CALVERT BRAIN & FRAULO
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 Portland Street, King's Lynn, Norfolk
PE30 1PB Tel : 01553 766220

Project				Job Ref.	
South Wootton Parish Council Offices				218608	
Section				Sheet no./rev.	
Extension - Structural Design - SD				SD / 1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
JRR	27/10/2021	RWB	29/10/2021		

General Loads and Information.

Roof Load.

Dead Roof Load @ SLS	DRS = **1.25** kN/m^2
Live Roof Load @ SLS	LRS = **0.85** kN/m^2
Total Roof Load @ SLS	TRS = DRS + LRS = **2.10** kN/m^2
Total Roof Load @ ULS	TRU = (1.4 $\times$ DRS) + (1.6 $\times$ LRS) = **3.11** kN/m^2

Cavity Wall Load.

Brickwork	BWK = 0.1025m $\times$ 18kN/m^3 = **1.85** kN/m^2
Insulation	INS = **0.10** kN/m^2
Blockwork	BLK = 0.1m $\times$ 15kN/m^3 = **1.50** kN/m^2
Plaster & Skim	PS = **0.20** kN/m^2
Total Cavity Wall Load @ SLS	TCWS = BWK + INS + BLK + PS = **3.65** kN/m^2
Total Cavity Wall Load @ ULS	TCWU = 1.4 $\times$ TCWS = **5.10** kN/m^2

Foundation and Soils Investigation Information.

A foundation and soils investigation was undertaken on Tuesday 26th October 2021 by Calvert Brain & Fraulo Limited with the assistance of Smith Building Servcies Limited.

The results of this investigation are enclosed within Appendix 2 of these calculations as sketch number 218608 / SI-01.

The excavations revealed a 225mm thick concrete strip foundation located 725mm below existing ground level and a further 160mm below exisitng damp proof course (DPC) level. The foundation projected 135mm from the external facing brickwork face. Assuming that the cavity wall is located centrally to the strip foundation, the overall width would equate to 550mm.

A hand augured borehole was excavated beyond the base of the trial hole and revealed dry, firm, compact light brown SAND to approximately 1000mm bleow ground level, overlying, compact, dry, dark brown SAND and GRAVEL extending to the borehole end at approximately 2000mm below ground level.

The above soil findings would coincide with the likely soils to be encountered at this site as noted on the Geological Map of Great Britain and we would recommend that a maximum assumed bearing capacity of 75kN/m^2 be used for calculation purposes.

CALVERT BRAIN & FRAULO
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 Portland Street, King's Lynn, Norfolk
PE30 1PB Tel : 01553 766220

Project				Job Ref.	
South Wootton Parish Council Offices				218608	
Section				Sheet no./rev.	
Extension - Structural Design - SD				SD / 2	
Calc. by	Date	Chk'd by	Date	App'd by	Date
JRR	27/10/2021	RWB	29/10/2021		

Design Beams over Meeting Room Opening.

A new opening is to be formed between the former meeting room and the extened meeting room.

Clear Span of Beam S = **5340** mm

Length of Bearing Lb = **200** mm

Design Length of Beam L = S + (2 × (Lb / 2)) = **5540** mm
Note : Design Length of Beam is NOT the Overall Length of Beam.
Note : Overall Length of Beam MUST be determined on site prior to ordering of materials.

Existing Meeting Room Side Beam.
Dead UDL @ SLS DUDLE = ((6.0m / 2) × DRS) + ((1.5m / 2) × DRS) = **4.69** kN/m
Note : Self-weight of steelwork will be added to this load by the design software.
Live UDL @ SLS LUDLE = ((6.0m / 2) × LRS) + ((1.5m / 2) × LRS) = **3.19** kN/m

Steel Beam will be designed using TEKLA Simple Beam Design Software.

The results are contained with Appendix 1.

Steel Beam required :
Existing Side :
300 x 100 PFC x 46 kg/m Minimum Grade S 355
OR
300 x 100 RHS x 6.3 Minimum Grade S 355
OR
305 x 127 UB x 48 kg/m Minimum Grade S 355

CALVERT BRAIN & FRAULO
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 Portland Street, King's Lynn, Norfolk
PE30 1PB Tel : 01553 766220

Project				Job Ref.	
South Wootton Parish Council Offices				218608	
Section				Sheet no./rev.	
Extension - Structural Design - SD				SD / 3	
Calc. by	Date	Chk'd by	Date	App'd by	Date
JRR	27/10/2021	RWB	29/10/2021		

Check Bearing - Design Pad Stone - Meeting Room Opening Beam.

With reference to Appendix 1, the following Reactions are to be used.

Dead Reaction @ SLS	DR = 1.2kN + 13.0kN = **14.20** kN
Live Reaction @ SLS	LR = 8.9kN = **8.90** kN

With reference to the previous design Section, the following UDL's are to be used.

Dead UDL @ SLS	DUDL = 4.69kN/m = **4.69** kN/m
Live UDL @ SLS	LUDL = 3.19kN/m = **3.19** kN/m

MASONRY BEARING DESIGN TO BS5628-1:2005

Masonry details

Masonry type	**Aggregate concrete blocks (25% or less formed voids)**
Compressive strength of unit	p_{unit} = **3.6** N/mm^2
Mortar designation	**iii**
Least horizontal dimension of masonry units	l_{unit} = **100** mm
Height of masonry units	h_{unit} = **215** mm
Category of masonry units	**Category II**
Category of construction control	**Normal**
Partial safety factor for material strength	γ_m = **3.5**
Thickness of load bearing leaf	t = **100** mm
Effective thickness of masonry wall	t_{ef} = **100** mm
Height of masonry wall	h = **2400** mm
Effective height of masonry wall	h_{ef} = **2400** mm

Bearing details

Beam spanning in plane of wall	
Width of bearing	B = **100** mm
Length of bearing	l_b = **250** mm

Compressive strength from Table 2 BS5628:Part 1 - aggregate concrete blocks (25% or less formed voids)

Mortar designation	Mortar = **"iii"**
Block compressive strength	p_{unit} = **3.6** N/mm^2
Characteristic compressive strength (Table 2c)	f_{kc} = **1.70** N/mm^2
Characteristic compressive strength (Table 2d)	f_{kd} = **3.50** N/mm^2
Height of solid block	h_{unit} = **215.0** mm
Least horizontal dimension	l_{unit} = **100.0** mm
Block ratio	ratio = h_{unit} / l_{unit} = **2.2**

Ratio between 0.6 and 4.5 - OK

Characteristic compressive strength	f_k = **3.50** N/mm^2

Loading details

Characteristic concentrated dead load	G_k = **14** kN
Characteristic concentrated imposed load	Q_k = **9** kN
Design concentrated load	F = (G_k × 1.4) + (Q_k × 1.6) = **34.1** kN
Characteristic distributed dead load	g_k = **4.7** kN/m
Characteristic distributed imposed load	q_k = **3.2** kN/m
Design distributed load	f = (g_k × 1.4) + (q_k × 1.6) = **11.7** kN/m

Masonry bearing type

Bearing type	**Type 1**
Bearing safety factor	γ_{bear} = **1.25**

Check design bearing without a spreader

Design bearing stress $f_{ca} = F / (B \times l_b) + f / t =$ **1.482** N/mm^2

Allowable bearing stress $f_{cp} = \gamma_{bear} \times f_k / \gamma_m =$ **1.250** N/mm^2

FAIL - Design bearing stress exceeds allowable bearing stress, use a spreader

Spreader details

Length of spreader $l_s =$ **325** mm

Depth of spreader $h_s =$ **215** mm

Edge distance $s_{edge} = \max(0\ mm, x_{edge} – (l_s - B) / 2) =$ **0** mm

Spreader bearing type

Bearing type **Type 3**

Bearing safety factor $\gamma_{bear} =$ **2.00**

Check design bearing with a spreader

Loading acts eccentrically within middle third – triangular stress distribution

Eccentricity of load $e = (l_s – l_b) / 2 =$ **38** mm

Maximum bearing stress $f_{ca} = F \times (1 + (6 \times e / l_s)) / (l_s \times t) + f / t =$ **1.893** N/mm^2

Allowable bearing stress $f_{cp} = \gamma_{bear} \times f_k / \gamma_m =$ **2.000** N/mm^2

PASS - Allowable bearing stress exceeds design bearing stress

Check design bearing at 0.4 × h below the bearing level

Slenderness ratio	h_{ef} / t_{ef} = **24.00**
Eccentricity at top of wall	e_x = **0.0** mm
From BS5628:1 Table 7	
Capacity reduction factor	β = **0.61**
Length of bearing distributed at 0.4 × h	l_d = **1210** mm
Maximum bearing stress	$f_{ca} = F / (l_d \times t) + f / t$ = **0.399** N/mm^2
Allowable bearing stress	$f_{cp} = \beta \times f_k / \gamma_m$ = **0.605** N/mm^2

PASS - Allowable bearing stress at 0.4 × h below bearing level exceeds design bearing stress

Ensure : Steel Beam MUST have a Minimum of 250mm End Bearing

Provide : 325mm Long x 100mm Wide x 215mm High Concrete Pad Stone

CALVERT BRAIN & FRAULO
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 Portland Street, King's Lynn, Norfolk
PE30 1PB Tel : 01553 766220

Project				Job Ref.	
South Wootton Parish Council Offices				218608	
Section				Sheet no./rev.	
Extension - Structural Design - SD				SD / 7	
Calc. by	Date	Chk'd by	Date	App'd by	Date
JRR	27/10/2021	RWB	29/10/2021		

Design Lintels over Meeting Room / Kitchen Openings.

Maximum Clear Span — S = **1200** mm

Length of Bearings — Lb = **150** mm

Design Length of Beam — L = S + (2 × (Lb / 2)) = **1350** mm

Note : Design Length of Beam is NOT the Overall Length of Beam.

Note : Overall Length of Beam MUST be determined on site prior to ordering of materials.

Dead UDL @ SLS — DUDL = ((13.08m / 2) × DRS) + (0.45m × (BLK+PS+PS)) = **9.03** kN/m

Note : Self-weight of steelwork will be added to this load by the design software.

Live UDL @ SLS — LUDL = (13.08m / 2) × LRS = **5.56** kN/m

Total UDL @ SLS — TUDL = DUDL + LUDL = **14.59** kN/m

Total Load on Lintel — TLL = TUDL × L = **19.70** kN

CATNIC BHD 100 Lintel with 150mm End Bearing

Safe Working Load — SWL = **29** kN

Result : PASS

Foundation Assessment.

Reference to Appendix 2 and the first page paragragh is to be made for the following assessment.

Existing UDL.
EUDL = ((6.0m / 2) × TRS) + (3.0m × TCWS) + ((0.55m × 0.225m) × 24kN/m^3) = **20.20** kN/m

Width of Existing Foundation.
WEF = 550mm = **0.55** m

Existing Bearing Pressure.
EBP = EUDL / WEF = **36.74** kN/m^2

Additional UDL.
AUDL = (1.5m / 2) × TRS = **1.58** kN/m

Additional Point Load Reaction form New Steel Beams.
APL = 1.2kN + 13.0kN + 8.9kN = **23.10** kN

Length of Spread of Point Load along Exisitng Foundation.
LS = 0.25m + (2 × 0.725m) = **1.70** m

Additional Bearing Pressure.
ABP = (AUDL / WEF) + (APL / (WEF × LS)) = **27.57** kN/m^2

Total New Bearing Pressure.
TNBP = EBP + ABP = **64.31** kN/m^2

Result : New Total Bearing Pressure is LESS than the assumed maximum allowable bearing capacity of 75kN/m^2 stated on Page 1 of these calculations, however, the increase in pressure from 36.74kN/m^2 to 64.31kN/m^2 may result in some initial 'bedding-down' of the adjusted structure which may coause some minor cracking to the finishes but is NOT considered structural movement.

Appendix 1

TEKLA Simple Beam Design Software Results

REFERENCE: Meeting Room Opening Beam - Existing Side - PFC

Beam

Section Size, Grade	Span, L [m]
Rolled, RSCP 300x100x46, S355	5.540

Restraints

Left hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Start position [m]	End position [m]	Sub-beam length [m]	Eff. length Normal [m]	Eff. length Destab. [m]
0.0	5.540	5.540	1.2000L+2D	1.4000L+2D

Right hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Design Loadcases

Dead, Type: Dead

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	4.7	-	0.0	5.540	Destab.

Imposed, Type: Imposed

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	3.2	-	0.0	5.540	Destab.

Design Combinations

SW+D+I

Loadcase	Strength Factor	Service Factor
Self weight - steel beam only	1.400	1.000
Dead	1.400	1.000
Imposed	1.600	1.000

End Reactions Summary by Loadcase (Unfactored)

Loadcase	Reactions at supports	
	Left support [kN]	Right support [kN]
Self weight - steel beam only	1.2	1.2
Dead	13.0	13.0
Imposed	8.9	8.9

End Reactions Summary by Combination (Factored)

Combination	Reactions at supports	
	Left support [kN]	Right support [kN]
SW+D+I	34.1	34.1

Design Code: BS 5950-1 : 2000

Design Summary

Design Condition	Status	Combination	Critical Value	Capacity\Limit	Units	Ratio
Class	Pass	1	Class 1			
Shear Vertical	Pass	1	34.1	558.9	kN	0.061
Shear Web Buckling	Pass	1	26.333	62.496		n/a
Moment	Pass	1	47.3	221.1	kNm	0.214
Buckling	Pass	1	47.3	56.2	kNm	0.841
Deflection	Pass	1	6.1	10.0	mm	0.607

Notes

SW+D+I

Classification check

Item	Value	Units	Clause Ref.
Flange Class	Class 1 Plastic		Table 11
Web Class	Class 1 Plastic		Table 11
Section Class	Class 1 Plastic		Part 1: 3.5
Pass			

Vertical Shear check

Support	Critical Value	Capacity	Units	Ratio	Status
Support	34.1	558.9	kN	0.061	Pass

Shear Web Buckling

Item	Value	Units	Clause Ref.
Depth to thickness ratio, d/t	26.333		
Depth to thickness ratio limit, d/t_{limit}	62.496		
Pass			

Moment check

Position	Critical Value	Capacity	Units	Ratio	Status
2.770 m	47.3	221.1	kNm	0.214	Pass

Lateral Torsional Buckling check

Sub Beam	Critical Value	Capacity	Units	Ratio	Status
Sub Beam 1	47.3	56.2	kNm	0.841	Pass

Deflection check

Condition	Critical Value	Limit	Units	Ratio	Status
Dead	3.7	11.1	mm	0.338	Pass
Imposed	2.3	10.0	mm	0.233	Pass
Total	6.1	10.0	mm	0.607	Pass

Notes

Note
No notes!

REFERENCE: Meeting Room Opening Beam - Existing Side - RHS

Beam

Section Size, Grade	Span, L [m]
Rolled, RHS 300x100x6.3, S355	5.540

Restraints

Left hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Start position [m]	End position [m]	Sub-beam length [m]	Eff. length Normal [m]	Eff. length Destab. [m]
0.0	5.540	5.540	1.2000L+2D	1.4000L+2D

Right hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Design Loadcases

Dead, Type: Dead

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	4.7	-	0.0	5.540	Destab.

Imposed, Type: Imposed

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	3.2	-	0.0	5.540	Destab.

Design Combinations

SW+D+I

Loadcase	Strength Factor	Service Factor
Self weight - steel beam only	1.400	1.000
Dead	1.400	1.000
Imposed	1.600	1.000

End Reactions Summary by Loadcase (Unfactored)

Loadcase	Reactions at supports	
	Left support [kN]	Right support [kN]
Self weight - steel beam only	1.0	1.0
Dead	13.0	13.0
Imposed	8.9	8.9

End Reactions Summary by Combination (Factored)

Combination	Reactions at supports	
	Left support [kN]	Right support [kN]
SW+D+I	33.9	33.9

Design Code: BS 5950-1 : 2000

Design Summary

Design Condition	Status	Combination	Critical Value	Capacity\Limit	Units	Ratio
Class	Pass	1	Class 1			
Shear Vertical	Pass	1	33.9	773.0	kN	0.044
Shear Web Buckling	Pass	1	44.619	61.610		n/a
Moment	Pass	1	46.9	145.2	kNm	0.323
Buckling	Pass	1	46.9	153.5	kNm	0.305
Deflection	Pass	1	9.7	10.0	mm	0.968

Notes

SW+D+I

Classification check

Item	Value	Units	Clause Ref.
Flange Class	Class 1 Plastic		Table 12
Web Class	Class 1 Plastic		Table 12
Section Class	Class 1 Plastic		Part 1: 3.5
Pass			

Vertical Shear check

Support	Critical Value	Capacity	Units	Ratio	Status
Support	33.9	773.0	kN	0.044	Pass

Shear Web Buckling

Item	Value	Units	Clause Ref.
Depth to thickness ratio, d/t	44.619		
Depth to thickness ratio limit, d/t_{limit}	61.610		
Pass			

Moment check

Position	Critical Value	Capacity	Units	Ratio	Status
2.770 m	46.9	145.2	kNm	0.323	Pass

Lateral Torsional Buckling check

Sub Beam	Critical Value	Capacity	Units	Ratio	Status
Sub Beam 1	46.9	153.5	kNm	0.305	Pass

Deflection check

Condition	Critical Value	Limit	Units	Ratio	Status
Dead	5.9	11.1	mm	0.536	Pass
Imposed	3.7	10.0	mm	0.375	Pass
Total	9.7	10.0	mm	0.968	Pass

Notes

Note
No notes!

REFERENCE: Meeting Room Opening Beam - Existing Side - UB

Beam

Section Size, Grade	Span, L [m]
Rolled, UB 305x127x48, S355	5.540

Restraints

Left hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Start position [m]	End position [m]	Sub-beam length [m]	Eff. length Normal [m]	Eff. length Destab. [m]
0.0	5.540	5.540	1.2000L+2D	1.4000L+2D

Right hand support type 1

Compression flange laterally unrestrained.
Both flanges free to rotate on plan.
Restraint against torsion provided only by the pressure of the bottom flange onto supports.

Design Loadcases

Dead, Type: Dead

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	4.7	-	0.0	5.540	Destab.

Imposed, Type: Imposed

Load Type	F [kN]	g1 [kN/m]	g2 [kN/m]	a [m]	b [m]	Stability type
UDL	-	3.2	-	0.0	5.540	Destab.

Design Combinations

SW+D+I

Loadcase	Strength Factor	Service Factor
Self weight - steel beam only	1.400	1.000
Dead	1.400	1.000
Imposed	1.600	1.000

End Reactions Summary by Loadcase (Unfactored)

Loadcase	Reactions at supports	
	Left support [kN]	Right support [kN]
Self weight - steel beam only	1.3	1.3
Dead	13.0	13.0
Imposed	8.9	8.9

End Reactions Summary by Combination (Factored)

Combination	Reactions at supports	
	Left support [kN]	Right support [kN]
SW+D+I	34.2	34.2

Design Code: BS 5950-1 : 2000

Design Summary

Design Condition	Status	Combination	Critical Value	Capacity\Limit	Units	Ratio
Class	Pass	1	Class 1			
Shear Vertical	Pass	1	34.2	596.2	kN	0.057
Shear Web Buckling	Pass	1	29.467	61.610		n/a
Moment	Pass	1	47.4	252.3	kNm	0.188
Buckling	Pass	1	47.4	49.6	kNm	0.957
Deflection	Pass	1	5.2	10.0	mm	0.523

Notes

SW+D+I

Classification check

Item	Value	Units	Clause Ref.
Flange Class	Class 1 Plastic		Table 11
Web Class	Class 1 Plastic		Table 11
Section Class	Class 1 Plastic		Part 1: 3.5
Pass			

Vertical Shear check

Support	Critical Value	Capacity	Units	Ratio	Status
Support	34.2	596.2	kN	0.057	Pass

Shear Web Buckling

Item	Value	Units	Clause Ref.
Depth to thickness ratio, d/t	29.467		
Depth to thickness ratio limit, d/t_{limit}	61.610		
Pass			

Moment check

Position	Critical Value	Capacity	Units	Ratio	Status
2.770 m	47.4	252.3	kNm	0.188	Pass

Lateral Torsional Buckling check

Sub Beam	Critical Value	Capacity	Units	Ratio	Status
Sub Beam 1	47.4	49.6	kNm	0.957	Pass

Deflection check

Condition	Critical Value	Limit	Units	Ratio	Status
Dead	3.2	11.1	mm	0.292	Pass
Imposed	2.0	10.0	mm	0.200	Pass
Total	5.2	10.0	mm	0.523	Pass

Notes

Note
No notes!

CALVERT BRAIN & FRAULO
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 Portland Street, King's Lynn, Norfolk
PE30 1PB Tel : 01553 766220

Project				Job Ref.	
South Wootton Parish Council Offices				218608	
Section				Sheet no./rev.	
Extension - Structural Design - SD				SD / 16	
Calc. by	Date	Chk'd by	Date	App'd by	Date
JRR	27/10/2021	RWB	29/10/2021		

Appendix 2

Soils Investigation : Sketch Number 218608 / SI-01

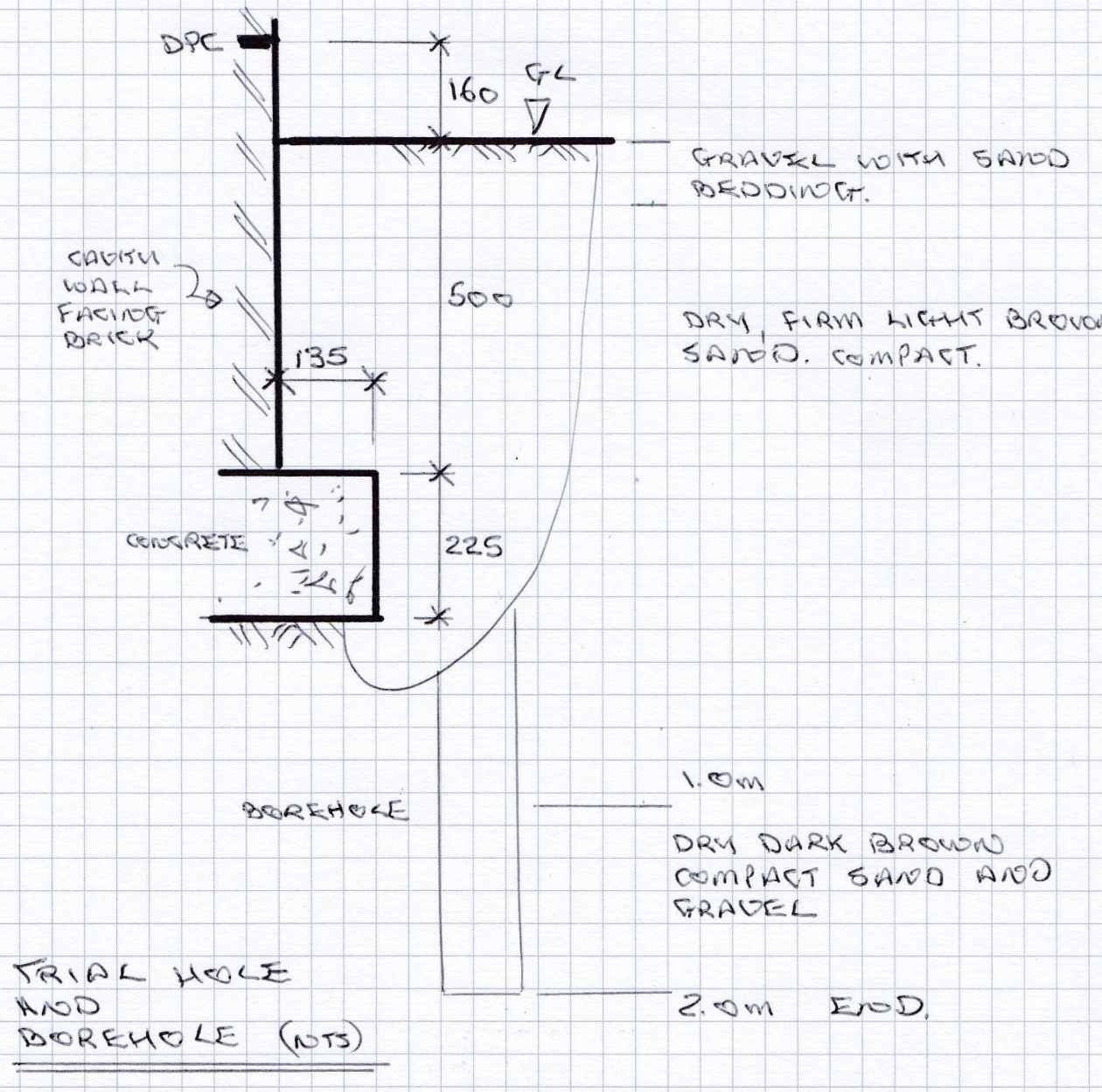
PROJECT SOUTH WOOTTON PARISH COUNCIL OFFICES. SOILS INVESTIGATION.

JOB NO.	SHEET NO.
218608	SI - 01

MADE BY	DATE	SCALE
JRR	26.10.21	NOT TO SCALE A4

CALVERT BRAIN & FRAULO LTD

PLAN (NTS)



TRIAL HOLE AND BOREHOLE (NTS)