

CONSULTING CIVIL, STRUCTURAL,
HIGHWAY AND TRANSPORTATION ENGINEERS

GCA



Structural Calculations

Starbucks
Rhostyllen
Wrexham



For

NiS Signs (Leicester) Ltd

Ref: K02906

5th April 2022



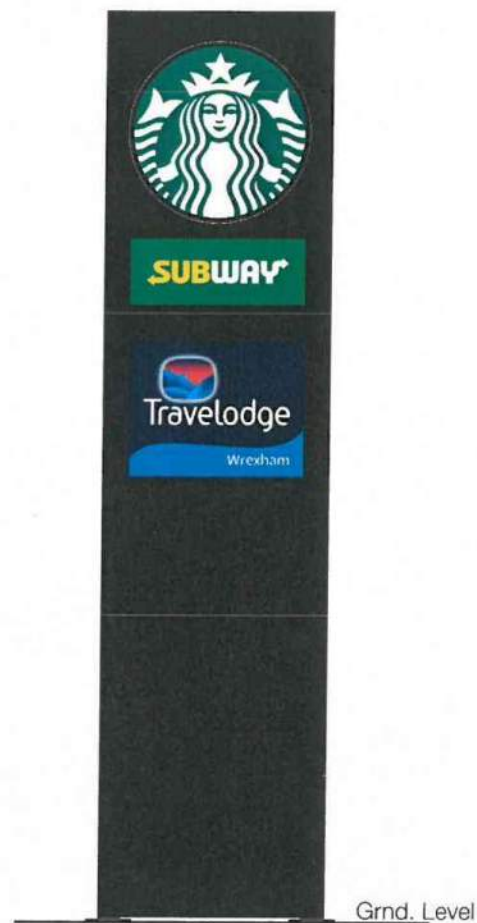
Assumptions used in the Preparation of Calculations.

- 1) The calculations, based upon the information provided to us, have been carried out wherever possible to current Eurocodes/British Standards and the guides developed them from.
- 2) Under certain circumstances the Engineer may have deviated from the recommendations of the Design Codes where in his opinion the recommendations are at variance with the client's proposed usage, and the client can satisfy the usual criteria by alternative means. In this case the Engineer will have clearly identified his assumptions and the reasons for them.
- 3) Where Design Standards are not available the Engineer will have developed his solutions using technical guides, and other standards as appropriate, or may have worked from first principles. The Engineer will have highlighted in his notes all non-standard sources of information so that any other parties will be able to validate his conclusions.
- 4) In certain circumstances the Engineer may have made recommendations about the maintenance of the structural elements where in his opinion the guidance laid out in the Design Codes does not cover this particular area of use.
- 5) The Engineer will have carried out the design in accordance with the information provided to him, in drawings, photographs, and site measurements, and if requested by the client, by his own visual inspection.
- 6) It should be noted that for modification works, unless and until the structural fabric of the existing structure is fully exposed, the calculations should be treated as draft, and their appropriateness must be confirmed or otherwise by the contractor when work starts on site. Should the contractors site discoveries indicate that these assumptions are incorrect the Engineer should be notified immediately, and the Engineers advice on how to proceed be obtained before work proceeds.

Site Specific Guidance

Refer to notes in hand calculations

Front Elevation - 1:50



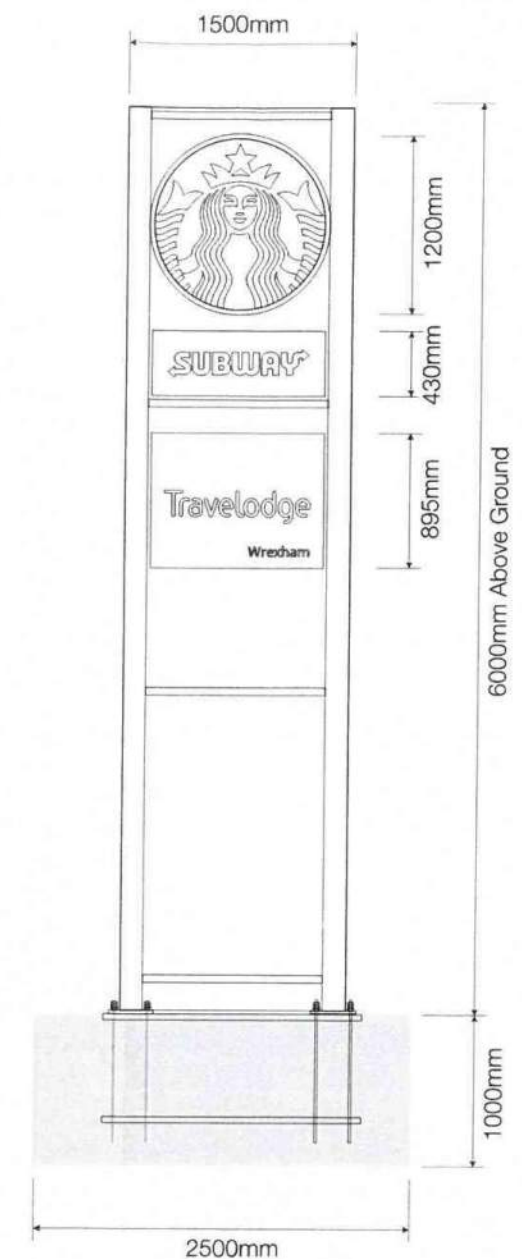
Side Elevation - 1:50



Rear Elevation - 1:50



Section Detail - 1:50



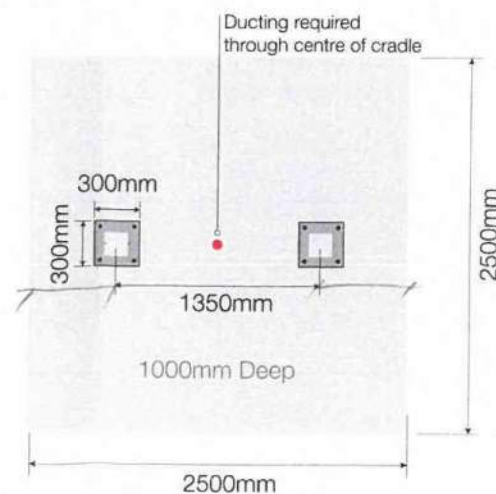
Double Sided 6m Totem - 1:50

1500mm x 6000mm x 200mm double sided totem.

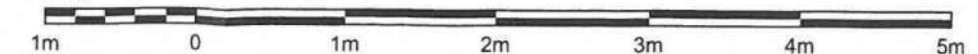
Consisting of a central Aluminium face tray finished Satin Black with the face tray to have fret cut apertures to accept flush fitting opal acrylic 'Subway logo' & 'Travelodge logo' mounted with joggles for extra support. 1200mm dia. 'Starbucks logo' built up rim and return roundal mounted to the face of the trays. All illuminated with LED's mounted within the sign.

Internal framework finished satin black c/w ground cage.

Groundworks - 1:50



1:50 @ A3





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PROJECT No.

K02906

SHEET No.

DATE

01/04/2022

ENG.

TO

CHECKED BY

J.B.

Ref:

Calculations

Results

STRUCTURAL CALCULATION

FOR

STARBUCKS, RHOSYLLLEN

01/04/2022.



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SUMMARY
PAGE

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SUMMARY OF RESULT:

1. TOTEM POST TO BE $180 \times 180 \times 16$ mm THICK SHS - (80.2 kg/m)
ALTERNATIVELY ADOPT $200 \times 200 \times 10$ mm THICK SHS (58.8 kg/m)
2. BASE PLATE : $300 \text{ mm} \times 300 \text{ mm} \times 20 \text{ mm}$ THICK (S275)
PLATE. + 4 NO M20 ϕ ANCHOR BOLTS
(REFER TO ATTACHED IDEA STATIC OUTPUT)
3. FOUNDATION : $2500 \text{ mm} \times 2500 \text{ mm} \times 1000 \text{ mm}$ DEEP
REINFORCE CONCRETE BASE.
4. BASE / FOUNDATION REINFORCEMENT:
MAIN BARS : 12 NO $20 \text{ mm} \phi$ BARS TOP AND BOTTOM
SECONDARY / DISTRIBUTION : 10 NO $16 \text{ mm} \phi$ BARS TOP AND BOTTOM.
BARS



GLOBAL CONSTRUCTION
SOFTWARE AND SERVICES

Project no: K02906 - STARBUCKS,
RHOSTTYLLEN

Prepared by: TO

Checked by:

Site reference: Colliery Road Rhosyllen, Wrexham Principal Area, LL14 4EG, UK

Calculation no: K02906

Date: 31-03-2022

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Notes

Peak velocity pressure calculation to BS EN 1991-1-4:2005+A1:2010 and UK national annex

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Peak velocity pressure - direction independent data

Description	Value	
OS grid reference	SJ 31427 48152	
Site location	53.026245°N -3.023849°E	
Fundamental basic wind velocity, $V_{b,map}$ (m/s)	23.0	(Figure NA.1)
Structure height, h (m)	6.00	
Seasonal factor is based on all year.		
Seasonal factor, C_{season}	1.00	(Table NA.2)
Probability factor, C_{prob}	1.00	(NA.2.8)
Site altitude, A (m)	109	
Structure orientation from North (°N)	0	

Peak velocity pressure - direction dependent data

Sector	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Sector orientation	345° - 15°	15° - 45°	45° - 75°	75° - 105°	105° - 135°	135° - 165°	165° - 195°	195° - 225°	225° - 255°	255° - 285°	285° - 315°	315° - 345°
Direction	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
Peak velocity pressure, q_p (kN/m²) [NA.2.17]	0.508	0.441	0.434	0.449	0.440	0.532	0.579	0.694	0.828	0.829	0.691	0.569
Directional factor, C_{dir} [Table NA.1]	0.78	0.73	0.73	0.74	0.73	0.80	0.85	0.93	1.00	0.99	0.91	0.82
Altitude factor, C_{alt} [NA.2.5]	1.11	1.11	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.10	1.10	1.10
Local effects factor, K_f [A.3(4)]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Basic wind velocity, V_b (m/s) [4.2]	19.9	18.6	18.5	18.8	18.5	20.3	21.7	23.7	25.5	25.1	23.1	20.8
Basic velocity pressure, q_b (kN/m²) [4.5]	0.242	0.212	0.211	0.217	0.211	0.253	0.288	0.345	0.399	0.387	0.327	0.266



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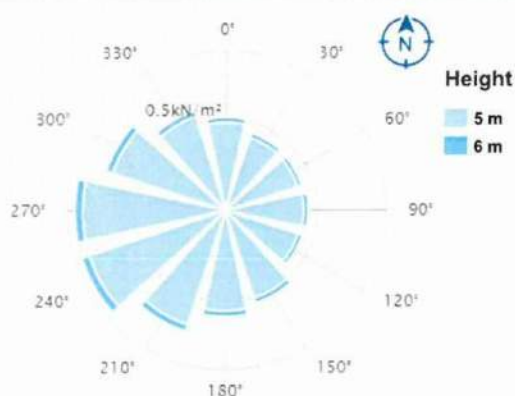
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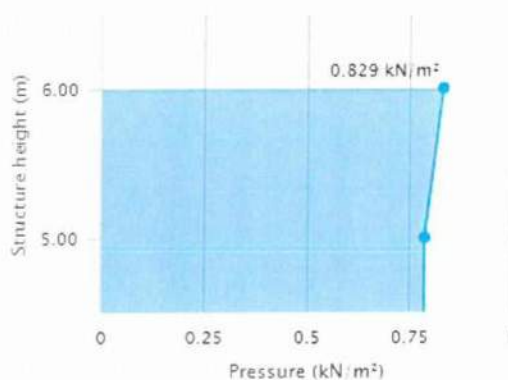
Page no: 2

Significant orography [Figure NA.2]	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Orography factor, C_o [A.3]	1.00	1.00	1.02	1.02	1.03	1.03	1.00	1.00	1.02	1.04	1.02	1.02
Orography correction factor [Eq. NA.4a]	N/A	N/A	1.012	1.016	1.019	1.021	N/A	N/A	1.012	1.027	1.014	1.014
Terrain category	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country
Distance to shoreline (km)	23.28	31.46	166.82	203.24	283.19	140.47	146.92	111.97	70.89	70.42	46.29	26.78
Exposure factor, C_e [Figure NA.7]	2.09	2.08	2.01	2.01	2.01	2.01	2.01	2.01	2.03	2.03	2.05	2.09
Zone for size factor, C_s [NA.8]	B	B	B	B	B	B	B	B	B	B	B	B
Peak velocity, V_p (m/s)	28.8	26.8	26.6	27.1	26.8	29.4	30.7	33.6	36.8	36.8	33.6	30.5

Pressure variation across compass directions



Pressure variation with height in dominant wind direction (270°)



Peak velocity pressure variation with height across all wind directions



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Structure height/Direction	Peak velocity pressure (kN/m ²)											
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
5.0 m	0.481	0.417	0.411	0.425	0.416	0.503	0.548	0.656	0.784	0.785	0.655	0.539
6.0 m	0.508	0.441	0.434	0.449	0.440	0.532	0.579	0.694	0.828	0.829	0.691	0.569

Orography details in each wind direction

Sector	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Direction	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
Orography category	Flat	Flat	Ridge	Ridge	Ridge	Ridge	Flat	Flat	Ridge	Ridge	Ridge	Ridge
Upwind base altitude, A _u (m)	N/A	N/A	104.9	104.7	104.6	105.5	N/A	N/A	109.2	104.0	104.5	104.1
Upwind slope height, H _u (m)	N/A	N/A	19.5	26.2	13.5	6.8	N/A	N/A	14.0	26.9	15.4	9.9
Upwind slope length, L _u (m)	N/A	N/A	250.0	250.0	150.0	100.0	N/A	N/A	250.0	300.0	225.0	150.0
Downwind base altitude, A _d (m)	N/A	N/A	114.1	109.3	110.4	104.1	N/A	N/A	104.9	104.7	104.6	105.5
Downwind slope height, H _d (m)	N/A	N/A	9.1	21.6	9.4	9.9	N/A	N/A	19.5	26.2	13.5	6.8
Downwind slope length, L _d (m)	N/A	N/A	125.0	175.0	100.0	150.0	N/A	N/A	250.0	250.0	150.0	100.0
Distance from crest, X (m)	N/A	N/A	-200.0	-200.0	-100.0	-50.0	N/A	N/A	250.0	200.0	150.0	100.0
Summit length, L _s (m)	N/A	N/A	50	0	50	50	N/A	N/A	50	0	50	50
Effective slope, Φ _e	N/A	N/A	0.08	0.10	0.09	0.07	N/A	N/A	0.06	0.09	0.07	0.07
Effective length, L _e (m)	N/A	N/A	250.0	250.0	150.0	100.0	N/A	N/A	250.0	300.0	225.0	150.0
Orography location factor, s	N/A	N/A	0.12	0.12	0.17	0.25	N/A	N/A	0.17	0.24	0.17	0.17



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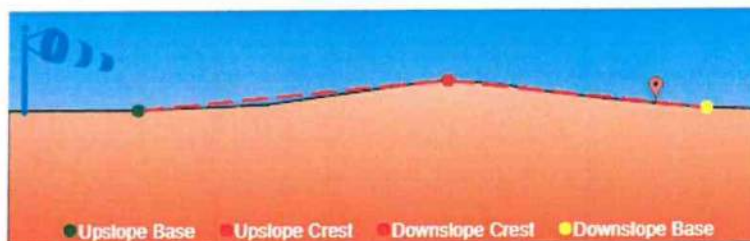
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Orography details in dominant wind direction (270°)



Ridge/hill upwind of site but slope sheltered by higher ground upwind. Orography Not significant

Orography category	Hill or Ridge
Upwind base altitude (m)	104.0
Upwind slope height (m)	26.9
Upwind slope length (m)	300.0
Downwind base altitude (m)	104.7
Downwind slope height (m)	26.2
Downwind slope length (m)	250.0
Distance from crest (m)	200.0
Summit length (m)	0.0
Effective slope	0.09
Effective length (m)	300.00



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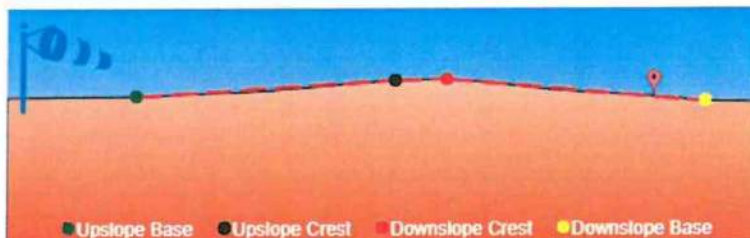
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Calculation no: K02906

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Orography details in selected wind direction (240°)



Ridge/hill upwind of site but slope sheltered by higher ground upwind. Orography Not significant

Orography category	Hill or Ridge
Upwind base altitude (m)	109.2
Upwind slope height (m)	14.0
Upwind slope length (m)	250.0
Downwind base altitude (m)	104.9
Downwind slope height (m)	19.5
Downwind slope length (m)	250.0
Distance from crest (m)	250.0
Summit length (m)	50.0
Effective slope	0.06
Effective length (m)	250.00

Ref:

Calculations

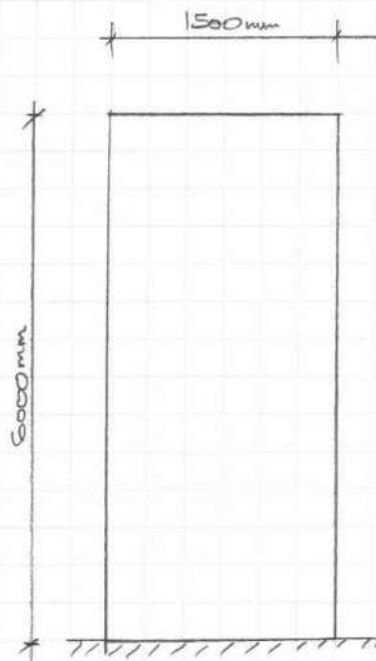
Results

PROJECT: STARBUCKS TOTEM @ RHOSTYLLEN,
WREXHAM, LL/4 4EG.

CLIENT'S BRIEF: PROVIDE A SET OF CALCULATION FOR
TOTEM POST AND BASE FOUNDATION.

WIND LOADING: REFER TO CADS VELVENTI WIND SOFTWARE
ANALYSIS RESULT (ATTACHED).

MAX PEAK VELOCITY PRESSURE, $q_{pe} = 0.83 \text{ kN/m}^2$.



CONSIDER TOTEM AS A FREE
STANDING STRUCTURE.

$$S_{lin} = \frac{6000}{180} = 33.3 \text{ mm}$$

$$\begin{aligned} \text{WIND FORCE} &= 0.83 \times 1.5 \times 6.0 \times 1.5 \\ &= 11.21 \text{ kN} \quad (7.47 \text{ kN}) \end{aligned}$$

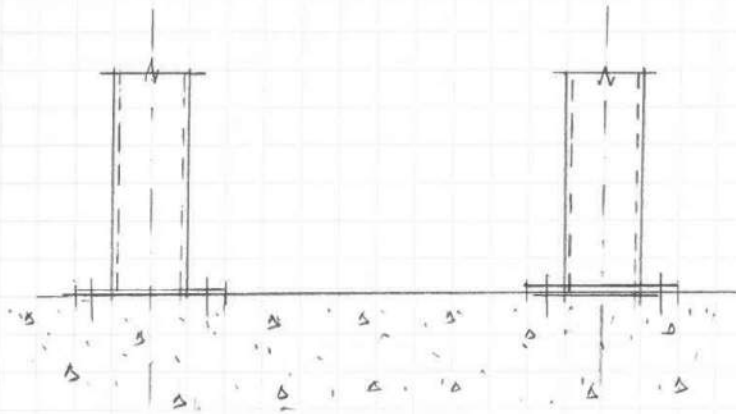
$$\begin{aligned} I_{reqd} &= \frac{PL^3}{3ES} \\ &= \frac{7.47 \times 1000 \times 6000^3}{3 \times 205000 \times 33.3} \\ &= 7878.71 \times 10^4 \text{ mm}^4 \\ &= 7878.71 \text{ cm}^4 \end{aligned}$$

$$I_{reqd} / LCA = \frac{7878.71}{2} = 3939.40 \text{ cm}^4.$$

Ref:

Calculations

Results



$$I_{reqd} / L_{EG} = 3939.40 \text{ cm}^4.$$

PROVIDE 180x180x16mm THK SHS OR 200x200x16mm THK SHS.
(4500 cm⁴) (4470 cm⁴)
80.2 kg/m (58.8 kg/m)

FOUNDATION BASE.

ASSUME A GROUND BEARING CAPACITY = 100 kN/m².

WEIGHT OF PILEM:

- DESIGN FOR 80.2 kg/m = 0.80 kN/m × 6m = 4.80 kN

- ALUMINIUM SIGNAGES (3mm THICK) = (0.003 × 1.5 × 6.0) × 2
+ (0.003 × 0.2 × 6.0) × 2
= 0.0576 m³.

WT OF ALUMINIUM CHADDING = 0.0576 × 27
= 1.56 kN.

TOTAL PILEM WEIGHT = 4.80 × 2 + 1.56 = 11.16 kN.

TOTAL WEIGHT / LEG = 5.60 kN. (SLS)
= 5.60 × 1.35 = 7.56 kN

2700 kg/m³

27 kN/m³



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Ref:	Calculations	Results
	HORIZONTAL LOADING = $0.83 \times 6.0 \times 1.5$ = $7.47 \text{ kN} \cdot (\text{SLS})$ = HORIZONTAL LOAD / LEG = $7.47 / 2$ = 3.74 kN. = $5.61 \text{ kN} \cdot (\text{ULS})$ BENDING MOMENT @ BASE $M = 7.47 \times 3.0 = 22.41 \text{ kNm}$. $M_u = 22.41 \times 1.5 = 33.62 \text{ kNm}$ = $16.81 \text{ kNm PER LEG}$. FOUNDATION / BASE DESIGN PARAMETERS. $N_{\text{ULT}} = 7.56 \text{ kN / LEG}$. $M_{\text{ULT}} = 16.81 \text{ kNm / LEG}$ $V_{\text{ULT}} = 5.61 \text{ kN / LEG}$.	

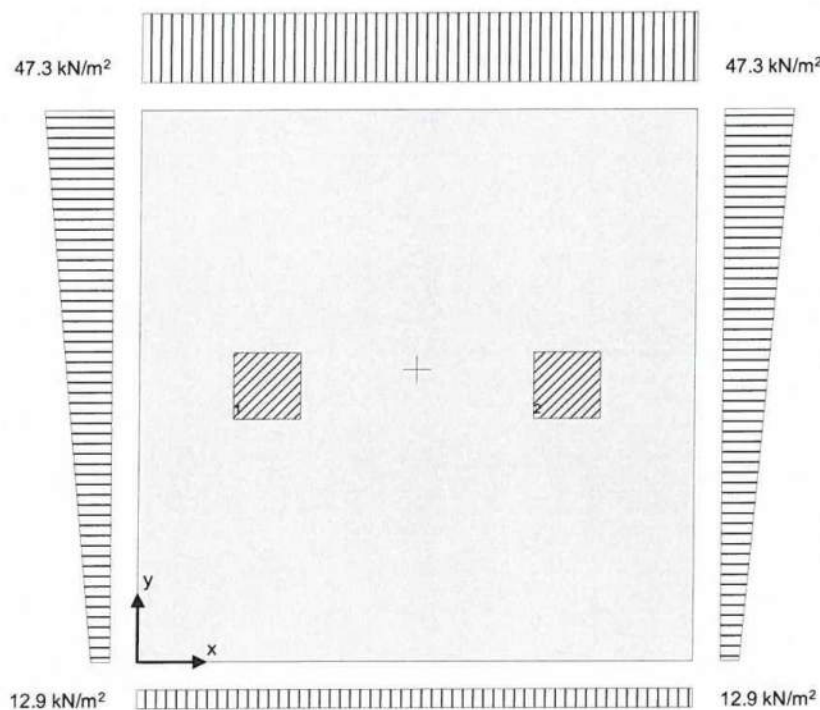
FOUNDATION ANALYSIS (EN1997-1:2004)

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

TEDDS calculation version 3.2.20

Pad foundation details

Length of foundation	$L_x = 2500 \text{ mm}$
Width of foundation	$L_y = 2500 \text{ mm}$
Foundation area	$A = L_x \times L_y = 6.250 \text{ m}^2$
Depth of foundation	$h = 1000 \text{ mm}$
Depth of soil over foundation	$h_{\text{soil}} = 150 \text{ mm}$
Level of water	$h_{\text{water}} = 0 \text{ mm}$
Density of water	$\gamma_{\text{water}} = 9.8 \text{ kN/m}^3$
Density of concrete	$\gamma_{\text{conc}} = 25.0 \text{ kN/m}^3$



Column no.1 details

Length of column	$l_{x1} = 300 \text{ mm}$
Width of column	$l_{y1} = 300 \text{ mm}$
position in x-axis	$x_1 = 575 \text{ mm}$
position in y-axis	$y_1 = 1250 \text{ mm}$

Column no.2 details

Length of column	$l_{x2} = 300 \text{ mm}$
Width of column	$l_{y2} = 300 \text{ mm}$
position in x-axis	$x_2 = 1925 \text{ mm}$
position in y-axis	$y_2 = 1250 \text{ mm}$

 GCA(UK) Ltd Leatherline Business Centre Narrow Lane, Leicester LE2 8NA	Project STARBUCKS, RHOSTYLLEN, WREXHAM, LL14 4EG			Job no. K02906	
	Calcs for BASE/FOUNDATION			Start page no./Revision 2	
	Calcs by TO	Calcs date 01/04/2022	Checked by	Checked date	Approved by Approved date

Soil properties

Density of soil	$\gamma_{\text{soil}} = 18.0 \text{ kN/m}^3$
Characteristic cohesion	$c'_k = 0 \text{ kN/m}^2$
Characteristic effective shear resistance angle	$\phi'_k = 30 \text{ deg}$
Characteristic friction angle	$\delta_k = 20 \text{ deg}$

Foundation loads

Self weight	$F_{\text{swt}} = h \times \gamma_{\text{conc}} = 25.0 \text{ kN/m}^2$
Soil weight	$F_{\text{soil}} = h_{\text{soil}} \times \gamma_{\text{soil}} = 2.7 \text{ kN/m}^2$

Column no.1 loads

Permanent load in z	$F_{\text{Gz1}} = 7.6 \text{ kN}$
Variable load in y	$F_{\text{Qy1}} = 5.6 \text{ kN}$
Variable moment in y	$M_{\text{Qy1}} = 16.8 \text{ kNm}$

Column no.2 loads

Permanent load in z	$F_{\text{Gz2}} = 7.6 \text{ kN}$
Variable load in y	$F_{\text{Qy2}} = 5.6 \text{ kN}$
Variable moment in y	$M_{\text{Qy2}} = 16.8 \text{ kNm}$

Bearing resistance (Section 6.5.2)

Forces on foundation

Force in y-axis	$F_{\text{dy}} = F_{\text{Qy1}} + F_{\text{Qy2}} = 11.2 \text{ kN}$
Force in z-axis	$F_{\text{dz}} = A \times (F_{\text{swt}} + F_{\text{soil}}) + F_{\text{Gz1}} + F_{\text{Gz2}} = 188.2 \text{ kN}$

Moments on foundation

Moment in x-axis	$M_{\text{dx}} = A \times (F_{\text{swt}} + F_{\text{soil}}) \times L_x / 2 + F_{\text{Gz1}} \times x_1 + F_{\text{Gz2}} \times x_2 = 235.3 \text{ kNm}$
Moment in y-axis	$M_{\text{dy}} = A \times (F_{\text{swt}} + F_{\text{soil}}) \times L_y / 2 + F_{\text{Gz1}} \times y_1 + F_{\text{Gz2}} \times y_2 + M_{\text{Qy1}} + F_{\text{Qy1}} \times h + M_{\text{Qy2}} + F_{\text{Qy2}} \times h = 280.1 \text{ kNm}$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis	$e_x = M_{\text{dx}} / F_{\text{dz}} - L_x / 2 = 0 \text{ mm}$
Eccentricity of base reaction in y-axis	$e_y = M_{\text{dy}} / F_{\text{dz}} - L_y / 2 = 238 \text{ mm}$

Pad base pressures

	$q_1 = F_{\text{dz}} \times (1 - 6 \times e_x / L_x - 6 \times e_y / L_y) / (L_x \times L_y) = 12.9 \text{ kN/m}^2$
	$q_2 = F_{\text{dz}} \times (1 - 6 \times e_x / L_x + 6 \times e_y / L_y) / (L_x \times L_y) = 47.3 \text{ kN/m}^2$
	$q_3 = F_{\text{dz}} \times (1 + 6 \times e_x / L_x - 6 \times e_y / L_y) / (L_x \times L_y) = 12.9 \text{ kN/m}^2$
	$q_4 = F_{\text{dz}} \times (1 + 6 \times e_x / L_x + 6 \times e_y / L_y) / (L_x \times L_y) = 47.3 \text{ kN/m}^2$
Minimum base pressure	$q_{\text{min}} = \min(q_1, q_2, q_3, q_4) = 12.9 \text{ kN/m}^2$
Maximum base pressure	$q_{\text{max}} = \max(q_1, q_2, q_3, q_4) = 47.3 \text{ kN/m}^2$

Presumed bearing capacity

Presumed bearing capacity	$P_{\text{bearing}} = 100.0 \text{ kN/m}^2$ PASS - Presumed bearing capacity exceeds design base pressure
---------------------------	---

Design approach 1

Partial factors on actions - Combination1

Partial factor set	A1
Permanent unfavourable action - Table A.3	$\gamma_G = 1.35$
Permanent favourable action - Table A.3	$\gamma_{\text{Gf}} = 1.00$
Variable unfavourable action - Table A.3	$\gamma_Q = 1.50$

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	Calcs by TO	Calcs date 01/04/2022	Checked by	Checked date	Approved by	Approved date

Variable favourable action - Table A.3

$$\gamma_{Qf} = 0.00$$

Partial factors for spread foundations - Combination1

Resistance factor set

R1

Bearing - Table A.5

$$\gamma_{R,v} = 1.00$$

Sliding - Table A.5

$$\gamma_{R,h} = 1.00$$

Forces on foundation

Force in y-axis

$$F_{dy} = \gamma_Q \times (F_{Qy1} + F_{Qy2}) = 16.8 \text{ kN}$$

Force in z-axis

$$F_{dz} = \gamma_G \times (A \times (F_{swt} + F_{soil}) + F_{Gz1} + F_{Gz2}) = 254.1 \text{ kN}$$

Moments on foundation

Moment in x-axis

$$M_{dx} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_x / 2 + F_{Gz1} \times x_1 + F_{Gz2} \times x_2) = 317.7 \text{ kNm}$$

Moment in y-axis

$$M_{dy} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_y / 2 + F_{Gz1} \times y_1 + F_{Gz2} \times y_2) + \gamma_Q \times (M_{Qy1} + M_{Qy2}) + (\gamma_Q \times (F_{Qy1} + F_{Qy2})) \times h = 384.9 \text{ kNm}$$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis

$$e_x = M_{dx} / F_{dz} - L_x / 2 = 0 \text{ mm}$$

Eccentricity of base reaction in y-axis

$$e_y = M_{dy} / F_{dz} - L_y / 2 = 265 \text{ mm}$$

Effective area of base

Effective length

$$L'_x = L_x - 2 \times e_x = 2500 \text{ mm}$$

Effective width

$$L'_y = L_y - 2 \times e_y = 1971 \text{ mm}$$

Effective area

$$A' = L'_x \times L'_y = 4.927 \text{ m}^2$$

Pad base pressure

Design base pressure

$$f_{dz} = F_{dz} / A' = 51.6 \text{ kN/m}^2$$

Sliding resistance (Section 6.5.3)

Forces on foundation

Force in y-axis

$$F_{dy} = \gamma_Q \times (F_{Qy1} + F_{Qy2}) = 16.8 \text{ kN}$$

Force in z-axis

$$F_{dz} = \gamma_{Gf} \times (A \times (F_{swt} + F_{soil}) + F_{Gz1} + F_{Gz2}) = 188.2 \text{ kN}$$

Sliding resistance verification (Section 6.5.3)

Horizontal force on foundation

$$H = \text{abs}(F_{dy}) = 16.8 \text{ kN}$$

Sliding resistance (exp.6.3a)

$$R_{H,d} = F_{dz} \times \tan(\delta_k) / \gamma_{\psi} = 68.5 \text{ kN}$$

$$H / R_{H,d} = 0.246$$

PASS - Foundation is not subject to failure by sliding

Library item: Check sliding output

Design approach 1

Partial factors on actions - Combination2

Partial factor set

A2

Permanent unfavourable action - Table A.3

$$\gamma_G = 1.00$$

Permanent favourable action - Table A.3

$$\gamma_{Gf} = 1.00$$

Variable unfavourable action - Table A.3

$$\gamma_Q = 1.30$$

Variable favourable action - Table A.3

$$\gamma_{Qf} = 0.00$$

Partial factors for spread foundations - Combination2

Resistance factor set

R1

Bearing - Table A.5

$$\gamma_{R,v} = 1.00$$

Sliding - Table A.5

$$\gamma_{R,h} = 1.00$$

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Forces on foundation

Force in y-axis

$$F_{dy} = \gamma_Q \times (F_{Qy1} + F_{Qy2}) = 14.6 \text{ kN}$$

Force in z-axis

$$F_{dz} = \gamma_G \times (A \times (F_{swt} + F_{soil}) + F_{Gz1} + F_{Gz2}) = 188.2 \text{ kN}$$

Moments on foundation

Moment in x-axis

$$M_{dx} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_x / 2 + F_{Gz1} \times x_1 + F_{Gz2} \times x_2) = 235.3 \text{ kNm}$$

Moment in y-axis

$$M_{dy} = \gamma_G \times (A \times (F_{swt} + F_{soil}) \times L_y / 2 + F_{Gz1} \times y_1 + F_{Gz2} \times y_2) + \gamma_Q \times (M_{Qy1} + M_{Qy2}) + (\gamma_Q \times (F_{Qy1} + F_{Qy2})) \times h = 293.6 \text{ kNm}$$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis

$$e_x = M_{dx} / F_{dz} - L_x / 2 = 0 \text{ mm}$$

Eccentricity of base reaction in y-axis

$$e_y = M_{dy} / F_{dz} - L_y / 2 = 310 \text{ mm}$$

Effective area of base

Effective length

$$L'_x = L_x - 2 \times e_x = 2500 \text{ mm}$$

Effective width

$$L'_y = L_y - 2 \times e_y = 1881 \text{ mm}$$

Effective area

$$A' = L'_x \times L'_y = 4.702 \text{ m}^2$$

Pad base pressure

Design base pressure

$$f_{dz} = F_{dz} / A' = 40 \text{ kN/m}^2$$

Sliding resistance (Section 6.5.3)

Forces on foundation

Force in y-axis

$$F_{dy} = \gamma_Q \times (F_{Qy1} + F_{Qy2}) = 14.6 \text{ kN}$$

Force in z-axis

$$F_{dz} = \gamma_{Gf} \times (A \times (F_{swt} + F_{soil}) + F_{Gz1} + F_{Gz2}) = 188.2 \text{ kN}$$

Sliding resistance verification (Section 6.5.3)

Horizontal force on foundation

$$H = \text{abs}(F_{dy}) = 14.6 \text{ kN}$$

Sliding resistance (exp.6.3a)

$$R_{H,d} = F_{dz} \times \tan(\delta_k) / \gamma_{\phi} = 54.8 \text{ kN}$$

$$H / R_{H,d} = 0.266$$

PASS - Foundation is not subject to failure by sliding

Library item: Check sliding output

FOUNDATION DESIGN (EN1992-1-1:2004)

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 3.2.20

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

Concrete strength class

C30/37

Characteristic compressive cylinder strength

$$f_{ck} = 30 \text{ N/mm}^2$$

Characteristic compressive cube strength

$$f_{ck,cube} = 37 \text{ N/mm}^2$$

Mean value of compressive cylinder strength

$$f_{cm} = f_{ck} + 8 \text{ N/mm}^2 = 38 \text{ N/mm}^2$$

Mean value of axial tensile strength

$$f_{ctm} = 0.3 \text{ N/mm}^2 \times (f_{ck} / 1 \text{ N/mm}^2)^{2/3} = 2.9 \text{ N/mm}^2$$

5% fractile of axial tensile strength

$$f_{ctk,0.05} = 0.7 \times f_{ctm} = 2.0 \text{ N/mm}^2$$

Secant modulus of elasticity of concrete

$$E_{cm} = 22 \text{ kN/mm}^2 \times [f_{cm} / 10 \text{ N/mm}^2]^{0.3} = 32837 \text{ N/mm}^2$$

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)

$$f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_C = 17.0 \text{ N/mm}^2$$

Tens.strength coeff.for plain concrete (cl.12.3.1(1))

$$\alpha_{ct,pl} = 0.80$$

Des.tens.strength for plain concrete (exp.12.1)

$$f_{ctd,pl} = \alpha_{ct,pl} \times f_{ctk,0.05} / \gamma_C = 1.1 \text{ N/mm}^2$$

Maximum aggregate size

$$h_{agg} = 20 \text{ mm}$$

Ultimate strain - Table 3.1

$$\epsilon_{cu2} = 0.0035$$

Shortening strain - Table 3.1

$$\epsilon_{cu3} = 0.0035$$

Effective compression zone height factor

$$\lambda = 0.80$$

Effective strength factor

$$\eta = 1.00$$

Bending coefficient k_1

$$K_1 = 0.40$$

Bending coefficient k_2

$$K_2 = 1.00 \times (0.6 + 0.0014/\epsilon_{cu2}) = 1.00$$

Bending coefficient k_3

$$K_3 = 0.40$$

Bending coefficient k_4

$$K_4 = 1.00 \times (0.6 + 0.0014/\epsilon_{cu2}) = 1.00$$

Reinforcement details

Characteristic yield strength of reinforcement

$$f_{yk} = 500 \text{ N/mm}^2$$

Modulus of elasticity of reinforcement

$$E_s = 210000 \text{ N/mm}^2$$

Partial factor for reinforcing steel (Table 2.1N)

$$\gamma_s = 1.15$$

Design yield strength of reinforcement

$$f_{yd} = f_{yk} / \gamma_s = 435 \text{ N/mm}^2$$

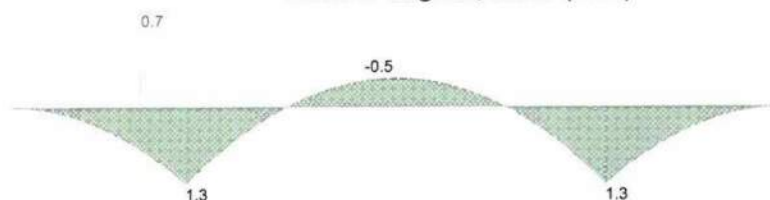
Nominal cover to reinforcement

$$c_{nom} = 50 \text{ mm}$$

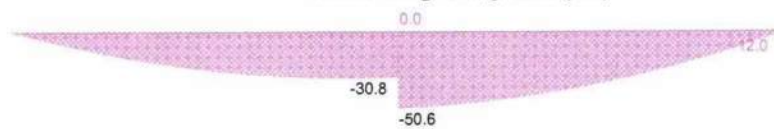
Shear diagram, x axis (kN)



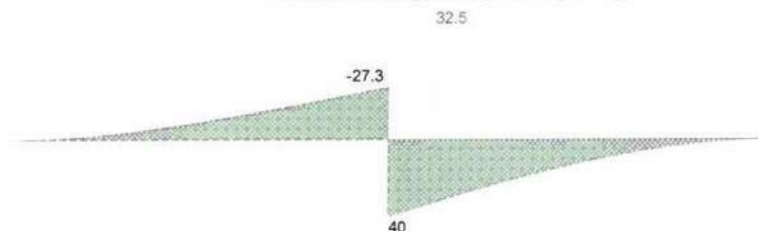
Moment diagram, x axis (kNm)



Shear diagram, y axis (kN)



Moment diagram, y axis (kNm)



Rectangular section in flexure (Section 6.1)

Design bending moment

$$M_{Ed,y,max} = 32.5 \text{ kNm}$$

Depth to tension reinforcement

$$d = h - c_{nom} - \phi_{y,bot} / 2 = 940 \text{ mm}$$

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	$K = M_{Ed,y,max} / (L_x \times d^2 \times f_{ck}) = 0.000$ $K' = (2 \times \eta \times \alpha_{cc} / \gamma_c) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times K_2))$ $K' = 0.207$ $K' > K$ - No compression reinforcement is required
Lever arm	$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = 893 \text{ mm}$
Depth of neutral axis	$x = 2.5 \times (d - z) = 118 \text{ mm}$
Area of tension reinforcement required	$A_{sy,bot,req} = M_{Ed,y,max} / (f_{yd} \times z) = 84 \text{ mm}^2$
Tension reinforcement provided	12 No.20 dia.bars bottom (215 c/c)
Area of tension reinforcement provided	$A_{sy,bot,prov} = 3770 \text{ mm}^2$
Minimum area of reinforcement (exp.9.1N)	$A_{s,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times L_x \times d = 3539 \text{ mm}^2$
Maximum area of reinforcement (cl.9.2.1.1(3))	$A_{s,max} = 0.04 \times L_x \times d = 94000 \text{ mm}^2$
PASS - Area of reinforcement provided is greater than area of reinforcement required	

Crack control (Section 7.3)

Limiting crack width	$w_{max} = 0.3 \text{ mm}$
Variable load factor (EN1990 – Table A1.1)	$\psi_2 = 0.3$
Serviceability bending moment	$M_{sls,y,max} = 9.2 \text{ kNm}$
Tensile stress in reinforcement	$\sigma_s = M_{sls,y,max} / (A_{sy,bot,prov} \times z) = 2.7 \text{ N/mm}^2$
Load duration factor	$k_t = 0.4$
Effective depth of concrete in tension	$h_{c,ef} = \min(2.5 \times (h - d), (h - x) / 3, h / 2) = 150 \text{ mm}$
Effective area of concrete in tension	$A_{c,eff} = h_{c,ef} \times L_x = 375000 \text{ mm}^2$
Mean value of concrete tensile strength	$f_{ct,eff} = f_{ctm} = 2.9 \text{ N/mm}^2$
Reinforcement ratio	$\rho_{p,eff} = A_{sy,bot,prov} / A_{c,eff} = 0.010$
Modular ratio	$\alpha_e = E_s / E_{cm} = 6.395$
Bond property coefficient	$k_1 = 0.8$
Strain distribution coefficient	$k_2 = 0.5$
	$k_3 = 3.4 = 3.4$
	$k_4 = 0.425$
Maximum crack spacing (exp.7.11)	$s_{r,max} = k_3 \times C_{nom} + k_1 \times k_2 \times k_4 \times \phi_{y,bot} / \rho_{p,eff} = 508 \text{ mm}$
Maximum crack width (exp.7.8)	$w_k = s_{r,max} \times \max([\sigma_s - k_t \times (f_{ct,eff} / \rho_{p,eff}) \times (1 + \alpha_e \times \rho_{p,eff})] / E_s,$ $0.6 \times \sigma_s / E_s) = 0.004 \text{ mm}$
PASS - Maximum crack width is less than limiting crack width	

Library item: Crack width output

Rectangular section in flexure (Section 6.1)

Design bending moment	$abs(M_{Ed,y,min}) = 22.7 \text{ kNm}$
Depth to tension reinforcement	$d = h - C_{nom} - \phi_{x,top} - \phi_{y,top} / 2 = 924 \text{ mm}$
	$K = abs(M_{Ed,y,min}) / (L_x \times d^2 \times f_{ck}) = 0.000$
	$K' = (2 \times \eta \times \alpha_{cc} / \gamma_c) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times K_2))$
	$K' = 0.207$ $K' > K$ - No compression reinforcement is required
Lever arm	$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = 878 \text{ mm}$
Depth of neutral axis	$x = 2.5 \times (d - z) = 116 \text{ mm}$
Area of tension reinforcement required	$A_{sy,top,req} = abs(M_{Ed,y,min}) / (f_{yd} \times z) = 59 \text{ mm}^2$
Tension reinforcement provided	12 No.20 dia.bars top (215 c/c)
Area of tension reinforcement provided	$A_{sy,top,prov} = 3770 \text{ mm}^2$
Minimum area of reinforcement (exp.9.1N)	$A_{s,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times L_x \times d = 3479 \text{ mm}^2$
Maximum area of reinforcement (cl.9.2.1.1(3))	$A_{s,max} = 0.04 \times L_x \times d = 92400 \text{ mm}^2$

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

Crack control (Section 7.3)

Limiting crack width	$w_{max} = 0.3 \text{ mm}$
Variable load factor (EN1990 – Table A1.1)	$\psi/2 = 0.3$
Serviceability bending moment	$abs(M_{sls,y,min}) = 1.9 \text{ kNm}$
Tensile stress in reinforcement	$\sigma_s = abs(M_{sls,y,min}) / (A_{sy,top,prov} \times z) = 0.6 \text{ N/mm}^2$
Load duration factor	$k_t = 0.4$
Effective depth of concrete in tension	$h_{c,ef} = \min(2.5 \times (h - d), (h - x) / 3, h / 2) = 190 \text{ mm}$
Effective area of concrete in tension	$A_{c,eff} = h_{c,ef} \times L_x = 475000 \text{ mm}^2$
Mean value of concrete tensile strength	$f_{ct,eff} = f_{ctm} = 2.9 \text{ N/mm}^2$
Reinforcement ratio	$\rho_{p,eff} = A_{sy,top,prov} / A_{c,eff} = 0.008$
Modular ratio	$\alpha_e = E_s / E_{cm} = 6.395$
Bond property coefficient	$k_1 = 0.8$
Strain distribution coefficient	$k_2 = 0.5$
	$k_3 = 3.4 = 3.4$
	$k_4 = 0.425$
Maximum crack spacing (exp.7.11)	$s_{r,max} = k_3 \times (c_{nom} + \phi_{x,top}) + k_1 \times k_2 \times k_4 \times \phi_{y,top} / \rho_{p,eff} = 653 \text{ mm}$
Maximum crack width (exp.7.8)	$w_k = s_{r,max} \times \max([\sigma_s - k_t \times (f_{ct,eff} / \rho_{p,eff}) \times (1 + \alpha_e \times \rho_{p,eff})] / E_s, 0.6 \times \sigma_s / E_s) = 0.001 \text{ mm}$

PASS - Maximum crack width is less than limiting crack width

Library item: Crack width output

Rectangular section in shear (Section 6.2)

Design shear force	$abs(V_{Ed,y,min}) = 12 \text{ kN}$
	$C_{Rd,c} = 0.18 / \gamma_c = 0.120$
	$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) = 1.465$
Longitudinal reinforcement ratio	$\rho_l = \min(A_{sy,bot,prov} / (L_x \times d), 0.02) = 0.002$
	$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = 0.340 \text{ N/mm}^2$
Design shear resistance (exp.6.2a & 6.2b)	$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times L_x \times d$
	$V_{Rd,c} = 785.4 \text{ kN}$

PASS - Design shear resistance exceeds design shear force

Punching shear (Section 6.4)

Strength reduction factor (exp 6.6N)	$v = 0.6 \times [1 - f_{ck} / 250 \text{ N/mm}^2] = 0.528$
Average depth to reinforcement	$d = 931 \text{ mm}$
Maximum punching shear resistance (cl.6.4.5(3))	$V_{Rd,max} = 0.5 \times v \times f_{cd} = 4.488 \text{ N/mm}^2$
	$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) = 1.463$
Longitudinal reinforcement ratio (cl.6.4.4(1))	$\rho_{lx} = A_{sx,bot,prov} / (L_y \times d) = 0.001$
	$\rho_{ly} = A_{sy,bot,prov} / (L_x \times d) = 0.002$
	$\rho_l = \min(\sqrt{\rho_{lx} \times \rho_{ly}}, 0.02) = 0.001$
	$C_{Rd,c} = 0.18 / \gamma_c = 0.120$
	$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = 0.339 \text{ N/mm}^2$
Design punching shear resistance (exp.6.47)	$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) = 0.339 \text{ N/mm}^2$
Design punching shear resistance at 1d (exp. 6.50)	$V_{Rd,c1} = (2 \times d / d) \times V_{Rd,c} = 0.679 \text{ N/mm}^2$

Column No.1 - Punching shear perimeter at column face

Punching shear perimeter	$u_0 = 1200 \text{ mm}$
Area within punching shear perimeter	$A_0 = 0.090 \text{ m}^2$

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Maximum punching shear force

$$V_{Ed,max} = 8.9 \text{ kN}$$

Punching shear stress factor (fig 6.21N)

$$\beta = 1.500$$

Maximum punching shear stress (exp 6.38)

$$V_{Ed,max} = \beta \times V_{Ed,max} / (u_0 \times d) = 0.012 \text{ N/mm}^2$$

PASS - Maximum punching shear resistance exceeds maximum punching shear stress

Column No.2 - Punching shear perimeter at column face

Punching shear perimeter

$$u_0 = 1200 \text{ mm}$$

Area within punching shear perimeter

$$A_0 = 0.090 \text{ m}^2$$

Maximum punching shear force

$$V_{Ed,max} = 8.9 \text{ kN}$$

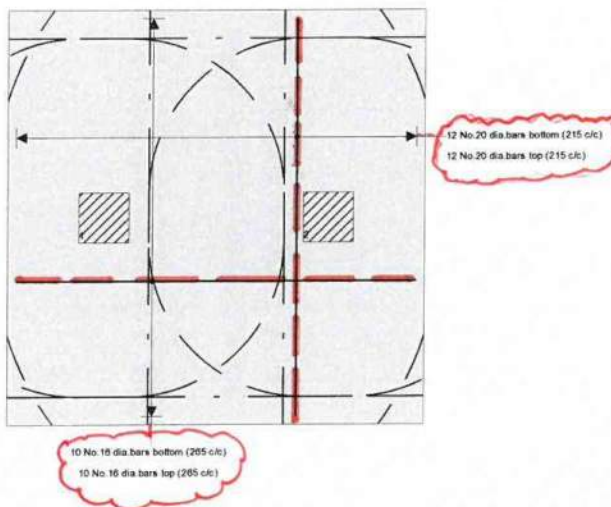
Punching shear stress factor (fig 6.21N)

$$\beta = 1.500$$

Maximum punching shear stress (exp 6.38)

$$V_{Ed,max} = \beta \times V_{Ed,max} / (u_0 \times d) = 0.012 \text{ N/mm}^2$$

PASS - Maximum punching shear resistance exceeds maximum punching shear stress



Project: STARBUCKS, RHOSTYLLEN
Project no: K02906
Author: TO



Project data

Project name	STARBUCKS, RHOSTYLLEN
Project number	K02906
Author	TO
Description	BASE PLATE AND FIXING
Date	4/1/2022
Design code	EN

Material

Steel	S 355, S 275
Concrete	C25/30, C30/37

Project: STARBUCKS, RHOSTYLLEN
 Project no: K02906
 Author: TO

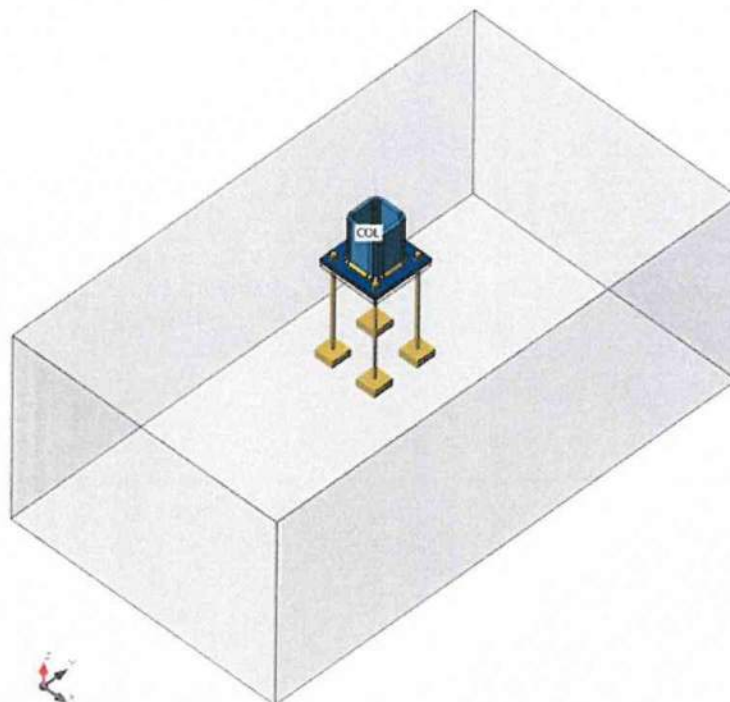
Project item STARBUCKS, RHOSTYLLEN

Design

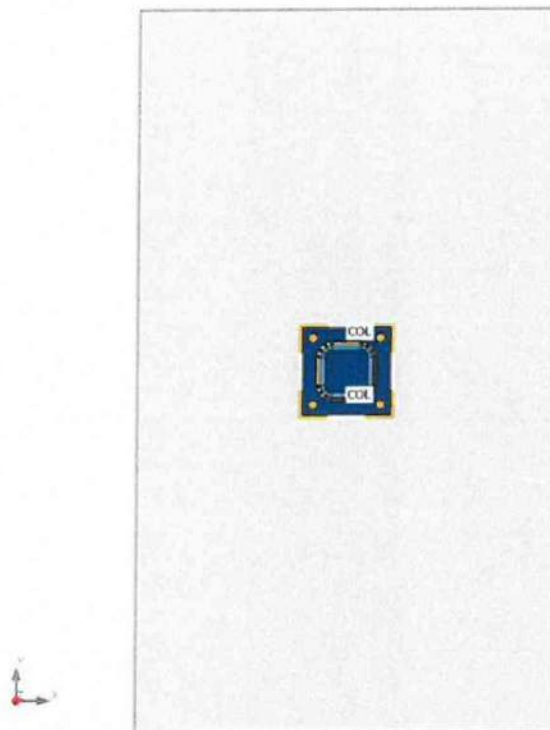
Name: STARBUCKS, RHOSTYLLEN
 Description: BASE PLATE AND FIXING
 Analysis: Stress, strain/ simplified loading

Beams and columns

Name	Cross-section	β - Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
COL	1 - SHS180/180/16.0	0.0	-90.0	0.0	0	0	0	Node



Project: STARBUCKS, RHOSTYLLEN
 Project no: K02906
 Author: TO



Cross-sections

Name	Material
1 - SHS180/180/16.0	S 355

Anchors

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm ²]
M20 8.8	M20 8.8	20	800.0	314

Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	COL	-7.6	5.6	0.0	0.0	0.0	16.8

Foundation block

Item	Value	Unit
CB 1		
Dimensions	2500 x 1450	mm
Depth	1000	mm
Anchor	M20 8.8	
Anchoring length	450	mm
Shear force transfer	Anchors	
Mortar joint	25	mm

Project: STARBUCKS, RHOSTYLLEN
 Project no: K02906
 Author: TO

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Anchors	32.9 < 100%	OK
Welds	52.5 < 100%	OK
Concrete block	15.8 < 100%	OK
Buckling	Not calculated	

Plates

Name	Material	Thickness [mm]	Loads	σ_{Ed} [MPa]	ϵ_{pl} [%]	σ_{cEd} [MPa]	Status
COL	S 355	16.0	LE1	104.4	0.0	0.0	OK
BP1	S 275	20.0	LE1	170.3	0.0	0.0	OK

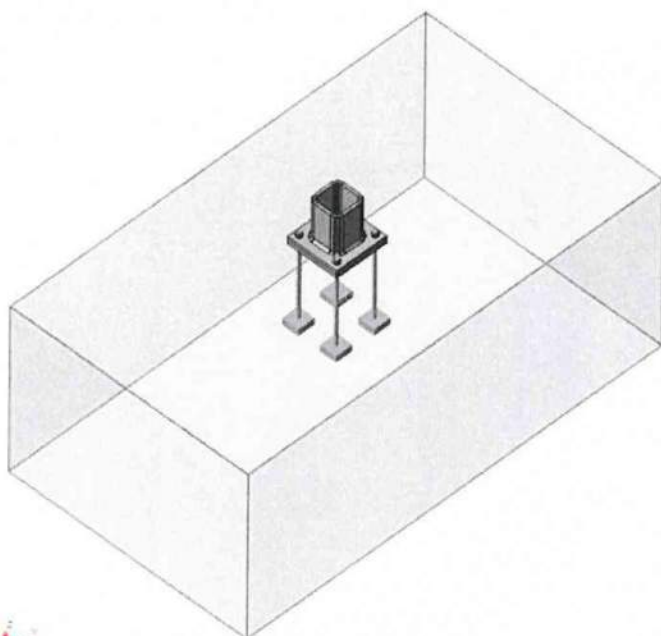
Design data

Material	f_y [MPa]	ϵ_{lim} [%]
S 355	355.0	5.0
S 275	275.0	5.0

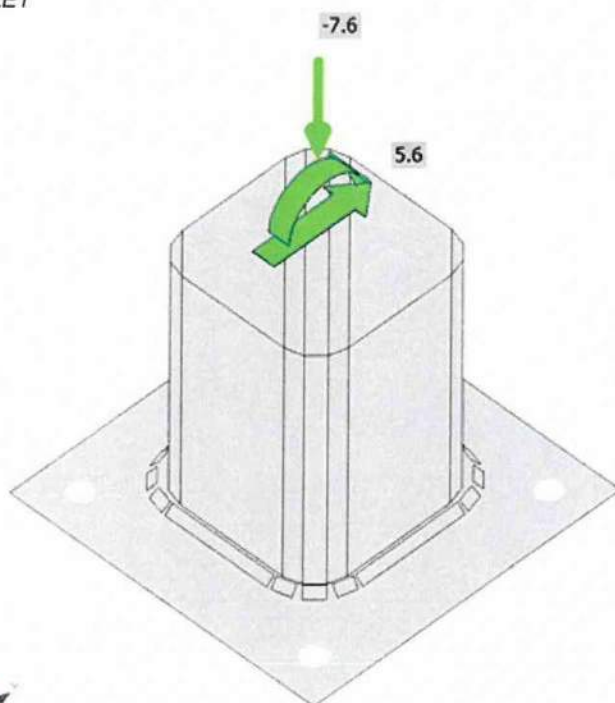
Symbol explanation

ϵ_{pl}	Strain
σ_{Ed}	Eq. stress
σ_{cEd}	Contact stress
f_y	Yield strength
ϵ_{lim}	Limit of plastic strain

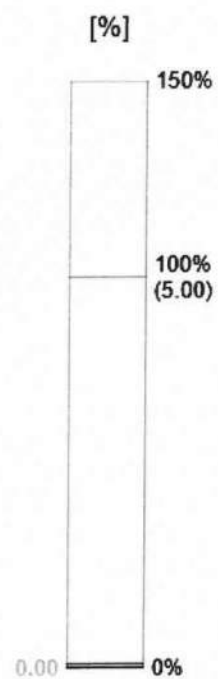
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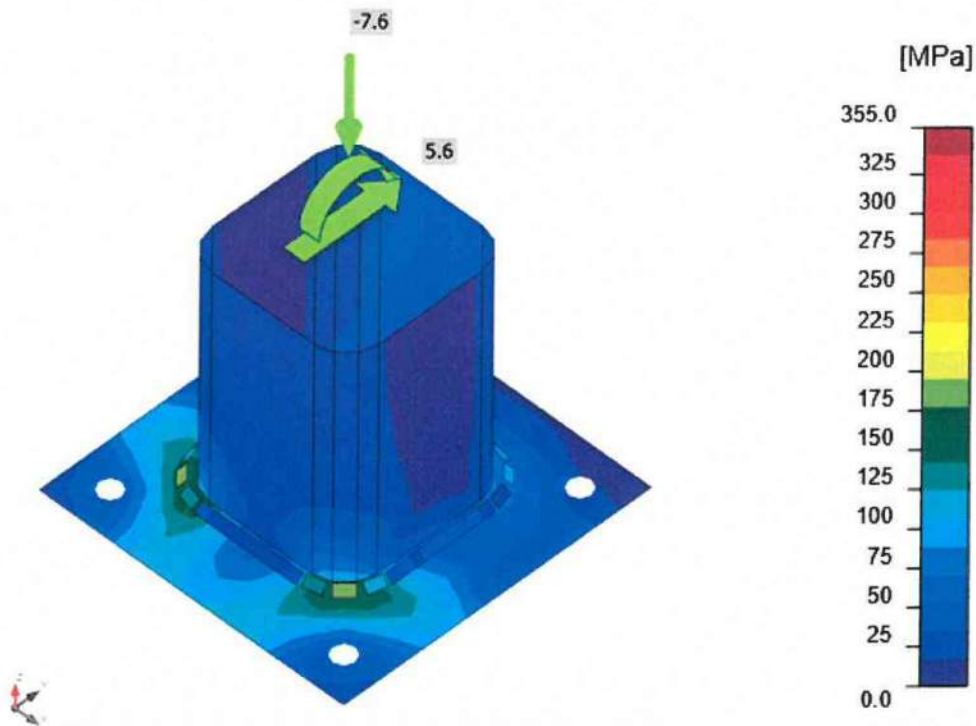
Overall check, LE1



Strain check, LE1



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Equivalent stress, LE1

Anchors

Shape	Item	Loads	N _{Ed} [kN]	V _{Ed} [kN]	N _{Rd,c} [kN]	N _{Rd,p} [kN]	N _{Rd,cb} [kN]	V _{Rd,s} [kN]	V _{Rd,c} [kN]	V _{Rd,cp} [kN]	U _t [%]	U _s [%]	U _{ts} [%]	Status
	A5	LE1	0.0	1.3	-	1210.7	-	18.5	106.8	757.4	0.0	7.3	1.2	OK
	A6	LE1	36.5	1.5	269.6	1210.7	-	12.4	-	757.4	32.9	12.4	14.2	OK
	A7	LE1	0.0	1.3	-	1210.7	-	18.5	106.8	757.4	0.0	7.3	1.2	OK
	A8	LE1	36.5	1.5	269.6	1210.7	-	12.4	-	757.4	32.9	12.4	14.2	OK

Design data

Grade	N _{Rd,s} [kN]	
M20 8.8 - 1		111.1

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Symbol explanation

N_{Ed}	Tension force
V_{Ed}	Resultant of shear forces V_y , V_z in bolt
$N_{Rd,c}$	Design resistance in case of concrete cone failure under tension load - EN1992-4 - Cl. 7.2.1.4
$N_{Rd,p}$	Design resistance in case of pull-out failure - EN1992-4 - Cl. 7.2.1.5
$N_{Rd,cb}$	Design resistance in case of concrete blow-out failure - EN1992-4 - Cl. 7.2.1.8
$V_{Rd,s}$	Design shear resistance in case of steel failure - EN1992-4 - Cl. 7.2.2.3.2
$V_{Rd,c}$	Design resistance in case of concrete cone failure under shear load - EN1992-4 - Cl. 7.2.2.5
$V_{Rd,cp}$	Design resistance in case of concrete pryout failure - EN1992-4 - Cl. 7.2.2.4
U_{t_t}	Utilization in tension
U_{t_s}	Utilization in shear
$U_{t_{ts}}$	Utilization in tension and shear
$N_{Rd,s}$	Design tensile resistance of a fastener in case of steel failure - EN1992-4 - Cl. 7.2.1.3

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ϵ_{pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{ }$ [MPa]	$\tau_{\perp}$ [MPa]	U_t [%]	U_{t_c} [%]	Status
BP1	COL	10.0	599	LE1	188.6	0.0	162.5	13.7	-53.5	52.5	17.7	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9σ [MPa]
S 275	0.85	404.7	309.6

Symbol explanation

ϵ_{pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{ }$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9σ	Perpendicular stress resistance - $0.9 \cdot f_u / \gamma_{M2}$
β_w	Corelation factor EN 1993-1-8 tab. 4.1
U_t	Utilization
U_{t_c}	Weld capacity utilization

Concrete block

Item	Loads	c [mm]	A_{eff} [mm ²]	σ [MPa]	k_j [-]	F_{jd} [MPa]	U_t [%]	Status
CB 1	LE1	30	13044	6.3	3.00	40.2	15.8	OK

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Symbol explanation

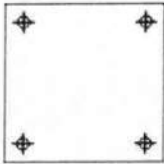
c	Bearing width
A_{eff}	Effective area
σ	Average stress in concrete
k_j	Concentration factor
F_{jd}	The ultimate bearing strength of the concrete block
U_t	Utilization

Buckling

Buckling analysis was not calculated.

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
BP1	P20.0x300.0-300.0 (S 275)		1	Fillet: a = 10.0	598.8	M20 8.8	4

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Fillet	S 275	10.0	14.1	598.8

Anchors

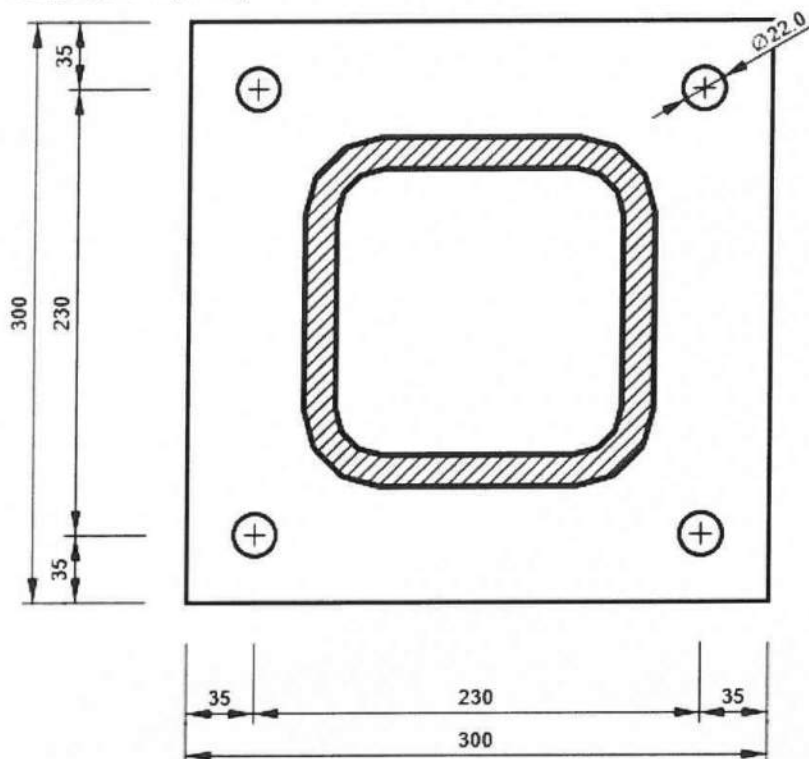
Name	Length [mm]	Drill length [mm]	Count
M20 8.8	495	450	4

Drawing

BP1

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P20.0x300-300 (S 275)



Code settings

Item	Value	Unit	Reference
YM0	1.00	-	EN 1993-1-1: 6.1
YM1	1.00	-	EN 1993-1-1: 6.1
YM2	1.25	-	EN 1993-1-1: 6.1
YM3	1.25	-	EN 1993-1-8: 2.2
YC	1.50	-	EN 1992-1-1: 2.4.2.4
YInst	1.20	-	EN 1992-4: Table 4.1
Joint coefficient β_j	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Weld stress evaluation	Plastic redistribution		
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated a_b in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	No		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints

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Item	Value	Unit	Reference
Braced system	No		EN 1993-1-8: 5.2.2.5

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