PRICE&MYERS

REPORT

12-14 Greville Street
London, EC1N 8SB

Construction Method Statement

Prepared by: Paul Batty BSc CEng MICE MIStructE
December 2015
Job No - 23327

Date	Version	Notes / Amendments / Issue Purpose
December 2015	1	Preliminary Issue
February 2016	2	Preliminary Issue
February 2016	3	Issued for Planning
December 2017	4	Updated for BIA Audit
February 2017	5	Revisions to monitoring strategy and calculation *(amendments in italic)*

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Contents

Appendices

Summary of changes included in Version 4

Changes to wording are highlighted in italics within the report

Section 2

- Reference to the undated Basement Impact Assessment by GEA
- Review of further site investigation.
- Additional trial pit records presented in Appendix B
- The level of the top of London Clay has been confirmed as consistent across the site at a typical level of 12.48m OD
- Groundwater has been confirmed at a typical level of 12.74m OD about 300mm depth over London Clay. This water level is about 700mm below the proposed excavation level for the raft foundation

Section 3

Existing buildings

- Further information added on the existing construction
- Further information added on Party Walls and adjoining structures

Permanent Works

- Additional wording regarding change to extent of raft foundation to suit Audrey House basements - revised drawings were submitted in July 2017
- Diagram showing extent of underpinning - 23327 SK102 - remains as previously submitted

Temporary Works

- Additional wording to give more detail on requirements for temporary works
- Revised retaining wall calculation for Party Wall with 11 Greville Street incorporating a raised ground water level and lateral propping. Included in Appendix G.

Movement Monitoring Strategy

- Additional wording to give more detail including contingency planning recommendations

1 Introduction

This Construction Method Statement has been prepared under the instruction of the Client, Workspace Group. It outlines the construction methodology for the proposed rebuilding of 12-14 Greville Street partially behind a retained façade including a new reinforced concrete raft foundation. This report has been prepared as part of the documentation for submission of a Planning application.

The information in this report is based upon a visual survey of the existing property and desk study searches of the area. A basement impact assessment report has been prepared by GEA and is included in Appendix A. The site sits over the southern Crossrail running tunnel which is at a depth of approximately 25m to the crown.

This report should also be read in conjunction with the Architect's Drawings, the Design and Access Statement and the Planning Statement.

2 Surveys, Ground Conditions and Ground Water

Refer to Appendix A for the site-specific Desk Study and Basement Impact Assessment Report prepared by Geotechnical & Environmental Associates Limited (GEA); report reference J15340A, Issue No 4, dated December 2017.

Geological maps of the area indicate that the site is founded on the Hackney Gravel formation, underlain by London Clay. Borehole information available on the British Geological Society (BGS) website indicates the London Clay is at a level of 12.25m around 60m to the west of the site. With the current proposals, this would result in a thickness of hackney gravel under the raft slab of just over 1 metre.

Three trail pits were originally excavated within the existing basement, the logs of these can be found in Appendix B. The trial pits, which were dug to approximately 1m below existing slab level, showed varying levels of foundations due to the different buildings and boundary conditions on the site. Water was not encountered in any of the pits.

Further trial pits and boreholes were excavated in 2017 and have demonstrated a consistent depth of gravel over London Clay, at a level of around 12.48m and groundwater at a level of around 12.74m. For further information refer to the Basement Impact Assessment Report, Issue 4. The neighbouring building to the south, Audrey House, has a double basement with the sub-basement requiring underpinning of the southern elevation of No 14 Greville Street. Trial pits have confirmed this underpinning to a depth of

Further site investigation works will be required to enable the raft foundation to be designed.

3 Proposals and Construction Methodology

Introduction

The site includes two existing buildings; No12-13, which has 5 storeys plus a basement and is substantially original; and No 14 which also has 5 storeys plus a basement and has a steel and concrete frame and precast hollow core concrete slabs and a non-original front façade. The site sits over the recently bored western running tunnel of Crossrail which is at a depth of approximately 25 metres. Both existing buildings are proposed to be demolished, with the exception of the front and side elevation of No 12-13, to make way for a single unified structure

with a single basement.

The new structure will be a braced reinforced concrete frame with flat slabs (spans of around 6m), with a basement and 5 storeys above ground. Crossrail will be looking for a design which makes the minimum impact on their tunnels which means that a concrete raft foundation will be preferred over piles, as this spreads load around the site area as evenly as possible. The front elevation and west side wall of 12-13 Greville Street will be retained as they are in the original brickwork. This retained fabric will be tied to the new concrete frame with suitably designed anchorages allowing a degree of differential vertical movement.

The existing basements are around 3 metres deep so the proposed single basement will occupy a similar volume. The proposed concrete raft slab will be around 750mm thick which will project below the base of foundations to existing adjoining buildings adjoining 12-13 Greville Street and on the western boundary, requiring the underpinning of some of these perimeter walls. Refer to drawing 23327 SK102 in Appendix F for the currently proposed extent of underpinning, to be confirmed following further investigations into the existing foundations on site.

The adjacent buildings have basements, although the exact level relationships have not yet been established and are the subject of ongoing Party Wall discussions. The only new low height retaining structures required are to the Party Wall between 11 and 12 Greville Street and the base of the retained façade to 12-13 Greville Street. The perimeter walls at basement to ground floor level will be retained and tied back to the new concrete frame as required. The new ground floor will provide a permanent prop to the external pavement on Greville Street.

Permanent Works

See Appendix C for existing and proposed plans and sections of the building. Also refer to the Architects drawings.

Following demolition, a new 750mm thick raft slab will be constructed in the basement at a consistent level throughout (the current proposal is 14.28 AOD). The existing slab seems to be at two different levels, the majority is at 14.28 AOD but a section to the front of 12-13 Greville Street is approximately 550mm higher at 14.83 AOD. The existing slab is expected to be around 100mm thick, and so the proposed structure will require an excavation to formation level of around 700mm below the underside of the existing slab generally, 1250mm to the higher section. The proposed formation level of the raft is above the bearing level of the eastern and southern Party walls and front elevation to 14 Greville Street but slightly lower than the other existing perimeter walls. Underpinning to some of the boundary walls will be required so that the proposed excavation does not undermine the existing footings.

The existing sub-basement to Audrey House on the southern boundary is approximately 3.9m below the proposed new raft slab level. To avoid producing excessive lateral loadings on the boundary wall, the raft slab will be curtailed at a distance of around 4m to 5m from the boundary with a suspended slab bearing on the edge of the raft and the existing boundary wall foundation.

A central area on the site (measuring approximately 8m by 5m) does not currently have a basement. The proposals are for this area to be excavated so that the basement is continuous through the whole site. The area is surrounded by basement on all sides and so we are expecting this to have no significant impact on the adjacent buildings or ground.

Above basement, the proposed structure is to be reinforced concrete columns supporting 275mm thick reinforced concrete flat slabs. The core area will provide bracing by shear walls around the lift and stair. The top level has setbacks and will have a lightweight roof constructed from long span steel beams or trusses, supported on a thickened fourth floor slab.

Refer to structural drawings 23327 SK09 - SK15, SK20 in Appendix C for further preliminary information on the proposed permanent structure. Also refer to the Architects drawings.

Temporary Works

We have prepared an assumed sequence of construction and temporary works requirements to demonstrate how the basement could be constructed. Refer to drawing 23327 SK100 for the assumed sequence of construction and drawings 23327 SK101 for details of the proposed temporary propping requirements. Propping will be provided to existing party walls to be retained, at floor levels, from within our site, until the permanent works are in place and suitable ties can be installed between the two. The temporary works will be designed to provide the stiff propping assumed in the movement analysis contained in the Basement Impact Assessment. The beams at basement level at the base of the retained elevation to 12&13 Greville Street and to the Party wall with 11 Greville Street will include provision for the lateral loads due to the additional depth of excavation in these areas, so that the underpinning can act as a propped cantilever during excavations and up until the time that the raft provides permanent lateral support.

Temporary lateral support will be provided within underpinning excavations to retain any loose areas within the gravels.

The temporary works and construction sequence will be discussed in detail with the contractor, their temporary works engineer and temporary works co-ordinator. The temporary works will be planned such that loadings from construction activities, particularly differential loadings, are managed carefully. The contractor will review the outline proposals and prepare a detailed construction sequence. They will have full responsibility for designing and implementing the temporary works.

Crossrail

Price and Myers met with a Crossrail representative at the beginning of February 2016 to discuss the current proposals for the development. There were no immediate concerns over the scheme. The proposal of a raft foundation (as opposed to piles) will keep the new construction works well above the tunnels, which are some 25m down from basement level, and spread the loads evenly over the ground between.

We discussed that Crossrail will impose some standard planning conditions, as outlined in their "Information for Developers" document, January 2016, to be completed by the developer. These will likely include:

- Method statements are to be agreed with Crossrail for various aspects of the demolition and construction;
- A requirement for a ground movement analysis assessment, demonstrating that any movements are within limits imposed by Crossrail (to include a category 2 check);
- Evidence is to be provided to show that mitigation of the effects of noise and movement on the proposed structure from the operation of the Crossrail tunnels has been considered;
- A condition survey of the Crossrail tunnel pre and post construction of the new development.

Movement Monitoring Strategy

The retained front elevation of 12-13 Greville Street will be monitored for signs of movement during the demolition and reconstruction works. Other existing walls to be retained will also likely be monitored for movement.

Where agreed, monitoring should begin prior to demolition or underpinning commencing and continue until the front elevation is tied to the new frame, and for 2 months after the basement structure and ground floor slab have been completed in respect of Party walls. Monitoring should be carried out weekly during the construction phase and fortnightly for the additional 2 month period. The suggested vertical settlement trigger levels are outlined below and the monitoring should be carried out in accordance with the recommendations with Ciria C579. The structures listed below to be monitored are to be confirmed following further discussions with GEA and the Party Wall surveyors. *Monitoring would cover both vertical and horizontal movements.*

Sufficient monitoring points will be used to ensure that any significant movements of adjoining structures are picked up and acted upon. If an amber trigger level is breached the measurement will be immediately reviewed and the wall will be inspected visually for distress or distortion to ensure that the movement is genuine. If the movement is genuine, the pattern and rate of change of movement will be examined and any appropriate alterations to sequence of works or propping will be implemented. In the event that a red trigger level is breached, the Contractor is to cease works in the area of the Party wall and is to review any requirements for additional temporary works or safeguarding measures to ensure that any damage does not exceed Burland Category 1.

	'Green' trigger level (mm)	'Amber' trigger level (mm)	'Red' trigger level (mm)
11 Greville Street	5	7	10
12/13 Greville Street	5	7	10
15 Greville Street	5	7	10
19-21 Hatton Garden	5	7	10
22 Hatton Garden	5	7	10
23 Hatton Garden	5	7	10
24 Hatton Garden	5	7	10

Health & Safety

Health and Safety on site will be managed by the contractor, and they will need to carefully consider the risks of the alterations to the existing basement. The temporary works will be planned rigorously to mitigate any risks to the existing building, adjacent buildings and workers on site.

Site Logistics

Site routes and deliveries will likely be off Greville Street. Temporary suspension of parking bays and pavements will be required.

Site Hoardings and Security

Site hoardings will be erected such that members of the public on Greville Street will be sufficiently protected from work to the properties. The hoardings will be made secure, and any access to site restricted and locked whilst the site is not in use.

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Appendix G

Supporting Calculations

Calculation for retaining wall at base of 11 Greville Street Party Wall

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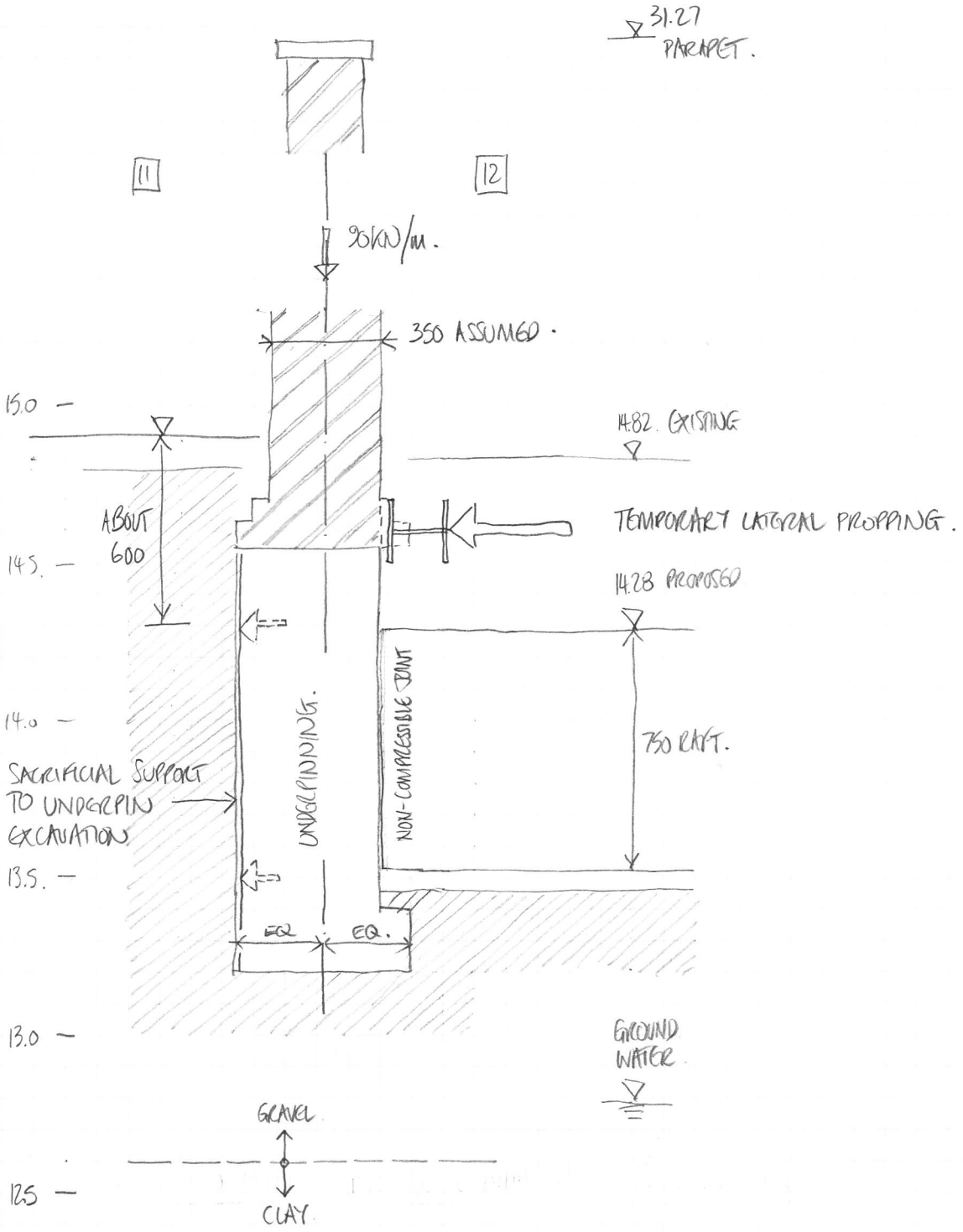
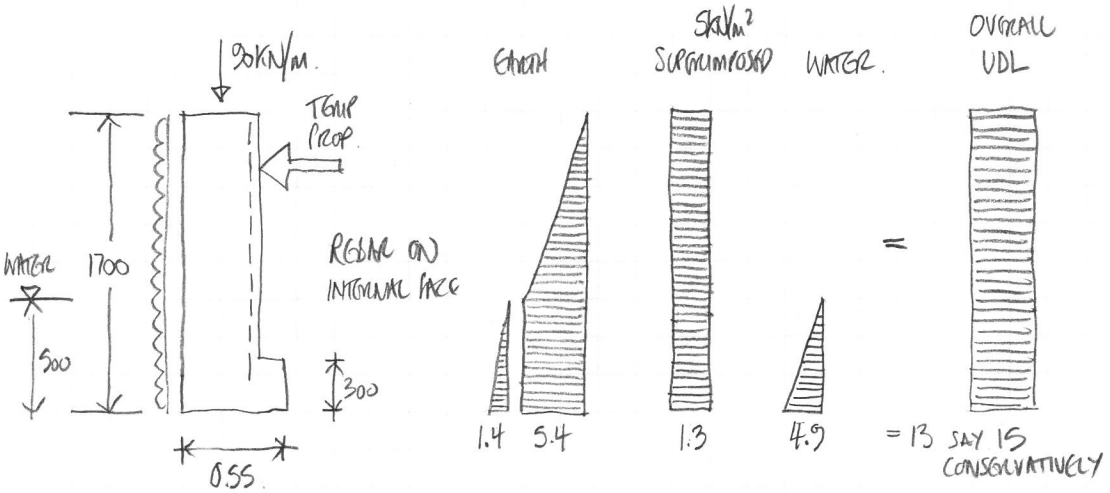
Job No	23327	Page	RAFT 8	Ver	3
Date	JUNE 2017	Eng	PB.	Chd	VT
Job	12-14 GRENVILLE STREET				



PROPOSED SECTION THROUGH PARTY WALL WITH N°11 GRENVILLE STREET

PROPPED RETAINING WALL WITH N°11 GRENVILLE STREET



RETAINING WALL ANALYSED AS A SIMPLY SUPPORTED BEAM WITH NO FIXITY AT THE BASE WITH OVERTURNING MOMENT RESISTED BY THE TEMPORARY PROPPING. A NOMINAL WATER PRESSURE IS INCLUDED BUT IS UNLIKELY TO BE REALISTIC AS THE RETAINING WALL WILL BECOME FULLY PROPPED BY THE RAFT FOUNDATION SOON AFTER COMPLETION. LATERAL LOADS HAVE BEEN WORKED OUT IN TEKLA USING $\phi' = 33°$ (SEE SHEET RAFT 11) IN SIMPLE TERMS. THE PROPPED WALL CAN BE IDEALISED TO A SIMPLY SUPPORTED BEAM WITH A UDL OF LESS THAN 15 KN/m

SUPPORT REACTION $R < 15 \times 1.7 \div 2$ = 13 KN/m. LATERAL FORCE AT BASE.

MOMENT IN WALL $M < 15 \times 1.7^2 \div 8$ = 6 KNm/m.

SLIDING RESISTANCE 90×0.46 (SEE RAFT 11) = 41 KN/m.

FACTOR OF SAFETY - SLIDING $41 \div 13$ = 3.1 > 1.5 ✓OK.

BEARING PRESSURE $[90 + (1.7 \times 0.5 \times 24)] \div 0.55$ = 200 KN/m².
= 20

THE BIA STATES AN ALLOWABLE BEARING PRESSURE IN THE GRAVEL OF 225 KN/m² ✓OK.

THE BASE OF UNDERPINNING IS AT 13.3
LONDON CLAY IS AT 12.5
DEPTH OF GRAVEL UNDER FOOTING = 0.8m.

THE CONCLUSION IS THAT BEARING PRESSURES AND SLIDING RESISTANCE ARE WITHIN ACCEPTABLE LIMITS.

LOAD SPREAD AT 45° IN = 0.55 + 0.8 + 0.8 = 2.15m.

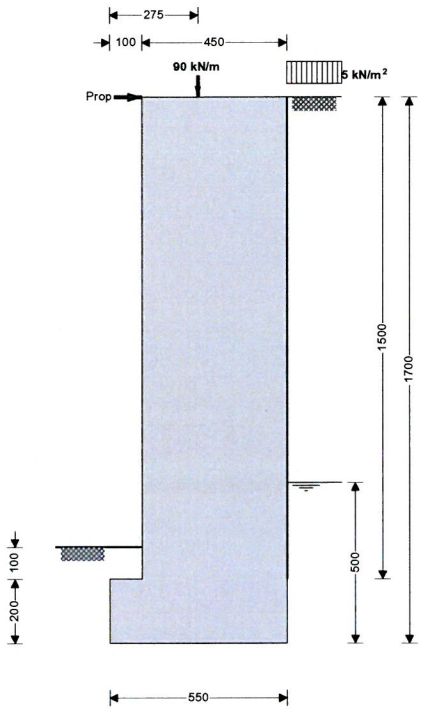
PRESSURE AT TOP OF LONDON CLAY $(110 \div 2.15) + 0.8 \times 18$ = 69 KN/m² < 100 ✓OK.

REINFORCEMENT IN INTERNAL FACE OF RETAINING WALL — MINIMAL — USE 0.15%

Tekla Tedds Price & Myers 37 Alfred Place London	Project 12 - 14 GRENVILLE STREET				Job no. 23327
	Calcs for 11 GRENVILLE STREET - PROPPED RETAINING WALL				Start page no./Revision RAFT 10
	Calcs by P	Calcs date 13/02/2018	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever propped at top**
Height of retaining wall stem	h_{stem} = **1500** mm
Thickness of wall stem	t_{wall} = **450** mm
Length of toe	l_{toe} = **100** mm
Length of heel	l_{heel} = **0** mm
Overall length of base	$l_{base} = l_{toe} + l_{heel} + t_{wall}$ = **550** mm
Thickness of base	t_{base} = **200** mm
Depth of downstand	d_{ds} = **0** mm
Position of downstand	l_{ds} = **100** mm
Thickness of downstand	t_{ds} = **200** mm
Height of retaining wall	$h_{wall} = h_{stem} + t_{base} + d_{ds}$ = **1700** mm
Depth of cover in front of wall	d_{cover} = **100** mm
Depth of unplanned excavation	d_{exc} = **0** mm
Height of ground water behind wall	h_{water} = **500** mm
Height of saturated fill above base	$h_{sat} = \max(h_{water} - t_{base} - d_{ds}, 0\ mm)$ = **300** mm
Density of wall construction	γ_{wall} = **23.6** kN/m^3
Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of rear face of wall	α = **90.0** deg
Angle of soil surface behind wall	β = **0.0** deg
Effective height at virtual back of wall	$h_{eff} = h_{wall} + l_{heel} \times \tan(\beta)$ = **1700** mm

Retained material details

Mobilisation factor	M = **1.5**
Moist density of retained material	γ_m = **18.0** kN/m^3

Saturated density of retained material — γ_s = **21.0** kN/m³

Design shear strength (GRAVEL.) — ϕ' = **33.0** deg

Angle of wall friction — δ = **18.6** deg

GEA ADVICE.
SLIDING RESISTANCE = TAN $\frac{3}{4}\phi'$
= TAN $\frac{3 \times 33}{4}$
= TAN 24.75
= 0.46.

Base material details

Moist density — γ_{mb} = **18.0** kN/m³

Design shear strength — ϕ'_b = **33.0** deg

Design base friction — δ_b = **18.6** deg

Allowable bearing pressure — $P_{bearing}$ = **225** kN/m²

Using Coulomb theory

Active pressure coefficient for retained material

$$K_a = \sin(\alpha + \phi')^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta) \times [1 + \sqrt{(\sin(\phi' + \delta) \times \sin(\phi' - \beta) / (\sin(\alpha - \delta) \times \sin(\alpha + \beta)))}]^2) = \mathbf{0.266}$$

Passive pressure coefficient for base material

$$K_p = \sin(90 - \phi'_b)^2 / (\sin(90 - \delta_b) \times [1 - \sqrt{(\sin(\phi'_b + \delta_b) \times \sin(\phi'_b) / (\sin(90 + \delta_b)))}]^2) = \mathbf{6.860}$$

At-rest pressure

At-rest pressure for retained material — $K_0 = 1 - \sin(\phi') = \mathbf{0.455}$

Loading details

Surcharge load on plan — Surcharge = **5.0** kN/m²

Applied vertical dead load on wall — W_{dead} = **90.0** kN/m

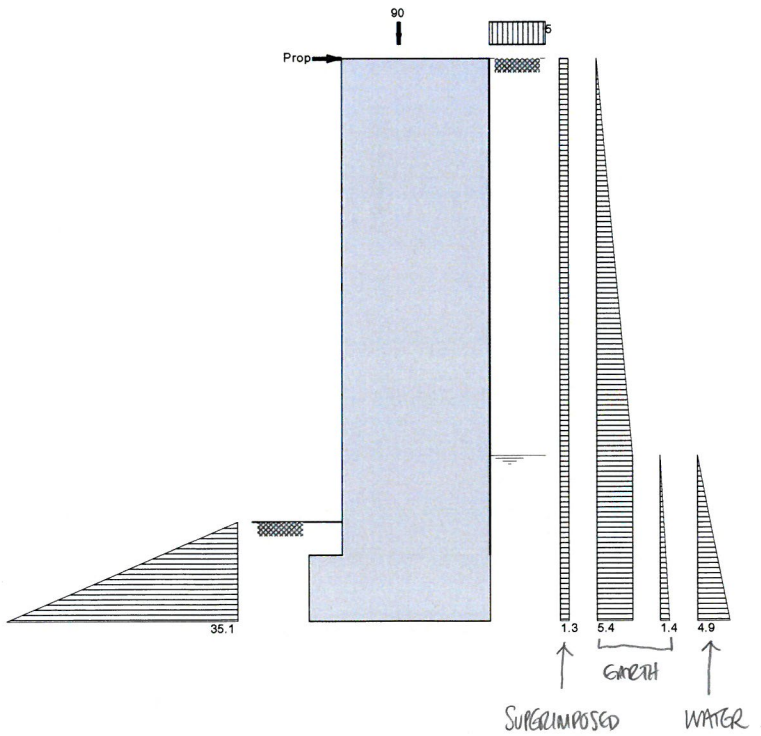
Applied vertical live load on wall — W_{live} = **0.0** kN/m

Position of applied vertical load on wall — l_{load} = **275** mm

Applied horizontal dead load on wall — F_{dead} = **0.0** kN/m

Applied horizontal live load on wall — F_{live} = **0.0** kN/m

Height of applied horizontal load on wall — h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m²

Vertical forces on wall

Wall stem — $w_{wall} = h_{stem} \times t_{wall} \times \gamma_{wall}$ = **15.9** kN/m