Job No. 466617	Header	Date Sep - 2024
Job Rapid-Shield	By TB	Checked EG

STRUCTURAL DESIGN CALCULATIONS

Client: First Fence Limited

Project: Rapid-Shield Product Line

Fencing System: RAPID-SHIELD-6440: 2.0m high x 2.5m long 358 Prison Mesh panel with RapidShield UniFoot base inc 200kg ballast.

Design References: Wind Loading; BS-EN 1991-1-4:2005+A1:2010

Brief: The calculations have been carried out to provide a design wind speed V_e.

Design Assumptions:

- All dimensions and weights of the system have been taken from the First Fence system drawings and details.
- No signage or coverings to be fixed to any part of the fencing
- No horizontal loading except for wind loading has been applied to the design.
- Panels are installed upright and on firm ground
- The calculation assumes a single panel, but applies equally to multiple panels in a straight line configuration.

Design Summary: The maximum design wind speed of this system is:

24.4 m/s

54.6 mph

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Stability Calculations

Kit SKU — RAPID-SHIELD-6440

Panel Dimensions

Panel Height (H)	*from product drawing*	2010	mm
Panel Length (X)	*from product drawing*	2518	mm
Offset at base of Panel (s)	*from product drawing*	70	mm
Total area enclosed by panel (A)	(H-s)X	4884920	mm^2
		4.885	m^2

UniFoot & Ballast Dimensions

UniFoot & Ballast Height ($base_h$)		730	mm
UniFoot & Ballast Widge ($base_w$)		330	mm
UniFoot & Ballast Area	$base_w$*$base_h$	240900	mm^2
		0.241	m^2

Solidity of Panel

Pitch of vertical mesh bars (x)	*from product drawing*	12.7	mm
Pitch of horizontal mesh bars (y)	*from product drawing*	76.2	mm
Mesh Bar diameter (d_{bar})	*from product drawing*	4	mm
No. bars vertical (n_v)	*from product drawing*	34	
No. bars horizontal (n_h)	*from product drawing*	159	
Area of frame = one no. post (A_1)	H(post width)	120600	mm^2
		0.121	m^2
Area of vertical bars (A_2)	((h-s)-(n_h*d_{bar}))*(n_v* d_{bar})))	177344	mm^2
		0.177	m^2
Area of horizontal bars (A_3)	(X-post width)*(n_h* d_{bar})	1563288	mm^2
		1.563	m^2
Area of Unifoot Base & Ballast (A_4)	($base_w$*$base_h$) - (post width*$base_h$)	197100	mm^2
		0.197	m^2
Effective area of Panel (A_e)	$A_1 + A_2 + A_3 + A_4$	2058332	mm^2
		2.058	m^2
Solidity of Panel (ϕ)	A_e / A	0.42	

Force Co-efficiant

Effective Force Co-efficiant (C_f)	From Table 20	1.2	

System Weight

Kentledge Weight: Uni Foot (Base + Ballast) (P_1)		218	kg
		2138	N
Kentledge Lever Arm (Z_1)		416	mm
Weight of Panel (P_2)		58.8	kg
		577	N
Panel Width Lever Arm (Z_2)		30	mm

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Stabilising Moment

Stabilising Moment M_s	$(P_1*Z_1) + (P_2*Z_2)$	907	Nm

Wind Force required to overturn the panel

At the point where the fencing system loses stability, the overturning moment equals the stabilising moment

Lever Arm (Z_3)	H / 2	1005	mm
		1.005	m
Force at point of instability (F)	M_s / Z_3	902	N

Wind speed to generate overturning force

Dynamic wind pressure to generate wind force (q)	$(F/C_f) / A_e$	365	N/m^2
Factor for SI units (k)		0.613	
Wind Speed (Ve)	√(q/k)	24.4	m/s
		54.6	mph

Wind speed to generate sliding force

Sliding resistance force = Total weight of fence system

Sliding Resistance (S_R)	P_1+P_2	2714	N
Equivalent wind speed at point of sliding resistance (V_e)	$\sqrt{((S_R/A_e/C_f)/K))}$	42.3	m/s
		94.7	mph