 kN OK

Alternative **Use 152x152x30UC S355**
Pcy = le=5m = 327 kN Fuls / Pcy = 0.41
Pv = 169 kN

Connection to face of wall = PER PROP, consider at angle 45 degree

Fh = from above 62.5 kN <=== per prop (γf = 1.5)
Fh = uls **93.8 kN** (γf = 1.5) (Critical Single Rake A)



Use 2M16 Resin Anchors = Rawl R-Kex , cmin=

cv > 300 = s = 150 = 0.92 fb_n = C40 = 1.1
Vrd c = 52.7 kN/ anchor
Vrd s = M16 8.8 = 58.9 kN / anchor

capacity for 2 anchors= 105.5 kN > Vuls 94 kN **Use 2M16 at 150crs / per prop**

Connect with RMD - S/Slim = prop end con => AWL = pin and R Clip = 100 kN > **62.5** kN.... OK

Note: Conservatively friction of end plate to rough concrete face not considered.

Bearing on concrete face = F_v / 0.1 x 0.1 = 9.375 N/mm2 < 40N/mm2 / 1.5 = 26N/mm2

Design of Cross Strut B = Worst Case Low Level, apply to TW04

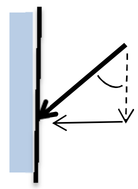
L effective =	5.0	m	
Fsls A =	223	kN	
Fuls A =	334	kN	(γf = 1.5)

Lateral Restraint Strut - not required

Use 203x203x46UC S355 at max 2.5m crs

Pcy = le=5m =	409	kN	Fuls / Pcy =	0.82
Pv =	241	kN		

Connection to face of wall = PER PROP, consider at angle 45 degree



Fh = from above 157.5 kN <=== per prop (γf = 1.5)

Fh = uls **236.3 kN** (γf = 1.5) (Single Rake B)

Use 2M16 Resin Anchors = Rawl R-Kex , cmin=

cv > 300 = s = 150 = 0.92 fb_n = C40 = 1.1

Vrd c = 52.7 kN/ anchor

Vrd s = M16 8.8 = 58.9 kN / anchor

capacity for 6 anchors= 316.4 kN > Vuls 236 kN **Use 6M16 at 150crs / per prop**

Connect with 15thk end plate x 200 x 200 100 kN > **157.5** kN.... OK

Note: Conservatively friction of end plate to rough concrete face not considered.

Bearing on concrete face = F_v / 0.2 x 0.2 = 5.90625 N/mm2 < 40N/mm2 / 1.5 = 26N/mm2

Temporary Toes calculations:

- to match size of existing footings under piers or as below for side walls where distribution of load is possible

Towards no15-17 & 17-19 Wadham Gardens

1st Stage U/pin = typical side walls 350THK - THE WORST CASE - DIG 1

Loadings:

	L or W	x	DL+IL		DL+IL		
Roof x 5/2m	2.5	x	1.5		3.75		
Floor x 3no x 5/2	7.5	x	1.25		9		(2nd,1st, GF timber)
9" Brick Wall chimneys x 1.5	1.5	x	5		7.5		allowance distributed
13.5" Brick Wall x 7h =	7	x	7.2		50.4		
350thk RC wall x 2.5 =	2.5	x	8.4		21		
				w =	92	kN/m	

Allowable GBP = C=50		100	kN/m2
unloading of the base = 2.5m x 16 x 0.75 =		30	
	ABP tot=	130	kN/m2

B of temporary = w / ABP =	0.71	m			
B used =	**0.750**	m	=> pressue =	**122.7**	kN/m2

2nd Stage U/pin = typical side walls 350THK - THE WORST CASE - DIG 2

Loadings:

	L or W	x	DL+IL		DL+IL		
Roof x 5/2m	2.5	x	1.5		3.75		
Floor x 3no x 5/2	7.5	x	1.25		9		(2nd,1st, GF timber)
9" Brick Wall chimneys x 1.5	1.5	x	5		7.5		allowance distributed
13.5" Brick Wall x 7h =	7	x	7.2		50.4		
350thk RC wall x 4.8 =	2.5	x	8.4		21		
				w =	92	kN/m	

Allowable GBP = C=75		180	kN/m2	AS PER SI BELOW 3.5m
unloading of the base = 4.8m x 16 x 0.75 =		57.6		
	ABP tot=	237.6	kN/m2	

B of temporary = w / ABP =	0.39	m			
B used =	**0.750**	m	=> pressue =	**122.7**	kN/m2

Temporary Piles Design Notes:

Specialist subcontractor is to carry out detail design of embedded piles.
principles of pile design are as per SI report prepared by Soil Consultants, BIM page 36-37

Axiom Structures have been involved in similar projects where 350dia piles were successfully used to form propped embedded contigous piled walls using mini- and medium size piling rigs.

As per temporary internal piles design, the maximium force does not exceed 250kN per pile

Scheme pile design for information is as follows and subject to detail design.

Pile Capacity Estimating

End Bearing Capacity in granular soil = (Nq D d Ab)/FOS1
but not more than 0.45fcuAb/1.5 or 15000Ab/FOS1 (in sand or gravel).
Shaft Friction Capacity in granular soil = (Ks AvgD As tan(φ))/FOS2
Friction limited to 110kN/m2, except in Rocks.
End Bearing Capacity in Clay Soil =(Nc cub Ab)/FOS1 but not more than 0.45fcuAb/1.5.
Nc taken as 9.
Shaft Friction Capacity in Clay Soil = (α c As)/FOS2.
α taken as 0.5

Factors of Safety: -
For End Bearing = 2.5
For Shaft Friction = 3.0

fcu = 35 N/mm2

Coefficient of Lateral Pressure
(Granular Soils) Ks: -
For Driven Piles = 0.5
For Bored Piles = 0.7

Soil Type	Fill	Clay	Clay
Depth from Surface (m)	0.00	5.00	10.00
to (m)	5.00	10.00	20.00
Soil Density D (kN/m2) =	0	18	18
Nq =			21
Cohesion at base cub (kN/m2) =			
Upper Limit on qb (kN/m2) =			26250
Shaft Friction Angle φ =		20	20
Shaft Friction cu (kN/m2) =		100	

Downwards Vertical Capacity (kN)

	Length (m)	Driven Square Piles 250	300	350	Bored Circular Piles 200	300	375	450	600	750	900
End Bear	10.00	47	68	93	24	53	83	120	214	334	481
	15.00	95	136	185	48	107	167	240	428	668	962
	20.00	142	204	278	71	160	250	361	641	1002	1443
Shaft Friction by Strata	Fill	0	0	0	0	0	0	0	0	0	0
	Clay	97	116	136	61	91	114	137	183	229	274
	10.00	0	0	0	0	0	0	0	0	0	0
	15.00	41	49	57	26	39	48	58	77	96	116
	20.00	164	197	229	103	154	193	232	309	386	463
Total for Length	10.00	144	184	228	85	145	198	257	397	562	755
	15.00	232	302	378	134	237	329	435	687	993	1352
	20.00	403	517	643	235	406	558	729	1133	1616	2180

Tension Vertical Capacity (kN)

Length (m)	Square Piles 250	300	350	Circular Piles 200	300	400	450	600	750	900
10.00	48	58	68	30	46	57	69	91	114	137
15.00	69	83	97	43	65	81	97	130	162	195
20.00	130	156	183	82	123	154	184	246	307	369