Vale Consultancy

CONSULTING CIVIL & STRUCTURAL ENGINEERS

STRUCTURAL CALCULATIONS

Garage site, Gurnos

Prepared for: Merthyr Valley Homes
Project Ref: 21417

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DOCUMENT CONTROL

Project:	Garage site, Gurnos
Client:	Merthyr Valley Homes
Vale Consultancy Ref:	21417

Issue	Prepared by	Approved by	Date	Status
01	Anastasija Solovjova *BEng* *Structural Engineer*	Matt Jones *MEng (Hons) CEng FICE FIStructE* *Managing Director*	17.09.2025	First issue

DESIGN STATEMENT

The design has been completed in accordance with British Standards BS6399, BS5628 (Masonry), & BS 8004 (Foundation).

Information provided by the client.

Ground bearing pressure assumed to be 100kPa, to be confirmed on site by contractor or building control officer prior to works.

Refer to our sketches 21417 - SK01 for references.

All dimensions, weights, member lengths, member tables, and any other relevant design information contained within this package is for analysis, and design purposes only, for submission to building control, and must not be used for pricing or fabrication purposes. All queries are to be directed to the engineer prior to tendering, pricing or fabrication. All structural members dimensions need to be taken accurately on site by the contractor prior to fabrication.

During any initial site visits performed by our Engineer, assumptions have to be made where structural elements may have been obscured by finishes. Opening up works should be undertaken prior to fabrication or construction of any structural members to confirm that the structural layout as indicated in our proposed sketches/detailed drawings is correct.

If there are any discrepancies, the Engineer MUST be informed immediately, and prior to proceeding with construction works on site.

CDM Comments:

- All temporary propping/support is to correspond to contractor's specification and details.

Garage site, Gurnos

The design has been completed in accordance with British Standards BS6399, BS5628 (Masonry).

All dimensions stated in the following calculations are for design purposes only and not for use for fabrication or construction purposes. All dimensions must be checked by a competent contractor prior to fabrication or construction and any discrepancies found are to be reported to the design engineer.

Design Loadings

1. Walls

Dead Loading:

Render	=	**0.15 kN/m²**
215mm masonry	=	**4.30kN/m²**
Plaster	=	**0.15 kN/m²**
		5.00 kN/m² Total Dead Loading

MASONRY WALL PANEL DESIGN

In accordance with BS5628-1:2005

Tedds calculation version 1.2.16

Masonry panel details

Garage wall - Unreinforced masonry wall without openings

Panel length L = **5600** mm

Panel height h = **2000** mm

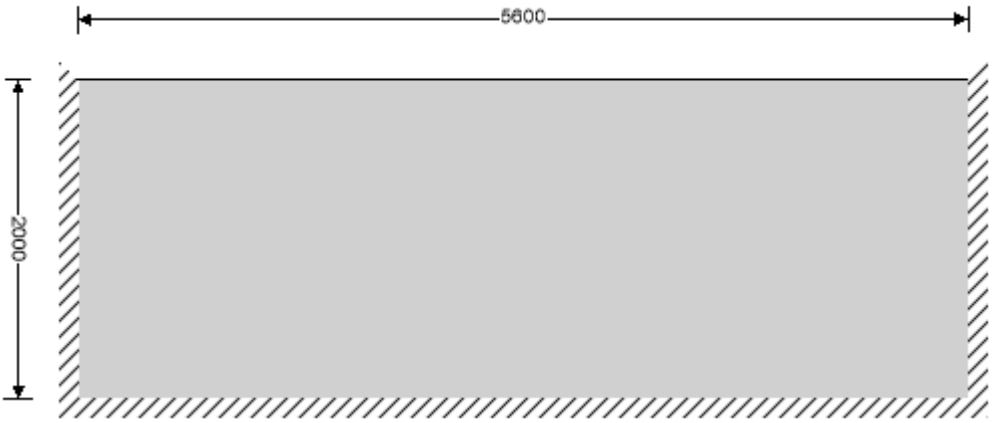
Panel support conditions

Right, left and bottom supported continuously

- Horizontal and vertical supports provide enhanced resistance to lateral movement

Effective panel length $L_{ef} = 0.75 \times L =$ **4200** mm

Effective panel height $h_{ef} = 2.0 \times h =$ **4000** mm



Single-leaf wall construction details

Wall thickness t = **215** mm

Effective wall thickness $t_{ef} = t =$ **215** mm

Masonry details

Masonry type **Aggregate concrete blocks with no voids**

Compressive strength of unit $p_{unit} =$ **7.3** N/mm^2

Mortar strength Class/Designation **M6 / (ii)**

Height of masonry units	h_b = **215** mm
Density of masonry	γ = **18.0** kN/m^3
Least horizontal dimension of masonry units	t_{min} = **215** mm
Ratio of height to least horizontal dimension	h_b / t_{min} = **1.00**

From BS5628-1 Table 2c & d - Characteristic compressive strength of masonry

Characteristic compressive strength	f_k = **4.11** N/mm^2

From BS5628-1 Table 3 - Characteristic flexural strength of masonry

Plane of failure parallel to bed joints	f_{kx_para} = **0.17** N/mm^2
Plane of failure perpendicular to bed joints	f_{kx_perp} = **0.41** N/mm^2

Lateral loading details

Characteristic wind load on panel	W_k = **1.000** kN/m^2

Partial safety factors for material strength

Category of manufacturing control	**Category II**
Category of construction control	**Normal**
Partial safety factor for masonry in compression	γ_{mc} = **3.50**
Partial safety factor for masonry in flexure	γ_{mf} = **3.00**
Partial safety factor for masonry in shear	γ_{mv} = **2.50**

Horizontal loading (cl 32)

Limiting dimensions (cl 32.3)

Area of panel	$A_p = h \times L$ = **11.2** m^2
Limiting area of panel	$A_{max} = 1500 \times t_{ef}^2$ = **69.3** m^2
	PASS - Area of panel does not exceed limiting area of panel
Limiting panel dimension	$L_{max} = 50 \times t_{ef}$ = **10750** mm
	PASS - Limiting panel dimension is not exceeded

Partial safety factors for design loads

Partial safety factor for design wind load	γ_{fW} = **1.40**
Partial safety factor for design dead load	γ_{fG} = **0.90**

Design moments of resistance in panels (cl 32.4.2)

Design vertical compressive stress	$g_d = \gamma_{fG} \times G_k / t$ = **0.00** N/mm^2
Enhanced flexural strength of masonry	$f_{ka\_para} = f_{kx\_para} + \gamma_{mf} \times g_d$ = **0.17** N/mm^2
Section modulus of wall	$Z = t^2 / 6$ = **7704167** mm^3/m
Elastic design moment of resistance	$M_d = f_{kx\_perp} \times Z / \gamma_{mf}$ = **1.049** kNm/m

Design moment in panels (cl 32.4.2)

Orthogonal strength ratio	$\mu = f_{ka\_para} / f_{kx\_perp}$ = **0.42**

Using yield line analysis to calculate bending moment coefficient

Bending moment coefficient	α = **0.023**
Design moment in wall	$M = \alpha \times W_k \times \gamma_{fW} \times L^2$ = **1.000** kNm/m
	PASS - Resistance moment exceeds design moment

YEW CLOSE, GURNOS ESTATE, MERTHYR

STRIP FOUNDATION, HAND CALCULATIONS.

1. INFORMATION GIVEN:
- WALL THICKNESS, $t = 215MM = 0.215M$
- WALL HEIGHT, $h = 2.0M$
- BRICK DENSITY, $\gamma = 20.0 KN/M^3$
- COPING ALLOWANCE $= 0.5 KN/M$
- AIR DENSITY, $\rho = 1.25 kg/m^3$, $C_{p,net} = 1.20$
- PARTIAL FACTORS: $\gamma_G = 1.35$, $\gamma_Q = 1.5$
- WIND VELOCITY, $V_{b0} = 22 m/s$

2. DEAD LOAD

- SELF WEIGHT PER M^2:

$$\omega = \gamma \times t = 20 \times 0.215 = 4.3 KN/M^2$$

- PER METRE RUN (HEIGHT 2.0M):

$$Wall = 4.3 KN/M^2 \times 2.0M = 8.6 KN/M$$

- ADD COPPING ALLOWANCE:

$$W_{dead} = 8.6 \frac{KN}{M} + 0.5 \frac{KN}{M} = 9.1 \frac{KN}{M}$$

- FACTORED (ULS)

$$W_{dead,ULS} = \gamma_G \times W_{dead} = 1.35 \times 9.1 \frac{KN}{M} = 12.3 \frac{KN}{M}$$

3. LIVE LOAD.

- PEAK VELOCITY PRESSURE:

$$q_p = 0.5 \times \rho \times V^2 = 0.5 \times 1.25 \times (22)^2 = 302.5 = 0.303 KN/M^2$$

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Sheet No. 06
Prepared by RH
Checked by MJ.

- DESIGN WIND PRESSURE ON WALL:

$$p = q \times C_{p.net} = 0.303 \frac{KN}{M^2} \times 1.2 = 0.364 KN/M^2$$

- HORIZONTAL LINE LOAD:

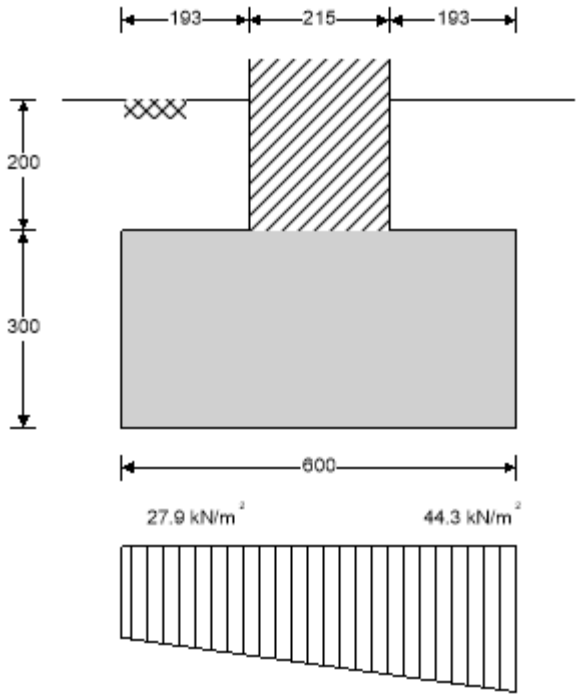
$$H = P \times h = 0.364 \times 2 = 0.73 KN/M$$

FACTORED, (ULS):

$$H_{ULS} = \gamma_Q \times H = 1.5 \times 0.73 = 1.1 KN/M$$

STRIP FOOTING ANALYSIS AND DESIGN (BS8110-1:1997)

Tedds calculation version 2.0.07



Strip footing details

Width of strip footing	B = **600** mm
Depth of strip footing	h = **300** mm
Depth of soil over strip footing	h_{soil} = **200** mm
Density of concrete	ρ_{conc} = **23.6** kN/m^3

Load details

Load width	b = **215** mm
Load eccentricity	e_P = **0** mm

Soil details

Density of soil	ρ_{soil} = **20.0** kN/m^3
Design shear strength	ϕ' = **25.0** deg
Design base friction	δ = **19.3** deg
Allowable bearing pressure	$P_{bearing}$ = **100** kN/m^2

Axial loading on strip footing

Dead axial load	P_G = **15.0** kN/m
Imposed axial load	P_Q = **0.0** kN/m
Wind axial load	P_W = **0.0** kN/m
Total axial load	P = **15.0** kN/m

Foundation loads

Dead surcharge load	F_{Gsur} = **0.000** kN/m^2
Imposed surcharge load	F_{Qsur} = **0.000** kN/m^2
Strip footing self weight	$F_{swt} = h \times \rho_{conc}$ = **7.080** kN/m^2
Soil self weight	$F_{soil} = h_{soil} \times \rho_{soil}$ = **4.000** kN/m^2

Total foundation load — $F = B \times (F_{Gsur} + F_{Qsur} + F_{swt} + F_{soil})$ = **6.6** kN/m

Horizontal loading on strip footing

Dead horizontal load — H_G = **0.0** kN/m

Imposed horizontal load — H_Q = **0.0** kN/m

Wind horizontal load — H_W = **1.6** kN/m

Total horizontal load — H = **1.6** kN/m

Check stability against sliding

Resistance to sliding due to base friction

$H_{friction} = \max([P_G + (F_{Gsur} + F_{swt} + F_{soil}) \times B], 0\ kN/m) \times \tan(\delta)$ = **7.6** kN/m

Passive pressure coefficient — $K_p = (1 + \sin(\phi')) / (1 - \sin(\phi'))$ = **2.464**

Passive resistance of soil — $H_{pas} = 0.5 \times K_p \times (h^2 + 2 \times h \times h_{soil}) \times \rho_{soil}$ = **5.2** kN/m

Total resistance to sliding — $H_{res} = H_{friction} + H_{pas}$ = **12.8** kN/m

PASS - Resistance to sliding is greater than horizontal load

Check stability against overturning

Total overturning moment — $M_{OT} = M + H \times h$ = **0.492** kNm/m

Restoring moment

Foundation loading — $M_{sur} = B^2 \times (F_{Gsur} + F_{swt} + F_{soil}) / 2$ = **1.994** kNm/m

Axial loading on column — $M_{axial} = (P_G) \times (B / 2 - e_P)$ = **4.500** kNm/m

Total restoring moment — $M_{res} = M_{sur} + M_{axial}$ = **6.494** kNm/m

PASS - Overturning safety factor exceeds the minimum of 1.5

Calculate base reaction

Total base reaction — T = F + P = **21.6** kN/m

Eccentricity of base reaction in x — $e_T = (P \times e_P + M + H \times h) / T$ = **23** mm

Base reaction acts within middle third of base

Calculate base pressures

$q_1 = (T / B) \times (1 - 6 \times e_T / B)$ = **27.880** kN/m^2

$q_2 = (T / B) \times (1 + 6 \times e_T / B)$ = **44.280** kN/m^2

Minimum base pressure — $q_{min} = \min(q_1, q_2)$ = **27.880** kN/m^2

Maximum base pressure — $q_{max} = \max(q_1, q_2)$ = **44.280** kN/m^2

PASS - Maximum base pressure is less than allowable bearing pressure