HOARDING DESIGN

In accordance with BS 5975:2019

Tedds calculation version 1.0.00

Design summary

Overall design status; PASS

Overall design utilisation; 0.985

Description	Unit	Allowable	Applied	Utilisation	Result
Timber post moment	kNm	6.75	6.46	0.957	PASS
Timber post shear	kN	21.19	5.59	0.264	PASS
Timber rail moment	kNm	1.26	1.24	0.985	PASS
Timber rail shear	kN	12.11	2.25	0.186	PASS
Face material moment	kNm/m	1.00	0.52	0.518	PASS
Panel-rail connection	kN/m	3.01	1.55	0.514	PASS
Rail-post connection	kN	12.60	1.70	0.135	PASS
Found. moment FoS		1.50	3.13	0.479	PASS
Found. sliding FoS		1.50	1.61	0.931	PASS

Site details

Site location; Norwich

Distance to the shoreline; $d_{shoreline}$ = **27** km

Site altitude; A = **24** m

Basic wind velocity; v_b = **22** m/s

Probability factor; c_{prob} = **1**

Terrain category; Town

Distance from town edge; d_{town} = **3.0** km

Topography

Topography type; Flat

Topographical factor, BS 5975 cl. Figure 9; T_{wind} = **1**

Design factors

Load duration factor; K_{52} = **1.25**

Service class factor; K_{53} = **0.7**

Screws in line factor; K_{54} = **1**

Foundation details

Foundation type; Kentledge

Width of kentledge block; $L_{Width.Block}$ = **1350** mm

Block weight per post; W_{Block} = **30** kN

Block friction coefficient; μ_{Block} = **0.30**

Loading

Crowd load; F_{crowd} = **1.50** kN/m

Crowd load applied at; H_{Fcrowd} = **1.1** m

Face material robustness load; F_{face} = **1.50** kN/m^2

Peak velocity pressure

Wind factor, BS 5975 cl. 17.5.1.3; $S_{wind} = T_{wind} \times v_b \times (1 + A / 1000\ m)$ = **22.84** m/s

Probability factor, BS 5975 cl. 17.5.1.3; c_{prob} = **1.0**

Combined exposure factor, BS 5975 Table 16; C_{ef} = **1.111**

Peak velocity pressure, BS 5975 cl. 17.5.1.3; $q_p = 0.613 \text{ kg/m}^3 \times c_{prob}^2 \times C_{ef} \times S_{wind}^2 = \mathbf{0.36} \text{ kN/m}^2$

Net pressure coefficients - Table B.2, Hoarding design guide

Effective length of hoarding; $L_{ef} = \mathbf{50}$ m

In plan hoarding shape; Without returns

Zone A; $C_{p,net.A} = \mathbf{3.40}$

Lenght of zone A; $L_A = \mathbf{0.74}$ m

Zone B; $C_{p,net.B} = \mathbf{2.10}$

Lenght of zone B; $L_B = \mathbf{4.21}$ m

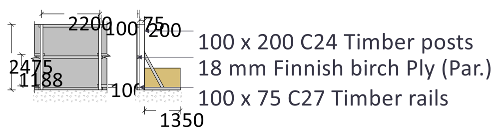
Zone C; $C_{p,net.C} = \mathbf{1.70}$

Lenght of zone C; $L_C = \mathbf{4.95}$ m

Zone D; $C_{p,net.D} = \mathbf{1.20}$

Lenght of zone D; $L_D = \mathbf{40.10}$ m

Hoarding design - Zone B



Timber post details

Breadth of section; $b_{post} = \mathbf{100}$ mm

Depth of section; $d_{post} = \mathbf{200}$ mm

Timber strength class; C24

Height of timber posts; $H_{post} = \mathbf{2475}$ mm

Spacing of timber posts; $s_{post} = \mathbf{2200}$ mm

Timber rail details

Breadth of section; $b_{rail} = \mathbf{100}$ mm

Depth of section; $d_{rail} = \mathbf{75}$ mm

Timber strength class; C27

Number of timber rails; $N_{rail} = \mathbf{3}$

Face material details

Board type; Finnish birch Plywood (Parallel)

Thickness; $t_{panel} = \mathbf{18}$ mm

Connection of panel to rail details

Screw diameter; $\phi_{screw.Panel} = \mathbf{4}$ mm

Screw length; $l_{screw.Panel} = \mathbf{75}$ mm

Screw spacing; $s_{screw.Panel} = \mathbf{300}$ mm

Connection of rail to post details

Screw diameter; $\phi_{screw.Post}$ = **5** mm

Screw length; $l_{screw.Post}$ = **200** mm

Number of screws; $N_{screw.Post}$ = **6**

Wind forces - Annex B, Hoarding design guide

Shielding factor; η = **1**

Maximum wind force; $F_{W.Max} = q_p \times C_{p,net.B} \times \eta \times H_{post}$ = **1.85** kN/m

Maximum working wind velocity pressure; $q_{p.work}$ = **0.2** kN/m^2

Working wind force; $F_{W.Work} = q_{p.work} \times C_{p,net.B} \times \eta \times H_{post}$ = **1.04** kN/m

Timber post

Maximum overturning moment; $M_{Post} = \max(F_{W.Max} \times H_{post} / 2, F_{W.Work} \times H_{post} / 2 + F_{crowd} \times H_{Fcrowd}) \times s_{post}$ = **6.46** kNm

Perm. moment capacity - Table C1, TWf publ.; M_{adm} = **6.75** kNm

M_{Post} / M_{adm} = **0.957**

PASS - Bending moment capacity is greater than applied bending moment

Shear force in base; $Q_{Post} = \max(F_{W.Max}, F_{W.Work} + F_{crowd}) \times s_{post}$ = **5.59** kN

Perm. shear capacity - Table C1, TWf publ.; Q_{adm} = **21.19** kN

Q_{Post} / Q_{adm} = **0.264**

PASS - Shear capacity is greater than applied shear

Timber rail

Centre to centre spacing of rails; $s_{rail} = (H_{post} - b_{rail}) / (N_{rail} - 1)$ = **1188** mm

Continuity factor; k_{rail} =**1.1**

Maximum bending moment; $M_{Rail} = \max(q_p \times s_{rail} \times \eta \times C_{p,net.B} \times k_{rail}, q_{p.work} \times s_{rail} \times \eta \times C_{p,net.B} \times k_{rail} + F_{crowd}) \times s_{post}^2 / 8$ = **1.24** kNm

Perm. moment capacity - Table C1, TWf publ.; $M_{Rail.adm}$ = **1.26** kNm

$M_{Rail} / M_{Rail.adm}$ = **0.985**

PASS - Bending moment capacity is greater than applied bending moment

Shear force; $Q_{Rail} = \max(q_p \times s_{rail} \times \eta \times C_{p,net.B} \times k_{rail}, q_{p.work} \times s_{rail} \times \eta \times C_{p,net.B} \times k_{rail} + F_{crowd}) \times s_{post} / 2$ = **2.25** kN

Perm. shear capacity - Table C1, TWf publ.; $Q_{Rail.adm}$ = **12.11** kN

$Q_{Rail} / Q_{Rail.adm}$ = **0.186**

PASS - Shear capacity is greater than applied shear

Face material

Maximum bending moment; $M_{Panel} = \max(F_{face} \times s_{rail}^2 / 8, q_p \times \eta \times C_{p,net.B} \times s_{rail}^2 / 8, q_{p.work} \times \eta \times C_{p,net.B} \times s_{rail}^2 / 8 + F_{crowd} \times s_{rail} / 4)$ = **0.519** kNm/m

Perm. moment capacity - Table C1, TWf publ.; $M_{Panel.adm}$ = **1.002** kNm/m

$M_{Panel} / M_{Panel.adm}$ = **0.518**

PASS - Bending moment capacity is greater than applied bending moment

Connection of panel to rail

Wind tension force; $F_{Wind.panel} = \max(q_p \times C_{p,net.A} \times \eta \times s_{rail}, q_{p.work} \times C_{p,net.A} \times \eta \times s_{rail} + F_{min})$ = **1.55** kN/m

Point side penetration; $L_{pen.Panel} = l_{screw.Panel} - t_{panel}$ = **57** mm

Basic withdrawal force, Table 4, TWf publ.; $F_{Panel.Basic}$ = **18.1** N/mm

Permissible force, eq 1, TWf publ.; $F_{Panel.adm} = F_{Panel.Basic} \times K_{52} \times K_{53} \times K_{54} \times L_{pen.Panel} / s_{screw.Panel}$ = **3.01** kN/m

$F_{Wind.panel} / F_{Panel.adm}$ = **0.514**

PASS - Permissible force is greater than applied wind tension force

Connection of rail to post

Wind tension force; $F_{Wind.post} = max(q_p \times C_{p,net.A} \times \eta \times s_{rail} \times s_{post} / 2, q_{p.work} \times C_{p,net.A} \times \eta \times s_{rail} \times s_{post} / 2 + F_{min} \times s_{post} / 2)$ = **1.70** kN

Point side penetration; $L_{pen.post} = l_{screw.Post} - d_{rail}$ = **125** mm

Basic withdrawal force, Table 4, TWf publ.; $F_{Post.Basic}$ = **19.2** N/mm

Permissible force, eq 1, TWf publ.; $F_{Post.adm} = N_{screw.Post} \times F_{Post.Basic} \times K_{52} \times K_{53} \times K_{54} \times L_{pen.post}$ = **12.60** kN

$F_{Wind.post} / F_{Post.adm}$ = **0.135**

PASS - Permissible force is greater than applied wind tension force

Foundation design

Overturning moment; $M_{max.Foundation} = M_{Post}$ = **6.46** kNm

Restoring moment; $M_R = W_{Block} \times L_{Width.Block} / 2$ = **20.25** kNm

Actual factor of safety; $FoS_{Actual.Mom} = M_R / M_{max.Foundation}$ = **3.13**

Allowable factor of safety; FoS = **1.5**

$FoS / FoS_{Actual.Mom}$ = **0.479**

PASS - Factor of safety against overturning is adequate

Maximum shear; $Q_{max.Foundation} = Q_{Post}$ = **5.59** kN

Sliding resistance; $Q_R = W_{Block} \times \mu_{Block}$ = **9.00** kN

Actual factor of safety; $FoS_{Actual.Sliding} = Q_R / Q_{max.Foundation}$ = **1.61**

Allowable factor of safety; FoS = **1.5**

$FoS / FoS_{Actual.Sliding}$ = **0.931**

PASS - Factor of safety against sliding is adequate