The Hope Project – HTS response to the BIA Audit

Please find appended our response to the Audit of the Basement Impact Assessment for The Hope Project, Camden.

The numbered responses relate to Campbell Reith's Audit Query Tracker dated February 2017 (revision D1).

Query 1 – Land Stability

- Outline retaining wall calculations – please see attached. The design of the contiguous piled retaining wall will be a contractor design portion.

- Indicative temporary works scheme, sequencing and propping arrangement – please see attached (Sketches SK40-45). The exact construction methodology is to be confirmed by the appointed contractor and temporary works engineer.

- Proposed ground water control measures:

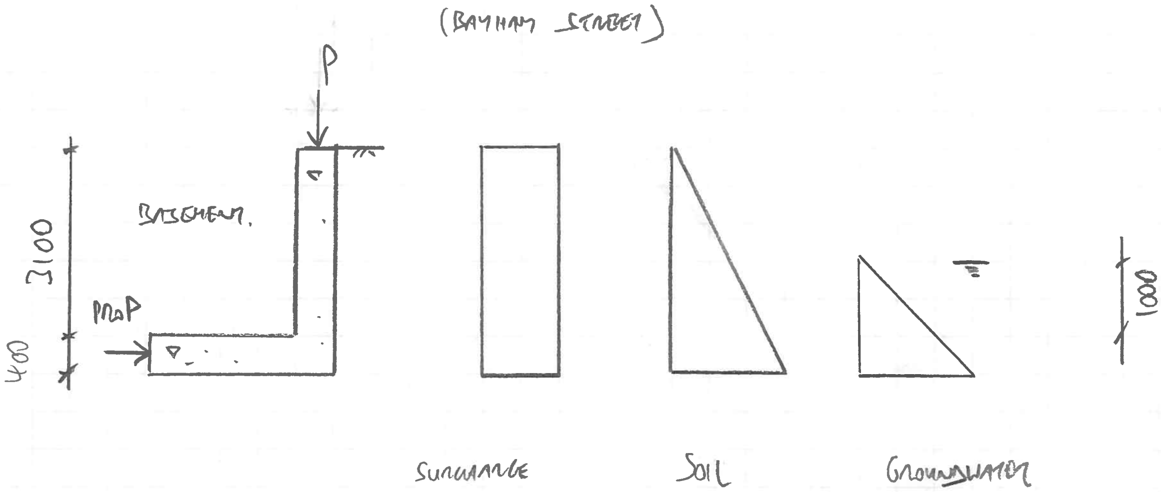
    - The ground water level has been measured below the proposed basement slab level. Localised dewatering will only be required if the ground water level is found to be higher than expected.
    - During construction – localised dewatering is proposed during construction via sump pumping. The sump will be located in the centre of the site to keep the dewatered level local to the site works. The dewatering will be monitored to ensure that no fines are washed in to the sump.
    - Permanent works – A Grade 3 waterproofing system is proposed in the basement areas. A drained cavity system will be installed enabling ground water collection within sump locations. Sump pumps will pump ground water via a rising main to ground floor level where it will be discharged via gravity into the combined Thames Water sewer network. Non return valves will be used to mitigate against sewer surcharging.

- Construction programme – To be confirmed once a contractor has been appointed.

HEYNE TILLETT STEEL

RETAINING WALL CALCULATIONS

BAYHAM STREET ELEVATION



* RETAINED HEIGHT = 3100mm
* CANTILEVERED RETAINING WALL TO BE PROPPED AT BASE BY NEW BASEMENT SLAB
* ASSUME TOE AND BASE THICKNESS ARE 400mm THICK.
* SURCHARGE → Q = 10 kN/m²
* SOIL - FROM RSK SI REPORT
  ↳ LONDON CLAY

$$\gamma = 20\,kN/m^3$$

$$C_u = 70 + 6.00z$$
$$= 70 + 6.00 \times 3.5 = 91\,kN/m^2$$

$$\phi' = 25°$$

* GROUNDWATER → CONSERVATIVELY ASSUME GWL AT LEVEL 1m ABOVE BASEMENT SSL = 20.5m AOD
* P = VERTICAL LOAD FROM STRUCTURE ABOVE

Job	THE HOPE PROJECT			Date	FEB. 2017
Title	RETAINING WALL DESIGN - BAYHAM STREET			Eng.	MJT
Job No.	1444	Sheet	2	Rev.	-

HEYNE TILLETT STEEL

$$G = \underbrace{(22\,kN/m^3 \times 5m \times 0.4m)}_{\text{WALL}} + \underbrace{(2\,kN/m^2 \times 1.25m)}_{\text{1ST FLOOR}} + \underbrace{(1.5\,kN/m^2 \times 1.25m)}_{\text{GROUND FLOOR}} = 48.4\,kN/m$$

$$Q = (1.5\,kN/m^2 \times 1.25m) + (5\,kN/m^2 \times 1.25m) = 8.1\,kN/m$$

RETAINING WALL DESIGNED USING TEDDS

↳ DESIGN PASSES, (SEE ATTACHED) //

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.6.11

Retaining wall details

Stem type	Cantilever
Stem height	h_{stem} = **3100** mm
Stem thickness	t_{stem} = **400** mm
Angle to rear face of stem	α = **90** deg
Stem density	γ_{stem} = **25** kN/m^3
Toe length	l_{toe} = **1200** mm
Base thickness	t_{base} = **400** mm
Base density	γ_{base} = **25** kN/m^3
Height of retained soil	h_{ret} = **3100** mm
Angle of soil surface	β = **0** deg
Depth of cover	d_{cover} = **0** mm
Height of water	h_{water} = **1000** mm
Water density	γ_w = **9.8** kN/m^3

Retained soil properties

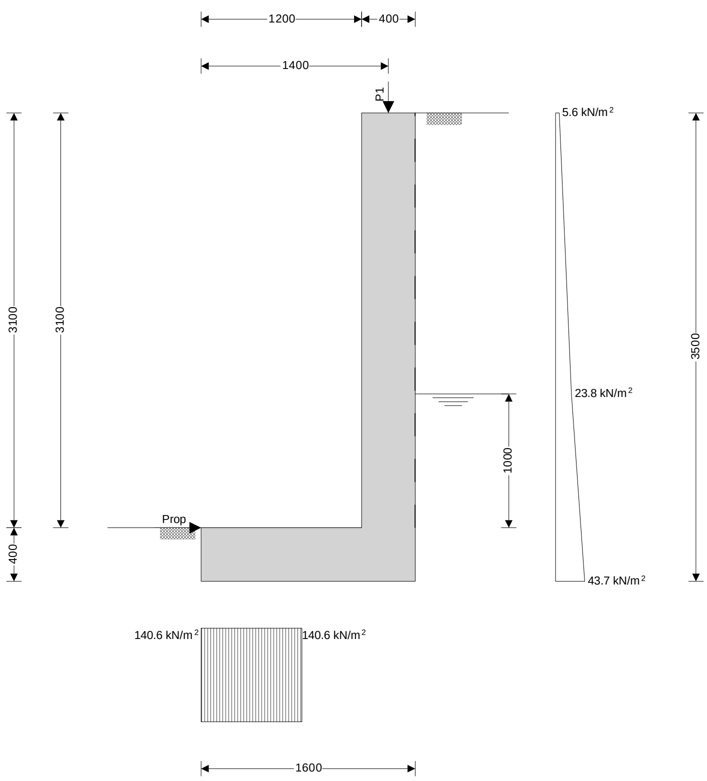
Soil type	Hard clay
Moist density	γ_{mr} = **20** kN/m^3
Saturated density	γ_{sr} = **20** kN/m^3
Characteristic effective shear resistance angle	$\phi'_{r.k}$ = **25** deg
Characteristic wall friction angle	$\delta_{r.k}$ = **12.5** deg

Base soil properties

Soil type	Hard clay
Soil density	γ_b = **20** kN/m^3
Characteristic undrained shear strength	$c_{b.u.k}$ = **91** kN/m^2
Characteristic effective shear resistance angle	$\phi'_{b.k}$ = **18** deg
Characteristic wall friction angle	$\delta_{b.k}$ = **9** deg
Characteristic base friction angle	$\delta_{bb.k}$ = **12** deg

Loading details

Variable surcharge load	$Surcharge_Q$ = **10** kN/m^2
Vertical line load at 1400 mm	P_{G1} = **48.4** kN/m
	P_{Q1} = **8.1** kN/m



General arrangement

Calculate retaining wall geometry

Base length	$l_{base} = l_{toe} + t_{stem} = \mathbf{1600}$ mm
Saturated soil height	$h_{sat} = h_{water} + d_{cover} = \mathbf{1000}$ mm
Moist soil height	$h_{moist} = h_{ret} - h_{water} = \mathbf{2100}$ mm
Length of surcharge load	$l_{sur} = l_{heel} = \mathbf{0}$ mm
- Distance to vertical component	$x_{sur\_v} = l_{base} - l_{heel} / 2 = \mathbf{1600}$ mm
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret} = \mathbf{3500}$ mm
- Distance to horizontal component	$x_{sur\_h} = h_{eff} / 2 = \mathbf{1750}$ mm
Area of wall stem	$A_{stem} = h_{stem} \times t_{stem} = \mathbf{1.24}$ m^2
- Distance to vertical component	$x_{stem} = l_{toe} + t_{stem} / 2 = \mathbf{1400}$ mm
Area of wall base	$A_{base} = l_{base} \times t_{base} = \mathbf{0.64}$ m^2
- Distance to vertical component	$x_{base} = l_{base} / 2 = \mathbf{800}$ mm

Partial factors on actions - Table A.3 - Combination 1

Permanent unfavourable action	$\gamma_G = \mathbf{1.35}$
Permanent favourable action	$\gamma_{Gf} = \mathbf{1.00}$
Variable unfavourable action	$\gamma_Q = \mathbf{1.50}$
Variable favourable action	$\gamma_{Qf} = \mathbf{0.00}$

Partial factors for soil parameters – Table A.4 - Combination 1

Angle of shearing resistance	$\gamma_{\phi'} = \mathbf{1.00}$
Undrained shear strength	$\gamma_{cu} = \mathbf{1.00}$
Weight density	$\gamma_{\gamma} = \mathbf{1.00}$

Water properties

Design water density $\gamma_{w}' = \gamma_{w} / \gamma_{\gamma} = \mathbf{9.8}$ kN/m^3

Retained soil properties

Design moist density $\gamma_{mr}' = \gamma_{mr} / \gamma_{\gamma} = \mathbf{20}$ kN/m^3

Design saturated density $\gamma_{sr}' = \gamma_{sr} / \gamma_{\gamma} = \mathbf{20}$ kN/m^3

Design effective shear resistance angle $\phi'_{r.d} = atan(tan(\phi'_{r.k}) / \gamma_{\phi'}) = \mathbf{25}$ deg

Design wall friction angle $\delta_{r.d} = atan(tan(\delta_{r.k}) / \gamma_{\phi'}) = \mathbf{12.5}$ deg

Base soil properties

Design soil density $\gamma_{b}' = \gamma_{b} / \gamma_{\gamma} = \mathbf{20}$ kN/m^3

Design effective shear resistance angle $\phi'_{b.d} = atan(tan(\phi'_{b.k}) / \gamma_{\phi'}) = \mathbf{18}$ deg

Design wall friction angle $\delta_{b.d} = atan(tan(\delta_{b.k}) / \gamma_{\phi'}) = \mathbf{9}$ deg

Design base friction angle $\delta_{bb.d} = atan(tan(\delta_{bb.k}) / \gamma_{\phi'}) = \mathbf{12}$ deg

Design undrained shear strength $c_{b.u.d} = c_{b.u.k} / \gamma_{cu} = \mathbf{91}$ kN/m^2

Using Coulomb theory

Active pressure coefficient $K_A = sin(\alpha + \phi'_{r.d})^2 / (sin(\alpha)^2 \times sin(\alpha - \delta_{r.d}) \times [1 + \sqrt{}[sin(\phi'_{r.d} + \delta_{r.d}) \times sin(\phi'_{r.d} - \beta) / (sin(\alpha - \delta_{r.d}) \times sin(\alpha + \beta))]]^2) = \mathbf{0.367}$

Passive pressure coefficient $K_P = sin(90 - \phi'_{b.d})^2 / (sin(90 + \delta_{b.d}) \times [1 - \sqrt{}[sin(\phi'_{b.d} + \delta_{b.d}) \times sin(\phi'_{b.d}) / (sin(90 + \delta_{b.d}))]]^2) = \mathbf{2.359}$

Overturning check

Vertical forces on wall

Wall stem $F_{stem} = \gamma_{Gf} \times A_{stem} \times \gamma_{stem} = \mathbf{31}$ kN/m

Wall base $F_{base} = \gamma_{Gf} \times A_{base} \times \gamma_{base} = \mathbf{16}$ kN/m

Line loads $F_{P\_v} = \gamma_{Gf} \times P_{G1} + \gamma_{Qf} \times P_{Q1} = \mathbf{48.4}$ kN/m

Total $F_{total\_v} = F_{stem} + F_{base} + F_{water\_v} + F_{P\_v} = \mathbf{95.4}$ kN/m

Horizontal forces on wall

Surcharge load $F_{sur\_h} = K_A \times cos(\delta_{r.d}) \times \gamma_Q \times Surcharge_Q \times h_{eff} = \mathbf{18.8}$ kN/m

Saturated retained soil $F_{sat\_h} = \gamma_G \times K_A \times cos(\delta_{r.d}) \times (\gamma_{sr}' - \gamma_{w}') \times (h_{sat} + h_{base})^2 / 2 = \mathbf{4.8}$ kN/m

Water $F_{water\_h} = \gamma_G \times \gamma_{w}' \times (h_{water} + d_{cover} + h_{base})^2 / 2 = \mathbf{13}$ kN/m

Moist retained soil $F_{moist\_h} = \gamma_G \times K_A \times cos(\delta_{r.d}) \times \gamma_{mr}' \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base})) = \mathbf{49.8}$ kN/m

Base soil $F_{exc\_h} = -\gamma_{Gf} \times K_P \times cos(\delta_{b.d}) \times \gamma_{b}' \times (h_{pass} + h_{base})^2 / 2 = \mathbf{-3.7}$ kN/m

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{exc\_h} + F_{water\_h} + F_{sur\_h} = \mathbf{82.7}$ kN/m

Overturning moments on wall

Surcharge load $M_{sur\_OT} = F_{sur\_h} \times x_{sur\_h} = \mathbf{33}$ kNm/m

Saturated retained soil $M_{sat\_OT} = F_{sat\_h} \times x_{sat\_h} = \mathbf{2.3}$ kNm/m

Water $M_{water\_OT} = F_{water\_h} \times x_{water\_h} = \mathbf{6.1}$ kNm/m

Moist retained soil $M_{moist\_OT} = F_{moist\_h} \times x_{moist\_h} = \mathbf{64.8}$ kNm/m

Total $M_{total\_OT} = M_{sat\_OT} + M_{moist\_OT} + M_{water\_OT} + M_{sur\_OT} = \mathbf{106}$ kNm/m

Restoring moments on wall

Wall stem $M_{stem\_R} = F_{stem} \times x_{stem} = \mathbf{43.4}$ kNm/m

Wall base $M_{base\_R} = F_{base} \times x_{base} = \mathbf{12.8}$ kNm/m

Line loads $M_{P\_R} = (abs(\gamma_{Gf} \times P_{G1} + \gamma_{Qf} \times P_{Q1})) \times p_1 = \mathbf{67.8}$ kNm/m

Total $M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{P\_R} = \mathbf{124}$ kNm/m

Check stability against overturning

Factor of safety $FoS_{ot} = M_{total\_R} / M_{total\_OT} = \mathbf{1.169}$

PASS - Maximum restoring moment is greater than overturning moment

Bearing pressure check

Vertical forces on wall

Wall stem $F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem} = \mathbf{41.9}$ kN/m

Wall base $F_{base} = \gamma_G \times A_{base} \times \gamma_{base} = \mathbf{21.6}$ kN/m

Line loads $F_{P\_v} = \gamma_G \times P_{G1} + \gamma_Q \times P_{Q1} = \mathbf{77.5}$ kN/m

Total $F_{total\_v} = F_{stem} + F_{base} + F_{water\_v} + F_{P\_v} = \mathbf{140.9}$ kN/m

Horizontal forces on wall

Surcharge load $F_{sur\_h} = K_A \times \cos(\delta_{r.d}) \times \gamma_Q \times Surcharge_Q \times h_{eff} = \mathbf{18.8}$ kN/m

Saturated retained soil $F_{sat\_h} = \gamma_G \times K_A \times \cos(\delta_{r.d}) \times (\gamma_{sr}' - \gamma_w') \times (h_{sat} + h_{base})^2 / 2 = \mathbf{4.8}$ kN/m

Water $F_{water\_h} = \gamma_G \times \gamma_w' \times (h_{water} + d_{cover} + h_{base})^2 / 2 = \mathbf{13}$ kN/m

Moist retained soil $F_{moist\_h} = \gamma_G \times K_A \times \cos(\delta_{r.d}) \times \gamma_{mr}' \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base})) = \mathbf{49.8}$ kN/m

Base soil $F_{pass\_h} = -\gamma_{Gf} \times K_P \times \cos(\delta_{b.d}) \times \gamma_b' \times (d_{cover} + h_{base})^2 / 2 = \mathbf{-3.7}$ kN/m

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{pass\_h} + F_{water\_h} + F_{sur\_h} = \mathbf{82.7}$ kN/m

Moments on wall

Wall stem $M_{stem} = F_{stem} \times x_{stem} = \mathbf{58.6}$ kNm/m

Wall base $M_{base} = F_{base} \times x_{base} = \mathbf{17.3}$ kNm/m

Surcharge load $M_{sur} = -F_{sur\_h} \times x_{sur\_h} = \mathbf{-33}$ kNm/m

Line loads $M_P = (\gamma_G \times P_{G1} + \gamma_Q \times P_{Q1}) \times p_1 = \mathbf{108.5}$ kNm/m

Saturated retained soil $M_{sat} = -F_{sat\_h} \times x_{sat\_h} = \mathbf{-2.3}$ kNm/m

Water $M_{water} = -F_{water\_h} \times x_{water\_h} = \mathbf{-6.1}$ kNm/m

Moist retained soil $M_{moist} = -F_{moist\_h} \times x_{moist\_h} = \mathbf{-64.8}$ kNm/m

Total $M_{total} = M_{stem} + M_{base} + M_{sat} + M_{moist} + M_{water} + M_{sur} + M_P = \mathbf{78.3}$ kNm/m

Check bearing pressure

Propping force $F_{prop\_base} = F_{total\_h} = \mathbf{82.7}$ kN/m

Distance to reaction $\bar{x} = M_{total} / F_{total\_v} = \mathbf{556}$ mm

Eccentricity of reaction $e = \bar{x} - l_{base} / 2 = \mathbf{-244}$ mm

Loaded length of base $l_{load} = 2 \times \bar{x} = \mathbf{1111}$ mm

Bearing pressure at toe $q_{toe} = F_{total\_v} / l_{load} = \mathbf{126.8}$ kN/m^2

Bearing pressure at heel $q_{heel} = \mathbf{0}$ kN/m^2

Effective overburden pressure $q = (t_{base} + d_{cover}) \times \gamma_b' = \mathbf{8}$ kN/m^2

Design effective overburden pressure $q' = q / \gamma_\gamma = \mathbf{8}$ kN/m^2

Foundation shape factors $s_c = 1$

Load inclination factors $H = F_{sur\_h} + F_{sat\_h} + F_{water\_h} + F_{moist\_h} = \mathbf{86.5}$ kN/m

$i_c = 0.5 \times (1 + \sqrt{(1 - H / (l_{load} \times c_{b.u.d}))}) = \mathbf{0.69}$

Net ultimate bearing capacity $n_f = (\pi + 2) \times c_{b.u.d} \times s_c \times i_c + q = \mathbf{331.1}$ kN/m^2

Factor of safety $FoS_{bp} = n_f / \max(q_{toe}, q_{heel}) = \mathbf{2.611}$

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

Partial factors on actions - Table A.3 - Combination 2

Permanent unfavourable action $\gamma_G = \mathbf{1.00}$

Permanent favourable action $\gamma_{Gf} = \mathbf{1.00}$

Variable unfavourable action γ_Q = **1.30**

Variable favourable action γ_{Qf} = **0.00**

Partial factors for soil parameters – Table A.4 - Combination 2

Angle of shearing resistance $\gamma_{\phi'}$ = **1.25**

Undrained shear strength γ_{cu} = **1.40**

Weight density γ_γ = **1.00**

Water properties

Design water density $\gamma_w' = \gamma_w / \gamma_\gamma$ = **9.8** kN/m^3

Retained soil properties

Design moist density $\gamma_{mr}' = \gamma_{mr} / \gamma_\gamma$ = **20** kN/m^3

Design saturated density $\gamma_{sr}' = \gamma_{sr} / \gamma_\gamma$ = **20** kN/m^3

Design effective shear resistance angle $\phi'_{r.d} = atan(tan(\phi'_{r.k}) / \gamma_{\phi'})$ = **20.5** deg

Design wall friction angle $\delta_{r.d} = atan(tan(\delta_{r.k}) / \gamma_{\phi'})$ = **10.1** deg

Base soil properties

Design soil density $\gamma_b' = \gamma_b / \gamma_\gamma$ = **20** kN/m^3

Design effective shear resistance angle $\phi'_{b.d} = atan(tan(\phi'_{b.k}) / \gamma_{\phi'})$ = **14.6** deg

Design wall friction angle $\delta_{b.d} = atan(tan(\delta_{b.k}) / \gamma_{\phi'})$ = **7.2** deg

Design base friction angle $\delta_{bb.d} = atan(tan(\delta_{bb.k}) / \gamma_{\phi'})$ = **9.7** deg

Design undrained shear strength $c_{b.u.d} = c_{b.u.k} / \gamma_{cu}$ = **65** kN/m^2

Using Coulomb theory

Active pressure coefficient $K_A = sin(\alpha + \phi'_{r.d})^2 / (sin(\alpha)^2 \times sin(\alpha - \delta_{r.d}) \times [1 + \sqrt{[sin(\phi'_{r.d} + \delta_{r.d}) \times sin(\phi'_{r.d} - \beta) / (sin(\alpha - \delta_{r.d}) \times sin(\alpha + \beta))]}]^2)$ = **0.439**

Passive pressure coefficient $K_P = sin(90 - \phi'_{b.d})^2 / (sin(90 + \delta_{b.d}) \times [1 - \sqrt{[sin(\phi'_{b.d} + \delta_{b.d}) \times sin(\phi'_{b.d}) / (sin(90 + \delta_{b.d}))]}]^2)$ = **1.965**

Overturning check

Vertical forces on wall

Wall stem $F_{stem} = \gamma_{Gf} \times A_{stem} \times \gamma_{stem}$ = **31** kN/m

Wall base $F_{base} = \gamma_{Gf} \times A_{base} \times \gamma_{base}$ = **16** kN/m

Line loads $F_{P\_v} = \gamma_{Gf} \times P_{G1} + \gamma_{Qf} \times P_{Q1}$ = **48.4** kN/m

Total $F_{total\_v} = F_{stem} + F_{base} + F_{water\_v} + F_{P\_v}$ = **95.4** kN/m

Horizontal forces on wall

Surcharge load $F_{sur\_h} = K_A \times cos(\delta_{r.d}) \times \gamma_Q \times Surcharge_Q \times h_{eff}$ = **19.7** kN/m

Saturated retained soil $F_{sat\_h} = \gamma_G \times K_A \times cos(\delta_{r.d}) \times (\gamma_{sr}' - \gamma_w') \times (h_{sat} + h_{base})^2 / 2$ = **4.3** kN/m

Water $F_{water\_h} = \gamma_G \times \gamma_w' \times (h_{water} + d_{cover} + h_{base})^2 / 2$ = **9.6** kN/m

Moist retained soil $F_{moist\_h} = \gamma_G \times K_A \times cos(\delta_{r.d}) \times \gamma_{mr}' \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base}))$ = **44.5** kN/m

Base soil $F_{exc\_h} = -\gamma_{Gf} \times K_P \times cos(\delta_{b.d}) \times \gamma_b' \times (h_{pass} + h_{base})^2 / 2$ = **-3.1** kN/m

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{exc\_h} + F_{water\_h} + F_{sur\_h}$ = **75** kN/m

Overturning moments on wall

Surcharge load $M_{sur\_OT} = F_{sur\_h} \times x_{sur\_h}$ = **34.4** kNm/m

Saturated retained soil $M_{sat\_OT} = F_{sat\_h} \times x_{sat\_h}$ = **2** kNm/m

Water $M_{water\_OT} = F_{water\_h} \times x_{water\_h}$ = **4.5** kNm/m

Moist retained soil $M_{moist\_OT} = F_{moist\_h} \times x_{moist\_h}$ = **57.9** kNm/m

Total $M_{total\_OT} = M_{sat\_OT} + M_{moist\_OT} + M_{water\_OT} + M_{sur\_OT} = \mathbf{98.8}$ kNm/m

Restoring moments on wall

Wall stem $M_{stem\_R} = F_{stem} \times x_{stem} = \mathbf{43.4}$ kNm/m

Wall base $M_{base\_R} = F_{base} \times x_{base} = \mathbf{12.8}$ kNm/m

Line loads $M_{P\_R} = (abs(\gamma_{Gf} \times P_{G1} + \gamma_{Qf} \times P_{Q1})) \times p_1 = \mathbf{67.8}$ kNm/m

Total $M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{P\_R} = \mathbf{124}$ kNm/m

Check stability against overturning

Factor of safety $FoS_{ot} = M_{total\_R} / M_{total\_OT} = \mathbf{1.255}$

PASS - Maximum restoring moment is greater than overturning moment

Bearing pressure check

Vertical forces on wall

Wall stem $F_{stem} = \gamma_G \times A_{stem} \times \gamma_{stem} = \mathbf{31}$ kN/m

Wall base $F_{base} = \gamma_G \times A_{base} \times \gamma_{base} = \mathbf{16}$ kN/m

Line loads $F_{P\_v} = \gamma_G \times P_{G1} + \gamma_Q \times P_{Q1} = \mathbf{58.9}$ kN/m

Total $F_{total\_v} = F_{stem} + F_{base} + F_{water\_v} + F_{P\_v} = \mathbf{105.9}$ kN/m

Horizontal forces on wall

Surcharge load $F_{sur\_h} = K_A \times \cos(\delta_{r.d}) \times \gamma_Q \times Surcharge_Q \times h_{eff} = \mathbf{19.7}$ kN/m

Saturated retained soil $F_{sat\_h} = \gamma_G \times K_A \times \cos(\delta_{r.d}) \times (\gamma_{sr}' - \gamma_w') \times (h_{sat} + h_{base})^2 / 2 = \mathbf{4.3}$ kN/m

Water $F_{water\_h} = \gamma_G \times \gamma_w' \times (h_{water} + d_{cover} + h_{base})^2 / 2 = \mathbf{9.6}$ kN/m

Moist retained soil $F_{moist\_h} = \gamma_G \times K_A \times \cos(\delta_{r.d}) \times \gamma_{mr}' \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base})) = \mathbf{44.5}$ kN/m

Base soil $F_{pass\_h} = -\gamma_{Gf} \times K_P \times \cos(\delta_{b.d}) \times \gamma_b' \times (d_{cover} + h_{base})^2 / 2 = \mathbf{-3.1}$ kN/m

Total $F_{total\_h} = F_{sat\_h} + F_{moist\_h} + F_{pass\_h} + F_{water\_h} + F_{sur\_h} = \mathbf{75}$ kN/m

Moments on wall

Wall stem $M_{stem} = F_{stem} \times x_{stem} = \mathbf{43.4}$ kNm/m

Wall base $M_{base} = F_{base} \times x_{base} = \mathbf{12.8}$ kNm/m

Surcharge load $M_{sur} = -F_{sur\_h} \times x_{sur\_h} = \mathbf{-34.4}$ kNm/m

Line loads $M_P = (\gamma_G \times P_{G1} + \gamma_Q \times P_{Q1}) \times p_1 = \mathbf{82.5}$ kNm/m

Saturated retained soil $M_{sat} = -F_{sat\_h} \times x_{sat\_h} = \mathbf{-2}$ kNm/m

Water $M_{water} = -F_{water\_h} \times x_{water\_h} = \mathbf{-4.5}$ kNm/m

Moist retained soil $M_{moist} = -F_{moist\_h} \times x_{moist\_h} = \mathbf{-57.9}$ kNm/m

Total $M_{total} = M_{stem} + M_{base} + M_{sat} + M_{moist} + M_{water} + M_{sur} + M_P = \mathbf{39.9}$ kNm/m

Check bearing pressure

Propping force $F_{prop\_base} = F_{total\_h} = \mathbf{75}$ kN/m

Distance to reaction $\bar{x} = M_{total} / F_{total\_v} = \mathbf{377}$ mm

Eccentricity of reaction $e = \bar{x} - l_{base} / 2 = \mathbf{-423}$ mm

Loaded length of base $l_{load} = 2 \times \bar{x} = \mathbf{753}$ mm

Bearing pressure at toe $q_{toe} = F_{total\_v} / l_{load} = \mathbf{140.6}$ kN/m^2

Bearing pressure at heel $q_{heel} = \mathbf{0}$ kN/m^2

Effective overburden pressure $q = (t_{base} + d_{cover}) \times \gamma_b' = \mathbf{8}$ kN/m^2

Design effective overburden pressure $q' = q / \gamma_\gamma = \mathbf{8}$ kN/m^2

Foundation shape factors $s_c = 1$

Load inclination factors $H = F_{sur\_h} + F_{sat\_h} + F_{water\_h} + F_{moist\_h} = \mathbf{78.1}$ kN/m

$i_c = 0.5 \times (1 + \sqrt{(H / (l_{load} \times c_{b.u.d}) - 1)}) = \mathbf{0.886}$

Net ultimate bearing capacity $n_f = (\pi + 2) \times c_{b.u.d} \times s_c \times i_c + q =$ **304.1** kN/m^2

Factor of safety $FoS_{bp} = n_f / \max(q_{toe}, q_{heel}) =$ **2.162**

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 2.6.11

Concrete details - Table 3.1 - Strength and deformation characteristics for concrete

Concrete strength class C32/40

Characteristic compressive cylinder strength $f_{ck} =$ **32** N/mm^2

Characteristic compressive cube strength $f_{ck,cube} =$ **40** N/mm^2

Mean value of compressive cylinder strength $f_{cm} = f_{ck} + 8\ N/mm^2 =$ **40** N/mm^2

Mean value of axial tensile strength $f_{ctm} = 0.3\ N/mm^2 \times (f_{ck} / 1\ N/mm^2)^{2/3} =$ **3.0** N/mm^2

5% fractile of axial tensile strength $f_{ctk,0.05} = 0.7 \times f_{ctm} =$ **2.1** N/mm^2

Secant modulus of elasticity of concrete $E_{cm} = 22\ kN/mm^2 \times (f_{cm} / 10\ N/mm^2)^{0.3} =$ **33346** N/mm^2

Partial factor for concrete - Table 2.1N $\gamma_C =$ **1.50**

Compressive strength coefficient - cl.3.1.6(1) $\alpha_{cc} =$ **0.85**

Design compressive concrete strength - exp.3.15 $f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_C =$ **18.1** N/mm^2

Maximum aggregate size $h_{agg} =$ **20** mm

Reinforcement details

Characteristic yield strength of reinforcement $f_{yk} =$ **500** N/mm^2

Modulus of elasticity of reinforcement $E_s =$ **200000** N/mm^2

Partial factor for reinforcing steel - Table 2.1N $\gamma_S =$ **1.15**

Design yield strength of reinforcement $f_{yd} = f_{yk} / \gamma_S =$ **435** N/mm^2

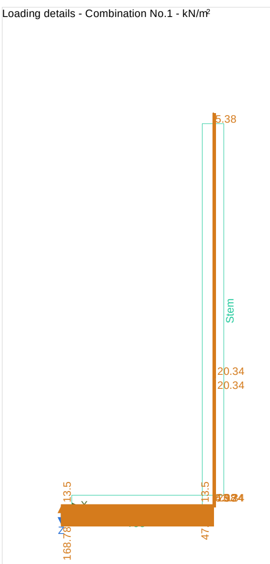
Cover to reinforcement

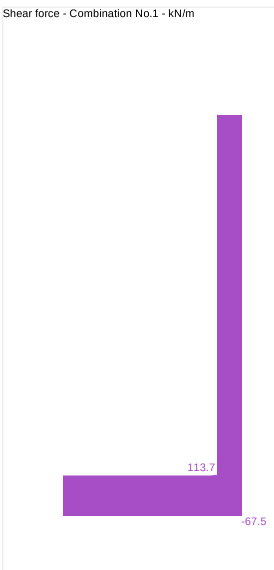
Front face of stem $c_{sf} =$ **40** mm

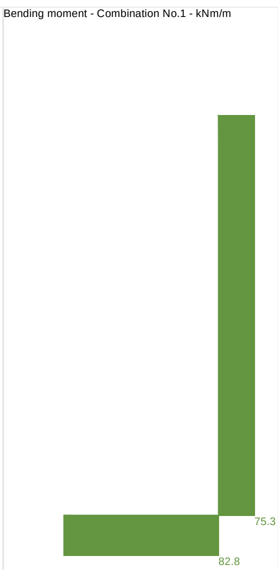
Rear face of stem $c_{sr} =$ **50** mm

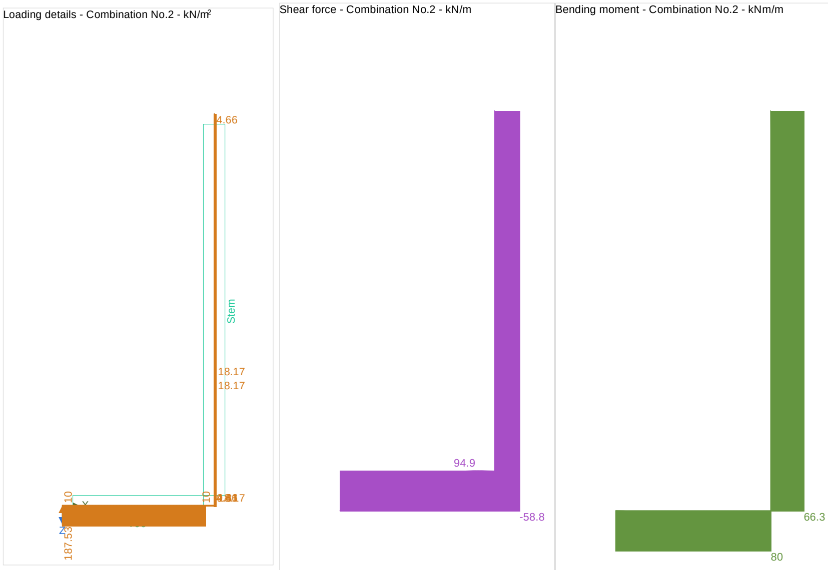
Top face of base $c_{bt} =$ **50** mm

Bottom face of base $c_{bb} =$ **75** mm









Check stem design at base of stem

Depth of section — h = **400** mm

Rectangular section in flexure - Section 6.1

Design bending moment combination 1 — M = **75.3** kNm/m

Depth to tension reinforcement — $d = h - c_{sr} - \phi_{sr} / 2 =$ **344** mm

$K = M / (d^2 \times f_{ck}) =$ **0.020**

$K' =$ **0.207**

K' > K - No compression reinforcement is required

Lever arm — $z = \min(0.5 + 0.5 \times (1 - 3.53 \times K)^{0.5}, 0.95) \times d =$ **327** mm

Depth of neutral axis — $x = 2.5 \times (d - z) =$ **43** mm

Area of tension reinforcement required — $A_{sr.req} = M / (f_{yd} \times z) =$ **530** mm²/m

Tension reinforcement provided — 12 dia.bars @ 150 c/c

Area of tension reinforcement provided — $A_{sr.prov} = \pi \times \phi_{sr}^2 / (4 \times s_{sr}) =$ **754** mm²/m

Minimum area of reinforcement - exp.9.1N — $A_{sr.min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d =$ **541** mm²/m

Maximum area of reinforcement - cl.9.2.1.1(3) — $A_{sr.max} = 0.04 \times h =$ **16000** mm²/m

$\max(A_{sr.req}, A_{sr.min}) / A_{sr.prov} =$ **0.717**

PASS - Area of reinforcement provided is greater than area of reinforcement required

Deflection control - Section 7.4

Reference reinforcement ratio — $\rho_0 = \sqrt{(f_{ck} / 1\ N/mm^2)} / 1000 =$ **0.006**

Required tension reinforcement ratio — $\rho = A_{sr.req} / d =$ **0.002**

Required compression reinforcement ratio — $\rho' = A_{sr.2.req} / d_2 =$ **0.000**

Structural system factor - Table 7.4N — $K_b =$ **0.4**

Reinforcement factor - exp.7.17 — $K_s = \min(500\ N/mm^2 / (f_{yk} \times A_{sr.req} / A_{sr.prov}), 1.5) =$ **1.422**

Limiting span to depth ratio - exp.7.16.a — $K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} / 1\ N/mm^2)} \times \rho_0 / \rho + 3.2 \times \sqrt{(f_{ck} / 1\ N/mm^2)} \times (\rho_0 / \rho - 1)^{3/2}] =$ **68.9**

Actual span to depth ratio — $h_{stem} / d =$ **9**

PASS - Span to depth ratio is less than deflection control limit

Crack control - Section 7.3

Limiting crack width	w_{max} = **0.3** mm
Variable load factor - EN1990 – Table A1.1	ψ_2 = **0.6**
Serviceability bending moment	M_{sls} = **47** kNm/m
Tensile stress in reinforcement	$\sigma_s = M_{sls} / (A_{sr.prov} \times z)$ = **190.8** N/mm^2
Load duration	Long term
Load duration factor	k_t = **0.4**
Effective area of concrete in tension	$A_{c.eff} = \min(2.5 \times (h - d), (h – x) / 3, h / 2)$ = **119000** mm^2/m
Mean value of concrete tensile strength	$f_{ct.eff} = f_{ctm}$ = **3.0** N/mm^2
Reinforcement ratio	$\rho_{p.eff} = A_{sr.prov} / A_{c.eff}$ = **0.006**
Modular ratio	$\alpha_e = E_s / E_{cm}$ = **5.998**
Bond property coefficient	k_1 = **0.8**
Strain distribution coefficient	k_2 = **0.5**
	k_3 = **3.4**
	k_4 = **0.425**
Maximum crack spacing - exp.7.11	$s_{r.max} = k_3 \times c_{sr} + k_1 \times k_2 \times k_4 \times \phi_{sr} / \rho_{p.eff}$ = **492** mm
Maximum crack width - exp.7.8	$w_k = s_{r.max} \times \max(\sigma_s – k_t \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_e \times \rho_{p.eff}), 0.6 \times \sigma_s) / E_s$
	w_k = **0.282** mm
	w_k / w_{max} = **0.938**

PASS - Maximum crack width is less than limiting crack width

Rectangular section in shear - Section 6.2

Design shear force	V = **67.5** kN/m
	$C_{Rd,c} = 0.18 / \gamma_C$ = **0.120**
	$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2)$ = **1.762**
Longitudinal reinforcement ratio	$\rho_l = \min(A_{sr.prov} / d, 0.02)$ = **0.002**
	$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5}$ = **0.463** N/mm^2
Design shear resistance - exp.6.2a & 6.2b	$V_{Rd.c} = \max(C_{Rd.c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$
	$V_{Rd.c}$ = **159.4** kN/m
	$V / V_{Rd.c}$ = **0.423**

PASS - Design shear resistance exceeds design shear force

Horizontal reinforcement parallel to face of stem - Section 9.6

Minimum area of reinforcement – cl.9.6.3(1)	$A_{sx.req} = \max(0.25 \times A_{sr.prov}, 0.001 \times t_{stem})$ = **400** mm^2/m
Maximum spacing of reinforcement – cl.9.6.3(2)	s_{sx_max} = **400** mm
Transverse reinforcement provided	10 dia.bars @ 150 c/c
Area of transverse reinforcement provided	$A_{sx.prov} = \pi \times \phi_{sx}^2 / (4 \times s_{sx})$ = **524** mm^2/m

PASS - Area of reinforcement provided is greater than area of reinforcement required

Check base design at toe

Depth of section	h = **400** mm

Rectangular section in flexure - Section 6.1

Design bending moment combination 1	M = **82.8** kNm/m
Depth to tension reinforcement	$d = h - c_{bb} - \phi_{bb} / 2$ = **317** mm
	$K = M / (d^2 \times f_{ck})$ = **0.026**
	K' = **0.207**

K' > K - No compression reinforcement is required

Lever arm	$z = \min(0.5 + 0.5 \times (1 - 3.53 \times K)^{0.5}, 0.95) \times d$ = **301** mm
Depth of neutral axis	$x = 2.5 \times (d – z)$ = **40** mm

Area of tension reinforcement required	$A_{bb.req} = M / (f_{yd} \times z) =$ **632** mm^2/m
Tension reinforcement provided	16 dia.bars @ 150 c/c
Area of tension reinforcement provided	$A_{bb.prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb}) =$ **1340** mm^2/m
Minimum area of reinforcement - exp.9.1N	$A_{bb.min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d =$ **498** mm^2/m
Maximum area of reinforcement - cl.9.2.1.1(3)	$A_{bb.max} = 0.04 \times h =$ **16000** mm^2/m
	$\max(A_{bb.req}, A_{bb.min}) / A_{bb.prov} =$ **0.472**

PASS - Area of reinforcement provided is greater than area of reinforcement required

Crack control - Section 7.3

Limiting crack width	$w_{max} =$ **0.3** mm
Variable load factor - EN1990 – Table A1.1	$\psi_2 =$ **0.6**
Serviceability bending moment	$M_{sls} =$ **59.3** kNm/m
Tensile stress in reinforcement	$\sigma_s = M_{sls} / (A_{bb.prov} \times z) =$ **146.9** N/mm^2
Load duration	Long term
Load duration factor	$k_t =$ **0.4**
Effective area of concrete in tension	$A_{c.eff} = \min(2.5 \times (h - d), (h – x) / 3, h / 2) =$ **120125** mm^2/m
Mean value of concrete tensile strength	$f_{ct.eff} = f_{ctm} =$ **3.0** N/mm^2
Reinforcement ratio	$\rho_{p.eff} = A_{bb.prov} / A_{c.eff} =$ **0.011**
Modular ratio	$\alpha_e = E_s / E_{cm} =$ **5.998**
Bond property coefficient	$k_1 =$ **0.8**
Strain distribution coefficient	$k_2 =$ **0.5**
	$k_3 =$ **3.4**
	$k_4 =$ **0.425**
Maximum crack spacing - exp.7.11	$s_{r.max} = k_3 \times c_{bb} + k_1 \times k_2 \times k_4 \times \phi_{bb} / \rho_{p.eff} =$ **499** mm
Maximum crack width - exp.7.8	$w_k = s_{r.max} \times \max(\sigma_s – k_t \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_e \times \rho_{p.eff}), 0.6 \times \sigma_s) / E_s$
	$w_k =$ **0.22** mm
	$w_k / w_{max} =$ **0.733**

PASS - Maximum crack width is less than limiting crack width

Rectangular section in shear - Section 6.2

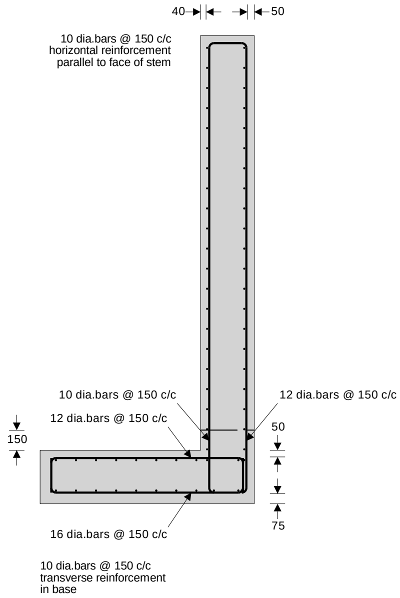
Design shear force	V = **113.7** kN/m
	$C_{Rd,c} = 0.18 / \gamma_C =$ **0.120**
	$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) =$ **1.794**
Longitudinal reinforcement ratio	$\rho_l = \min(A_{bb.prov} / d, 0.02) =$ **0.004**
	$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} =$ **0.476** N/mm^2
Design shear resistance - exp.6.2a & 6.2b	$V_{Rd.c} = \max(C_{Rd.c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$
	$V_{Rd.c} =$ **162.6** kN/m
	$V / V_{Rd.c} =$ **0.699**

PASS - Design shear resistance exceeds design shear force

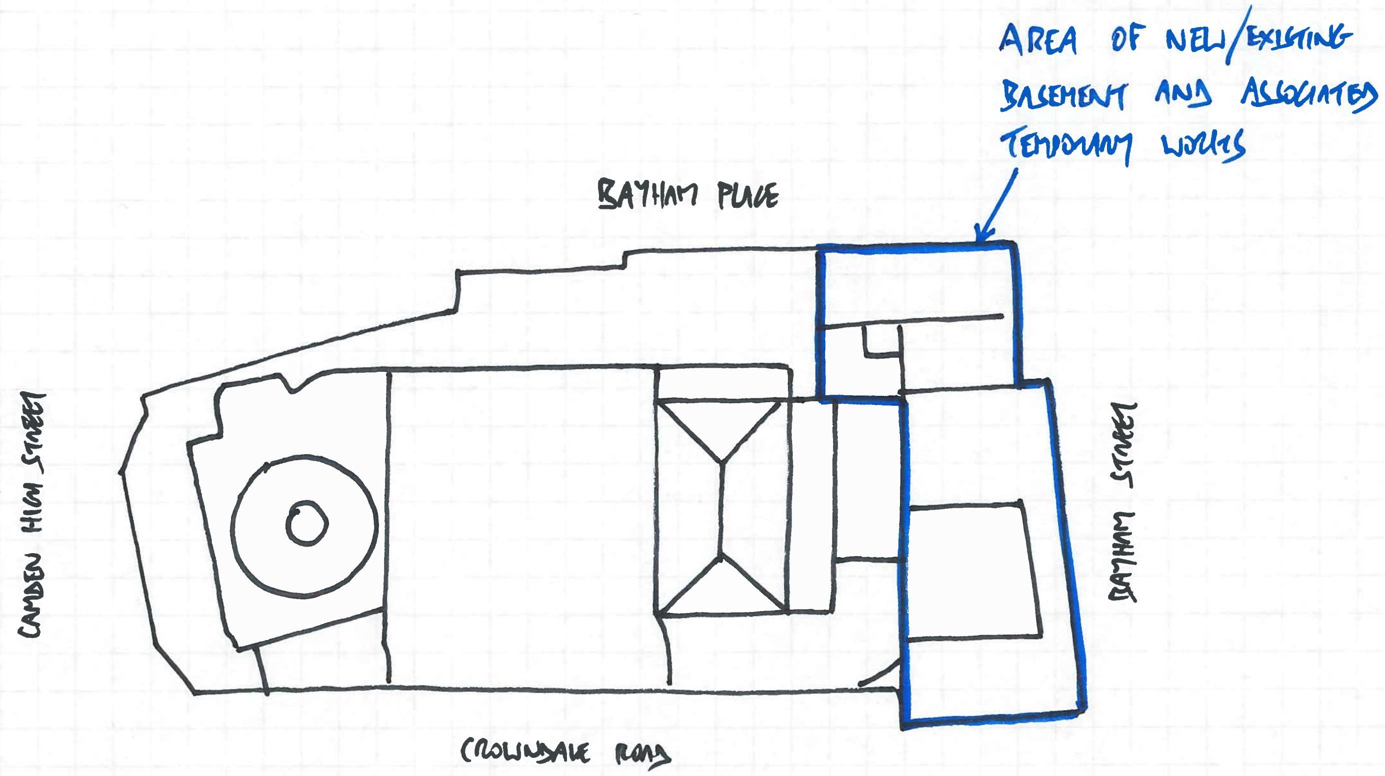
Secondary transverse reinforcement to base - Section 9.3

Minimum area of reinforcement – cl.9.3.1.1(2)	$A_{bx.req} = 0.2 \times A_{bb.prov} =$ **268** mm^2/m
Maximum spacing of reinforcement – cl.9.3.1.1(3)	$s_{bx\_max} =$ **450** mm
Transverse reinforcement provided	10 dia.bars @ 150 c/c
Area of transverse reinforcement provided	$A_{bx.prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) =$ **524** mm^2/m

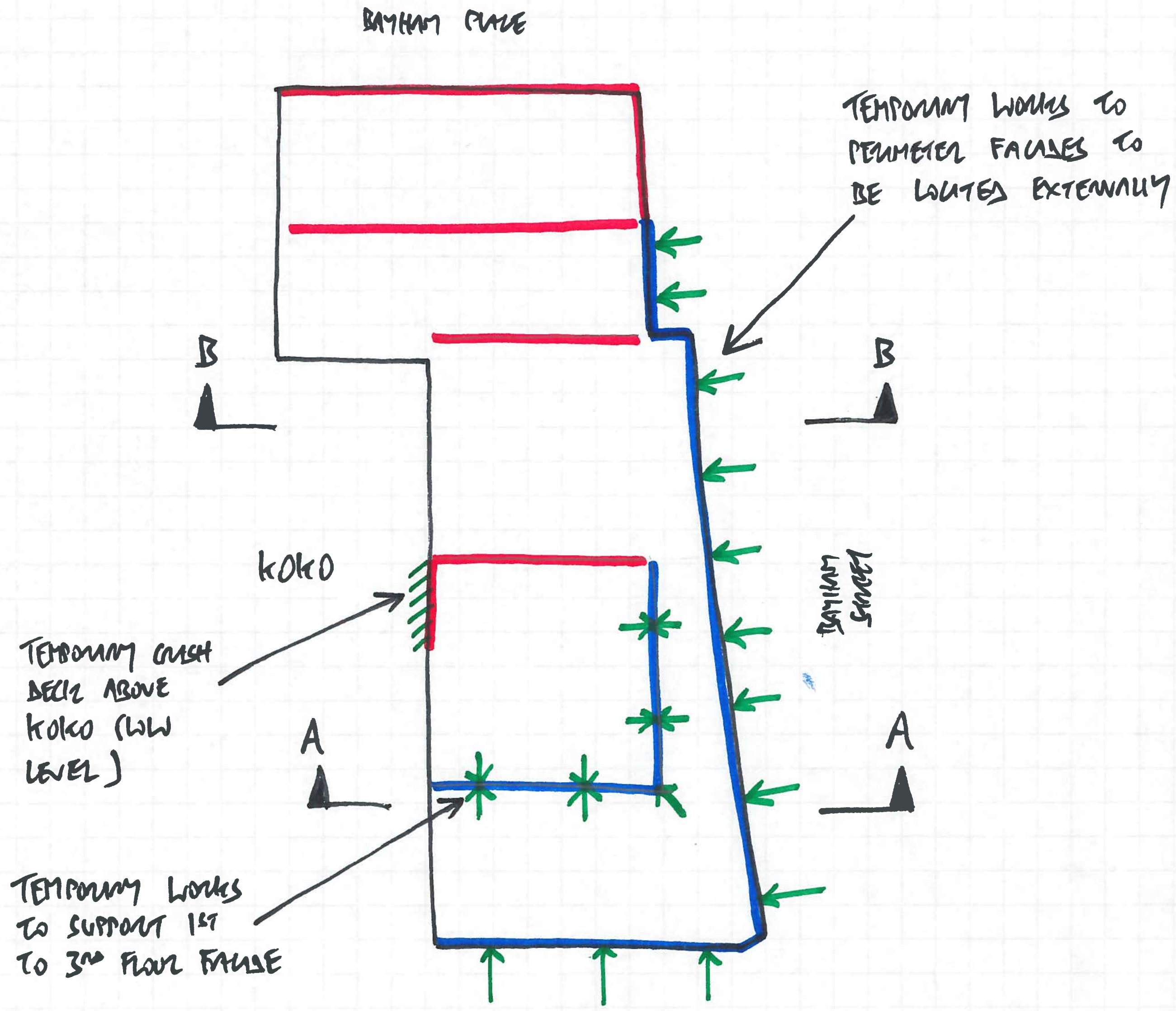
PASS - Area of reinforcement provided is greater than area of reinforcement required



Reinforcement details



SITE PLAN
NTS



PART PLAN
NTS

TEMPORARY WORKS, SEQUENCING & PROPPING

6.1 SITE SET UP

- ERECT SCAFFOLDING.
- ERECT HOARDING.
- SET UP SITE FACILITIES.
- INSTALL MONITORING SURVEY TARGETS.
- TERMINATE/PROTECT EXISTING SERVICES.
- CHECK CURRENT GROUNDWATER LEVELS.
- COMPLETE STRIP OUT.

(red) EXISTING WALLS TO BE DEMOLISHED

(blue) EXISTING WALLS TO BE RETAINED

(green) INDICATIVE LOCATION OF TEMPORARY WORKS

TO BE READ WITH HTS STRUCTURAL METHODOLOGY STATEMENT & BASEMENT IMPACT ASSESSMENT (REV C - DEC 2016), RSK BASEMENT IMPACT ASSESSMENT AND HTS SKETCHES SK40-45.

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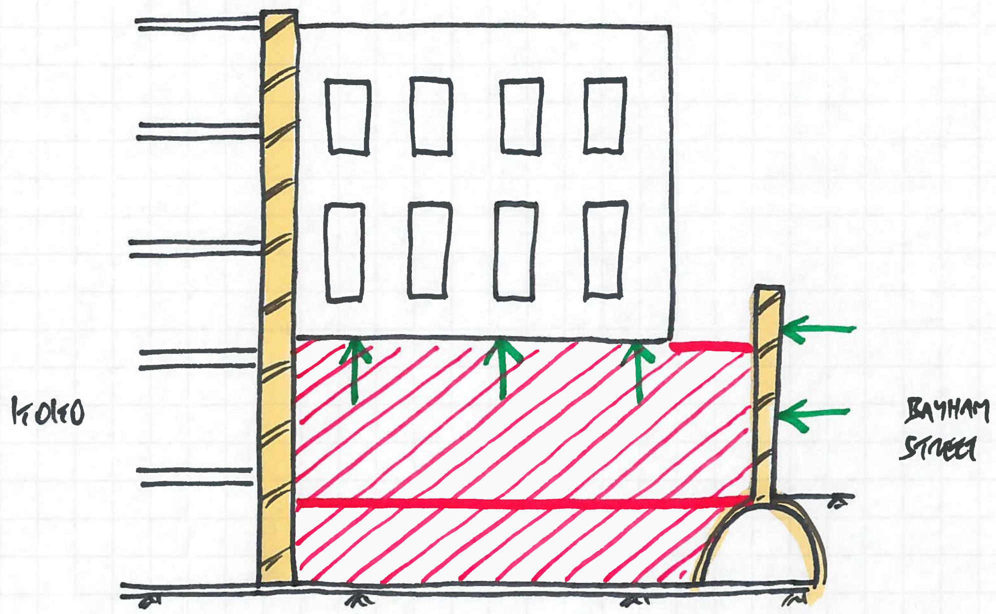
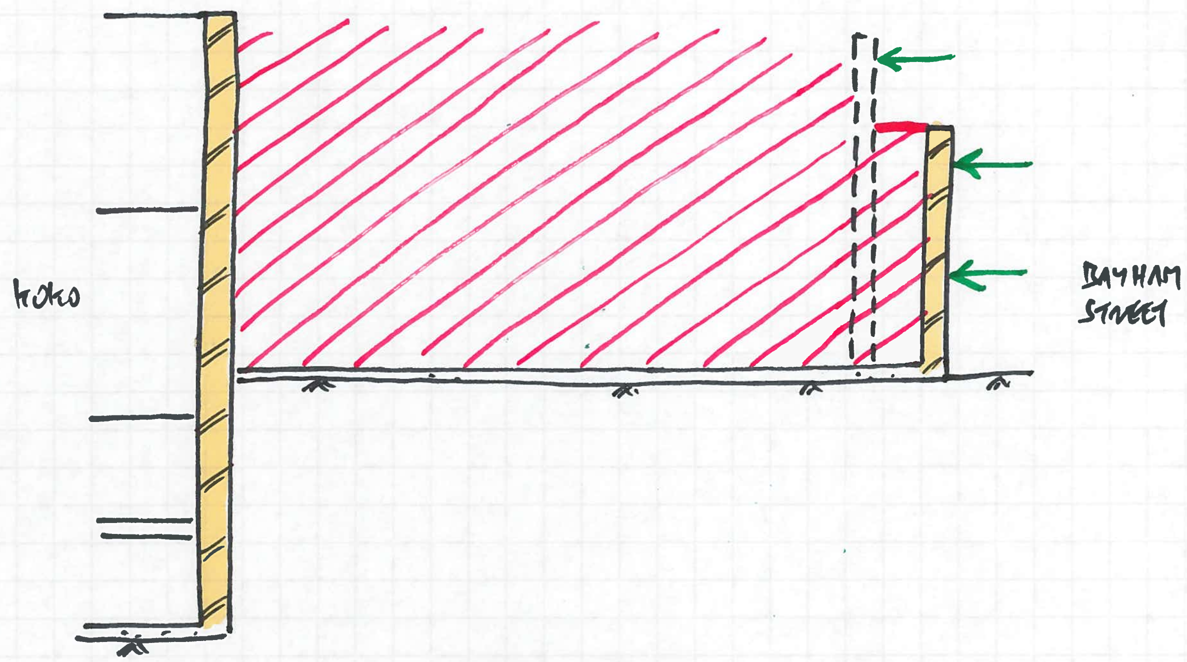
HEYNE TILLETT STEEL



SECTION A-A
NTS



SECTION B-B
NTS

6.2 DEMOLITION OF EXISTING STRUCTURE.

- INSTALL TEMPORARY WORKS TO RETAINED FACADES.
- COMMENCE DEMOLITION OF THE EXISTING SUPERSTRUCTURE FROM TOP LEVEL DOWN.
- GRUB OUT EXISTING FOUNDATIONS AT PILE LOCATIONS.

/// = DEMOLITION OF EXISTING STRUCTURE

TO BE READ WITH HTS SMS & BIA (REV C - DEC 2016), RSK BIA AND HTS SK40-45.

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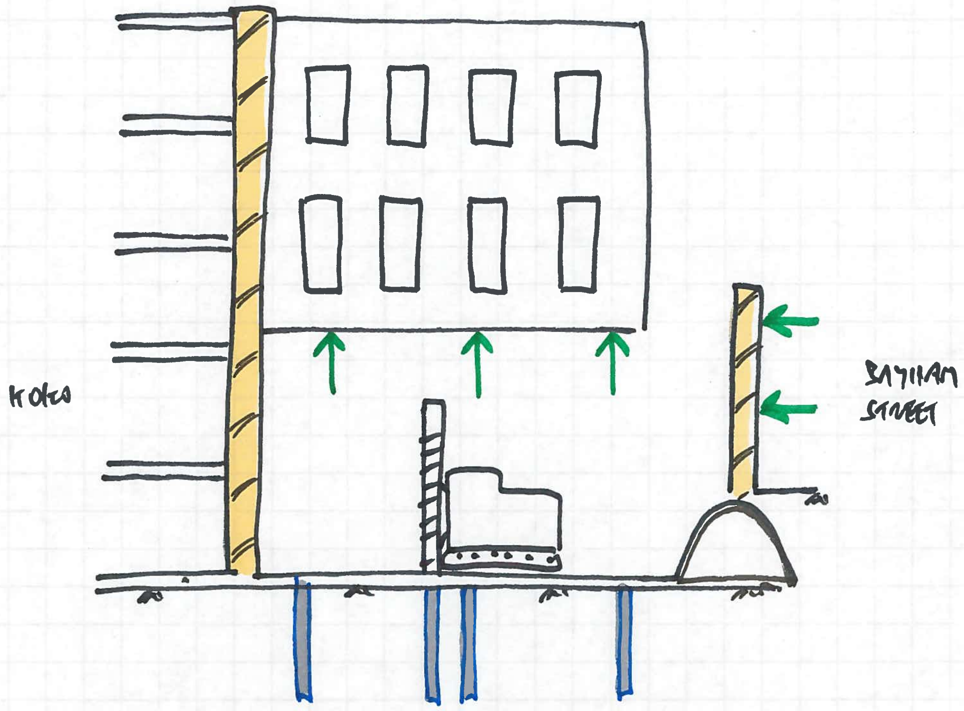
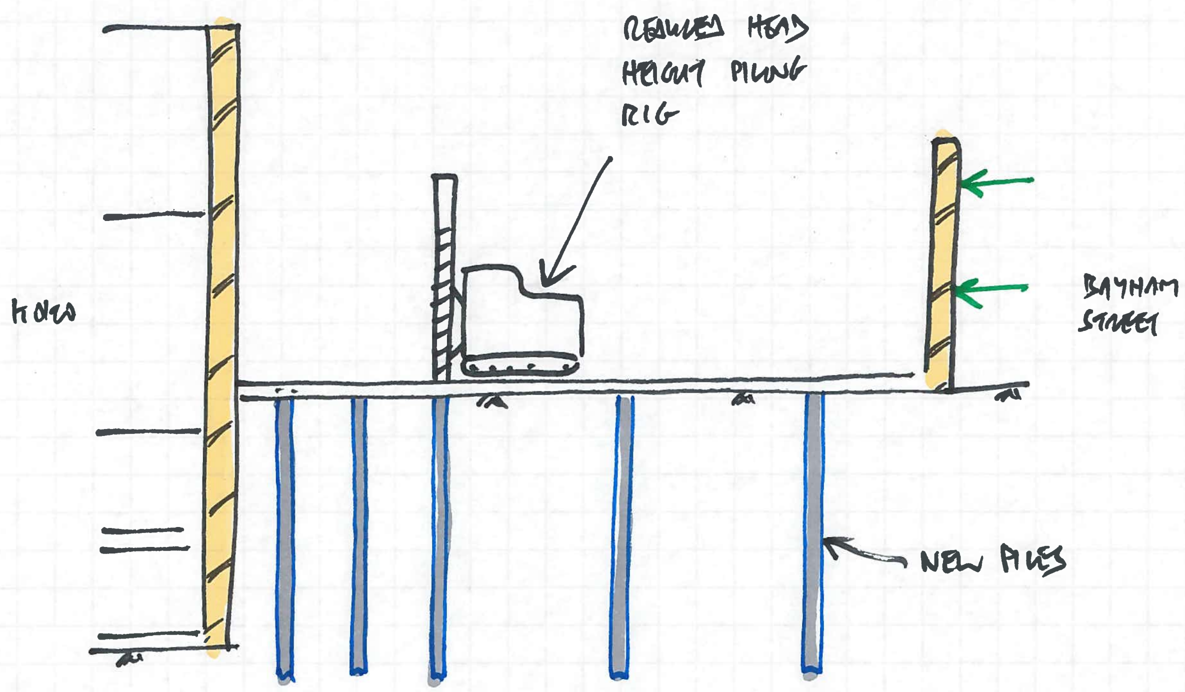
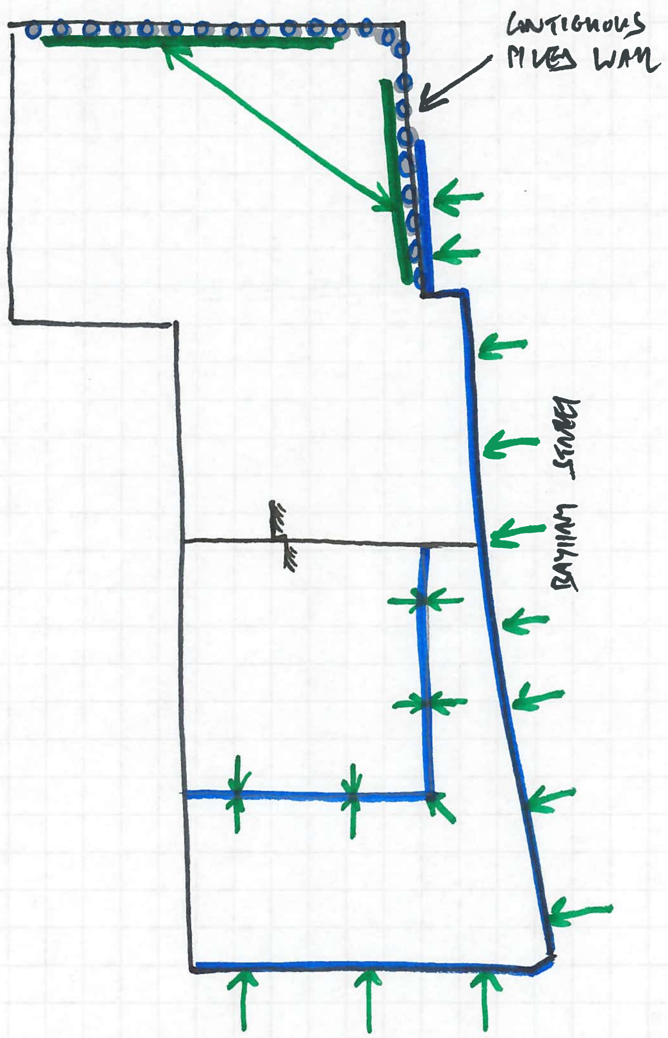
HEYNE TILLETT STEEL



SECTION A-A
NTS



SECTION B-B
NTS



PLAN NTS

6.3 PILING

- PROVIDE PILING MAT.
- INSTALL CONTIGUOUS PILES WALL.
- INSTALL PILES TO NEW FOUNDATIONS WITH REDUCED HEIGHT PILING RIG.
- INSTALL WALERS AND DIAGONAL PROPPING TO TOP OF CONTIGUOUS PILES WALL.

> TO BE READ WITH HTS SMS & BIA (REV C - DEC 2016), RSK BIA AND HTS SK40-45.

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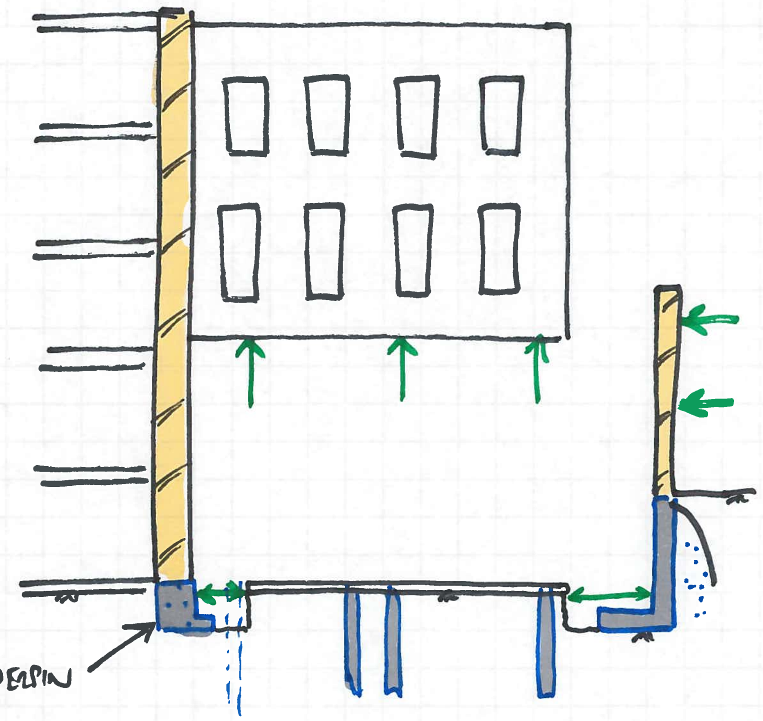
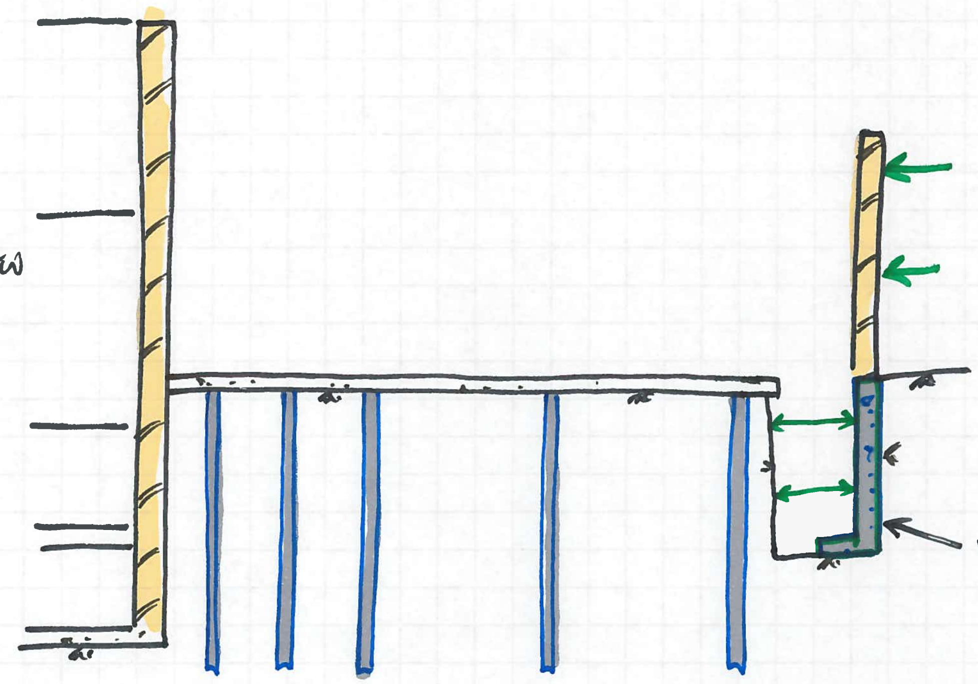


SECTION A-A
NTS



SECTION B-B
NTS

6.4 UNDERPINNING OF EXISTING WALLS

- COMMENCE INSTALLATION OF MASS & R.C. UNDERPINNING.
- INSTALL DEWATERING SUMP LOCATED CENTRALLY IN SITE TO ENABLE CONSTRUCTION OF PINS WHERE THE GROUND WATER LEVEL IS FOUND TO BE HIGH.
- PINS TO BE INSTALLED IN AGREED SEQUENCE WITH ADEQUATE TEMPORARY PROPPING/SHORING.
- EXCAVATIONS TO BE BACKFILLED TO LOWEST SUB LEVEL FOLLOWING COMPLETION OF PIN.

TO BE READ WITH HTS SMS & BIA (REV C - DEC 2016), RSK BIA AND HTS SK40-43.

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HEYNE TILLETT STEEL

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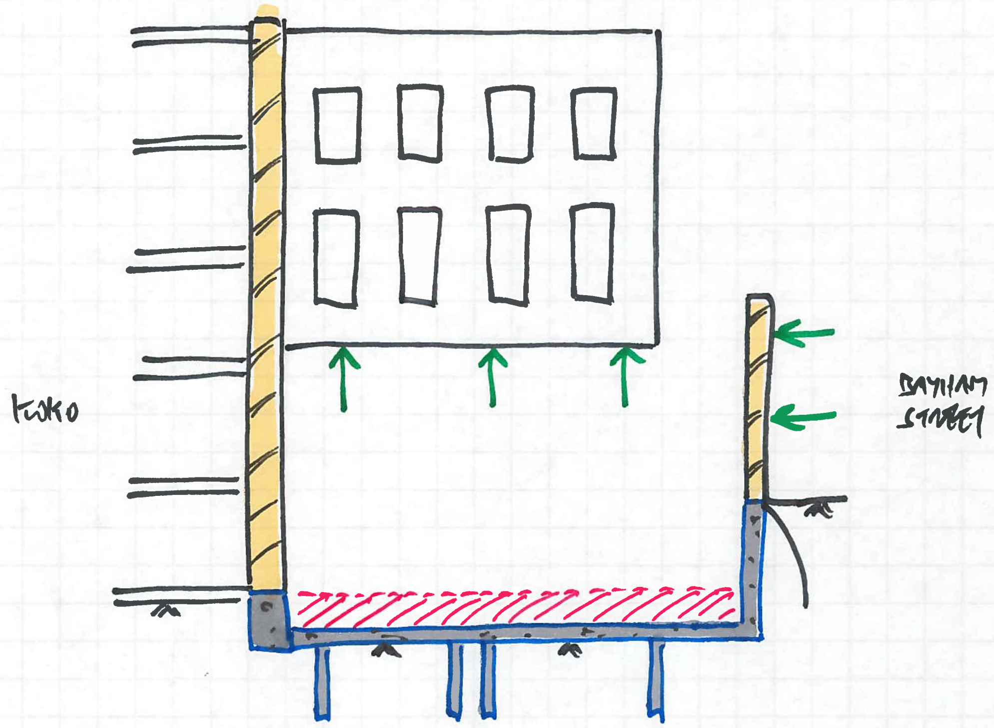

SECTION A-A
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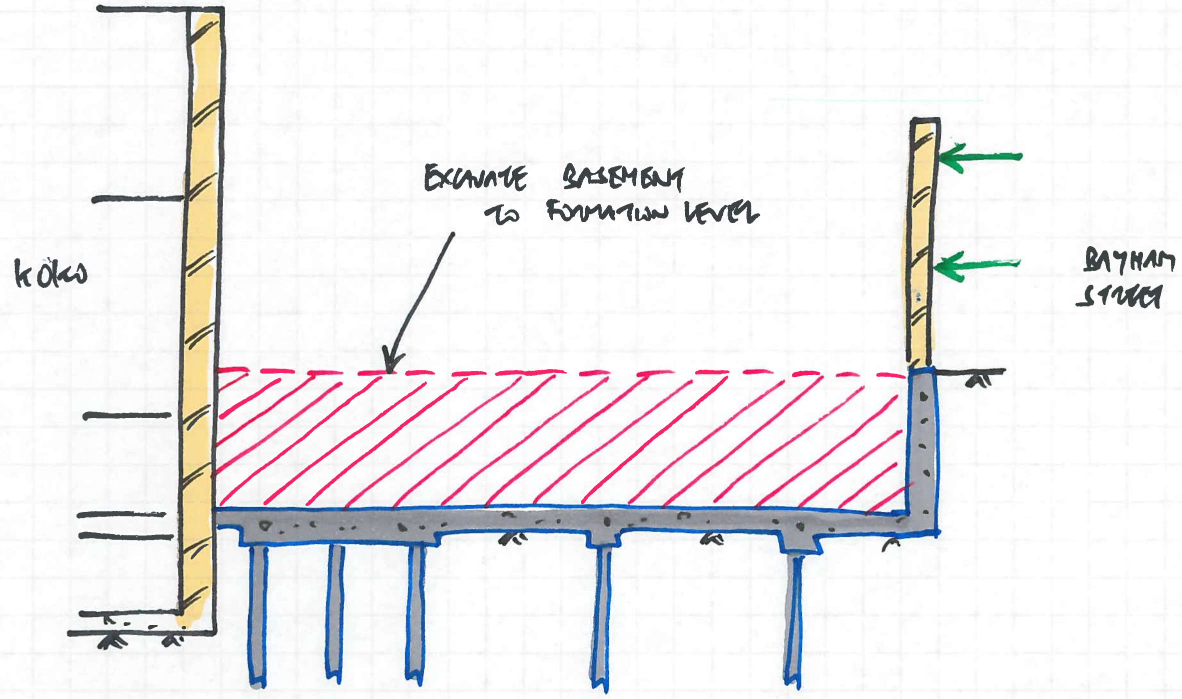

SECTION B-B
NTS

6.5/6.6 EXCAVATION OF BASEMENT, CASTING OF FOUNDATIONS, RC WALL AND BASEMENT

- COMPLETE EXCAVATION/DEMOLITION TO BASEMENT FORMATION LEVEL.
- ADDITIONAL TEMPORARY WORKS TO BE INSTALLED AS REQUIRED DURING REDUCED LEVEL DIG.
- COMPLETE OUTSTANDING UNDERPINNING IN THE AGREED SEQUENCE.
- INSTALL ADDITIONAL DEWATERING SUMP LOCATED CENTRALLY IN NEW BASEMENT.
- CUT DOWN PILES AS REQUIRED.
- CAST NEW FOUNDATIONS AND BASEMENT SLAB.

TO BE READ WITH HTS SMS & BIA (REV C-DEC 2016), RSK BIA AND HTS SK 40-45.

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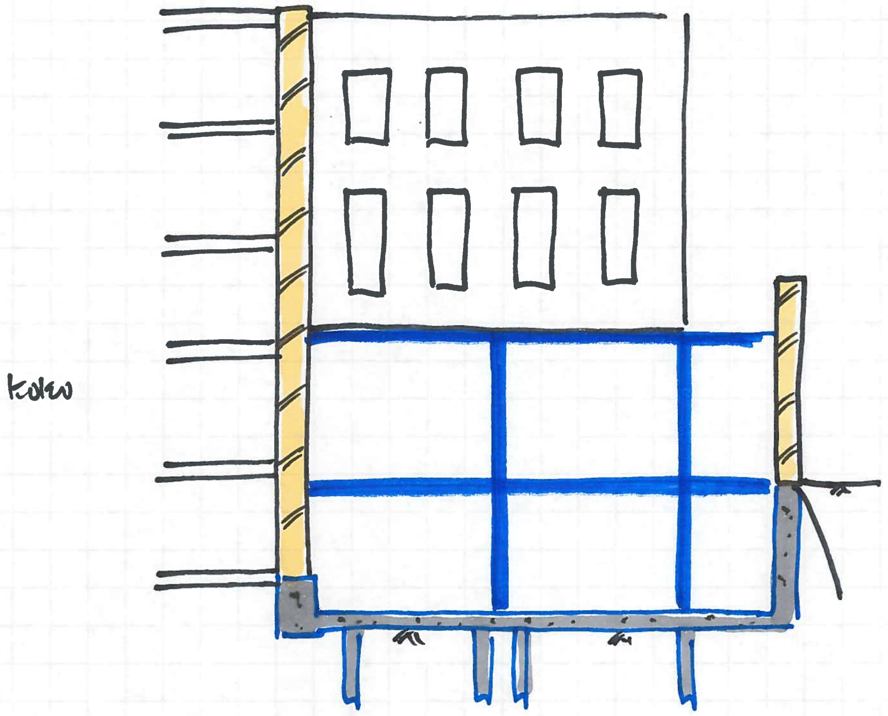
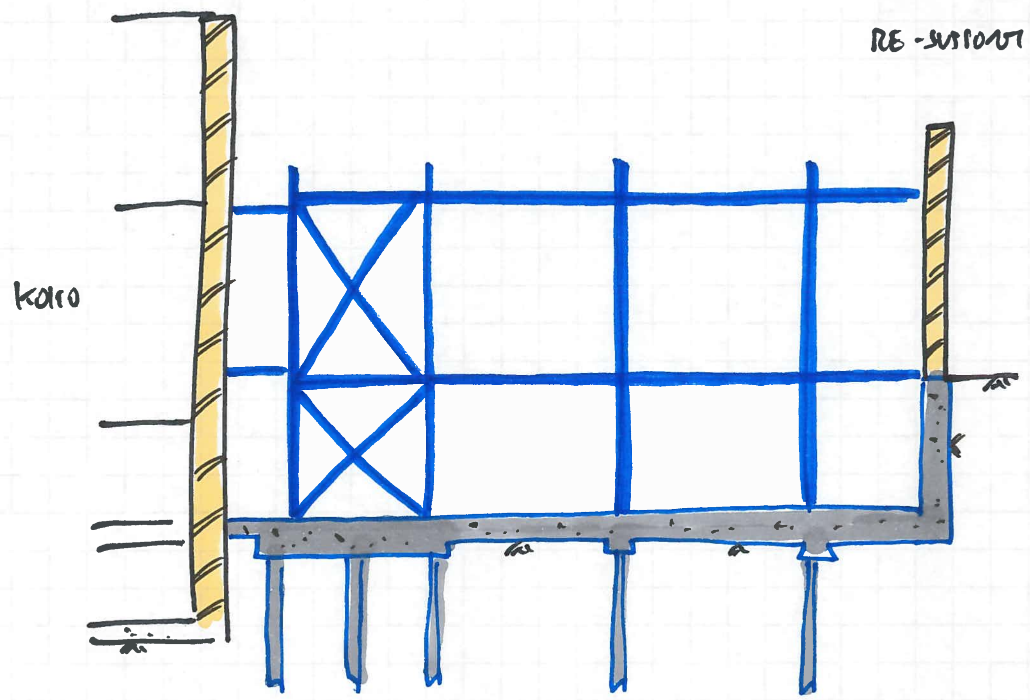


SECTION A-A
NTS

TEMPORARY WORKS REMOVED FOLLOWING INSTALLATION OF NEW SUPERSTRUCTURE AND RE-SUPPORT TO FACADES



SECTION B-B
NTS

6.7 COMPLETE SUPERSTRUCTURE WORKS & REMOVE TEMPORARY WORKS

- ERECT NEW SUPERSTRUCTURE AND PERMANENT SUPPORT TO RETAINED STRUCTURE.
- SEQUENTIALLY REMOVE TEMPORARY WORKS FOLLOWING CONFIRMATION FROM S.E.
- REMAINING INSTALLATION/ERECTION OF SUPERSTRUCTURE TO COMMENCE.

TO BE READ WITH HTS SMS & BIA (REV C - DEC 2016), RSK BIA AND HTS SK 40-45.

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HEYNE TILLETT STEEL

Query 2 – Land Stability

- Dimensions of the piles used in the ground movement assessment of the contiguous piled retaining wall (as confirmed by RSK):
  - Diameter = 450mm
  - Length = 12.3m deep
  - Toe depth = 10.2m AOD

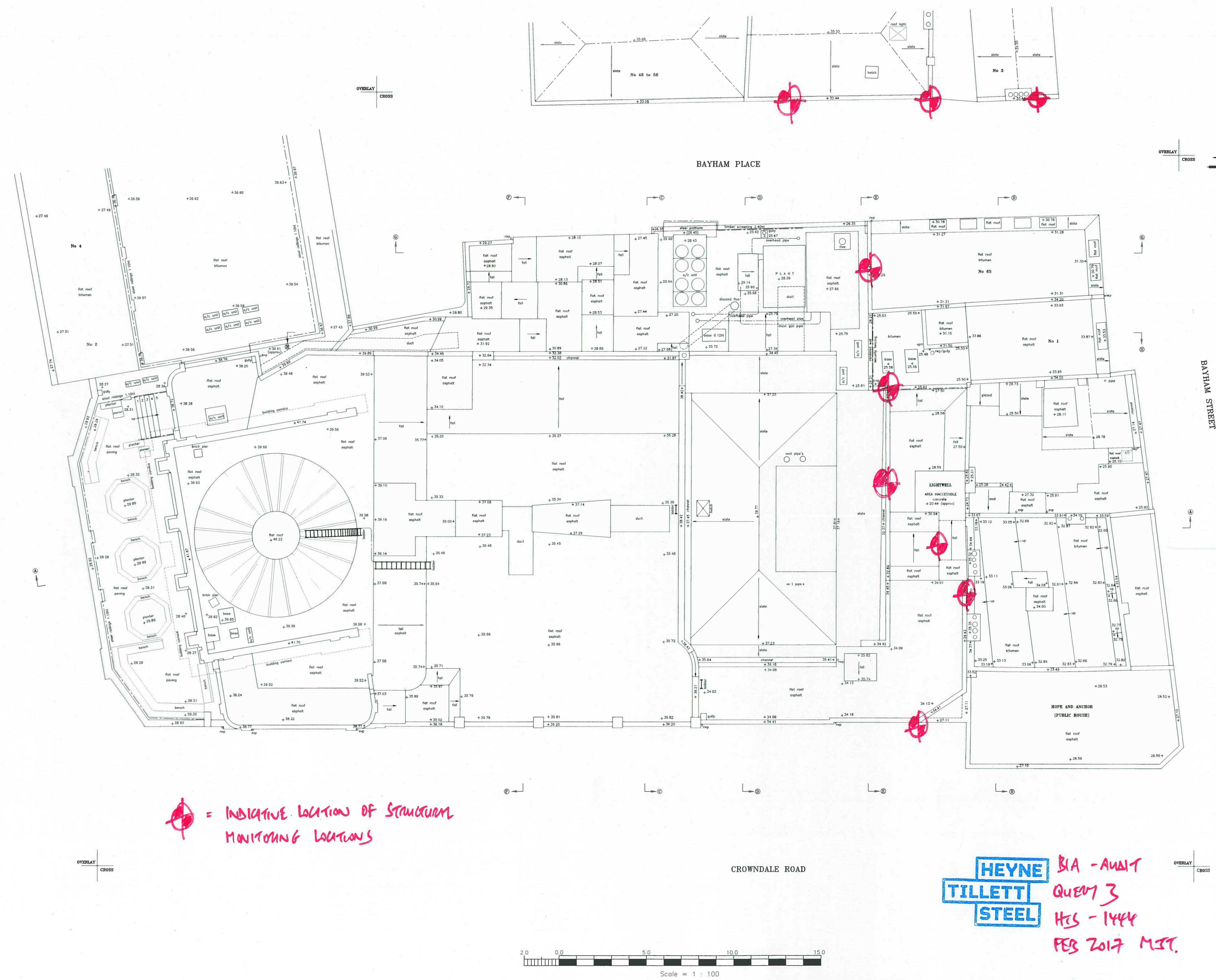
Query 3 – Land Stability

- Structural monitoring – see below for an outline structural monitoring plan. The final detailed monitoring plans with adjacent buildings will be agreed with the appointed contractor. There are no party wall awards as the buildings on the site are under the same ownership. A site plan with indicative locations of monitoring points is appended:

- The integrity of excavations is to be maintained by the contractor at all times.
- The contractor shall be responsible for establishing and setting out of all levels and datum.
- The contractor is to provide a schedule of conditions of all adjacent buildings with photographs agreed with the CA prior to works commencing.
- Any cracks to the fabric of the adjacent structures or perimeter retained walls are to have graduated tell tales applied prior to the commencement of the demotion works, or as they are uncovered.
- The perimeter walls shall be monitored regularly for signs of movement by all of the follow methods:
  - Visual inspection
  - Accurate survey techniques
  - Graduated tell tales
- Movement shall be measured with the use of prism reflector targets. Results are to be tabulated and represented graphically and submitted on a weekly basis.
- Monitoring to be undertaken until the retained walls are tied into the new structure.
- Monitoring is to be undertaken for a suitable period prior to main demolition and excavation works commencing to enable base movement due to daily thermal effects to be established.
- Readings should be taken at the same time each day to minimise the effects of temperature fluctuations.
- Frequency of monitoring to be in accordance with CIRIA guide C579.
- Lateral or vertical movements and deflections of the perimeter retained walls and adjacent structures above those due to daily thermal effects should be monitored against an agreed traffic light system to be proposed by the contractor, based on the following:
  - Green - The wall movement is within an acceptable range. Site works and frequency of monitoring can proceed as planned. Max lateral/vertical deflection trigger level 5mm.
  - Amber - Wall movement exceeds the green limit but is below the red limit. Monitoring frequency is increased. A meeting is convened to review working procedures and assumptions. Max lateral/vertical deflection trigger level is greater than 5mm but less than 10mm.
  - Red - Wall movement exceeds amber control limit. Work is stopped immediately and team meeting convened to identify the reason for reaching the limit and any remedial action or propping that may be required.
- Structural Engineer to be present on site to confirm remedial action.
- Differential movement trigger levels:
  - Amber - Differential movement between adjacent horizontal targets which exceed 3mm difference in figures but less than 5mm. A meeting is convened to review working procedures, condition of AO finishes & assumptions.
  - Red - Differential movement between adjacent horizontal targets which exceeds 5mm difference in figures. Work is stopped immediately and team meeting is convened to identify the reason for reaching the limit and any remedial action required.
- The contractor is to undertake a movement survey of the piled wall during basement construction twice weekly. Contractor to confirm method of survey. A brief report detailing monitoring locations & movement is to be issued 24 hours following survey.

- Suggested frequency of monitoring:

Activity	Suggested frequency
From installation of monitoring to start of demolition	Weekly until reading have stabilised (allow 4 weeks)
During demolition and excavation	Weekly
Construction of all remaining structure	Fortnightly
Remainder of contract period	Every 3 months
During defects liability period	Twice, at least 6 months apart



Notes

THIS SURVEY HAS BEEN PREPARED WITH A SCALING ACCURACY FOR A PLOT AT A SCALE OF 1/100

ALL LEVELS ARE IN METRES DERIVED FROM GPS TRANSFORMATION OSGM02

THE CO-ORDINATES ARE DERIVED FROM THE ORDNANCE SURVEY ACTIVE STATION NETWORK OSTM02 (BASE STATION ST02)

sh	sill to head height
fs	floor to sill height
u/s	underside height
t/s	topside height
fb	floorboard direction
conc	concrete
rl	roof light
cup'd	cupboard
fp	fireplace
sd	sliding door
svp	soil and vent pipe
rwp	rain water pipe
©	carpet
(3.17)	room height
- - - -	roof slope
———	radiator

NOTE:
R2= FLOOR PLANS EXTENDED 08/08/16

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KOKO
CAMDEN HIGH STREET
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client
BURKE HUNTER ADAMS LLP
On Behalf Of
VEVIL INTERNATIONAL LIMITED

title	dwg no
ROOF PLAN	23745A-8-R2
scale	date
1/100	JANUARY 2016

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Query 4 – Land Stability

N/A - Ongoing

Query 5 – Flood Risk

- Surface Water Floor Risk – please see the following response from RSK.

  "By way of background, if intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse. Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur. Excess surface water flows from the site are believed to drain into the surrounding Thames Water sewer network. For the avoidance of all doubt, the surrounding private drainage and highway drainage and/or surface/combined sewer network would either have to be blocked or overflowing for there to be any risk of surface water flooding in the area.

  - *There is a surface water flow path along Crowndale Road to the south, which extends (to a lesser extent) up Camden High Street to the west, Bayham Street to the east and into Bayham Place to the north of the site. The flood risk associated with this flow path ranges from **low** to **high**, however, the flow pathways do not encroach onto the site and <u>the site itself is assessed as being at **very low** risk from surface water flooding.</u> Meaning that any surface water flows are likely to be confined to the surrounding road network, and probably contained within the existing road gullies adjacent to the pavements surrounding the site.*

  - *As the area of high risk is confined to the surrounding road network, it is likely that surface water would be prevented from flowing through the site due to raised kerbs and the walls along the boundaries of the site. From Google Street View, it seems like there is a degree of freeboard between the road gullies and the site doorways, probably between 100mm and 200mm, meaning that flood depths would have to exceed these depths in order to flood the site.*

  - *Further reference to the expected flood depths mapping in the surrounding road network indicate that expected flood depths are likely to be less than 300mm and have a velocity in excess of 0.25m/s. The main flow route is expected to be north to south down Camden High Street then west to east along Crowndale Road.*

  - *The overall risk of flooding to the site from surface water is considered low, and therefore further site specific mitigation is not considered necessary. "*

Query 6 – Flood Risk

- Proposed ground water control measures:
    - The ground water level has been measured below the proposed basement slab level. Localised dewatering will only be required if the ground water level is found to be higher than expected.
    - During construction – localised dewatering is proposed during construction via sump pumping. The sump will be located in the centre of the site to keep the dewatered level local to the site works. The dewatering will be monitored to ensure that no fines are washed in to the sump.
    - Permanent works – A Grade 3 waterproofing system is proposed in the basement areas. A drained cavity system will be installed enabling ground water collection within sump locations. Sump pumps will pump ground water via a rising main to ground floor level where it will be discharged via gravity into the combined Thames Water sewer network. Non return valves will be used to mitigate against sewer surcharging.

Query 7 – Hydrology

N/A - Ongoing