AD Civil & Structural Engineers
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14 DEC 2025

# STRUCTURAL ENGINEERING CALCULATIONS,

# FOR NEW DWELLING AT BIRCHWOOD GARDENS, HEDGE END, SOUTHAMPTON.

## CLIENT: GLEN CRUMP

DESIGNED TO THE FOLLOWING CODES:
EC0, EC1 (ACTIONS ON STRUCTURES)
EC2 (CONCRETE)
EC3 (STEEL)
EC5 (TIMBER)
EC6 (MASONRY)

## DESCRIPTION OF WORKS

The client proposes to build a new dwelling close to existing mature trees. The proposal is to construct the house on a piled raft foundation which would be supported on helical screw piles to avoid damage to the roots and compaction of the ground around the trees.

The formwork for the raft will be Dufaylite clayboard which is a collapsible, biodegradable formwork which is washed through to weaken it after the slab has reached sufficient strength. Over time this then degrades naturally allowing water and oxygen to reach the roots below the tree without causing any compaction or permanent damage to the trees root system.

At or before construction, the buttress roots of the tree will need to be mapped out (with localized trial holes) to ensure that the new pile positions do not clash with these and cause to damage to them.

| | | | | |
|---|---|---|---|---|
| Job Name: Birchwood, Hedge End | | | | |
| Job Number: 240913 | Date: | 14/12/2025 | By: | AD |
| **GENERAL LOADINGS** | **SLS LOADS** | | **ULS LOADS** | |
| **1. Trussed Roof (30°)** | Dead (kN/m²) | Live (kN/m²) | Dead (kN/m²) | Live (kN/m²) |
| Trussed Rafters | 0.07 | | | |
| Clay Tiles | 0.65 | | | |
| Felt and Battens | 0.03 | | | |
| | | | | |
| Snow Load/ maintenance | | 0.75 | | |
| Slope load | 0.75 | | | |
| Roof Pitch | 30 | | | |
| Plan load | 0.87 | | | |
| | | | | |
| Trussed Ceiling Joists | 0.08 | | | |
| Insulation | 0.05 | | | |
| 12.5mm Plasterboard + skim | 0.15 | | | |
| 18mm Chipboard | 0.18 | | | |
| | | | | |
| Storage | | 0.25 | | |
| | | | | |
| Total Dead | 1.33 | | 1.79 | |
| Total Live | | 1.00 | | 1.5 |
| **Total Dead and Live** | **2.33** | | **3.29** | |
| **2. External Wall** | Dead (kN/m²) | | Dead (kN/m²) | |
| Lightweight block 100mm | 1.00 | | | |
| Insulation | 0.05 | | | |
| 12.5mm Plasterboard + skim | 0.15 | | | |
| Brick outer leaf | 2.10 | | | |
| | | | | |
| **Total Dead** | **3.30** | | **4.455** | |
| **3. Ground Floor** | Dead (kN/m²) | Live (kN/m²) | Dead (kN/m²) | Live (kN/m²) |
| 200mm suspended slab | 4.80 | | | |
| 75mm Screed | 1.65 | | | |
| Insulation | 0.05 | | | |
| Internal Partitions | 0.50 | | | |
| | | | | |
| Domestic Load | | 1.50 | | |
| | | | | |
| Total Dead | 7.00 | | 9.45 | |
| Total Live | | 1.50 | | 2.25 |
| **Total Dead and Live** | **8.50** | | **11.70** | |

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## Loadings

1) Slab internal loading = 7.0 DL + 1.50 LL = 8.50 kN/m². (ULS = 11.70 kN/m²)

2) Front wall loading = Truss × $\frac{6.9}{2}$ + 0.3m = 4.99 DL ; 3.75 LL

wall × 2.5 = 8.25 DL

Total load = 13.24 DL (kN/m) SLS Load = 16.99 kN/m
3.75 LL (kN/m) ULS Load = 23.5 kN/m

3) Side wall loading = Truss × $\frac{1.8}{2}$ + 0.3m = 1.60 kN/m DL ; 1.20 LL

wall × 2.5 = 8.25 DL

Total load = 9.85 DL (kN/m) SLS Load = 13.6 kN/m
3.75 LL (kN/m) ULS Load = 18.9 -"-

## Pile Loads

Assumed pile capacity = 73 kN SLS (FOS 2.0 handheld install)
= 180 kN ULS

* Based on 76R screw piles.

1) Internal piles :

Loaded Area = 3.2 × 2.4 = 7.68 m²

SLS Load = 7.68 × 8.50 = 65.3 kN < 73 ∴ ok.

ULS Load = 7.68 × 11.70 = 89.9 kN < 180 ∴ ok.

2) Edge piles (Front wall) :

Loaded Area = 3.2 × $\left(\frac{2.4}{2} + 0.25\right)$ = 4.64 m²

length of wall = 3.2m.

SLS Load = (4.64 × 8.50) + (3.2 × 16.99) = 93.8 kN > 73 ∴ not ok.

Therefore reduce spacing to 2.55m.

New loaded area = 2.55 × $\left(\frac{2.4}{2} + 0.25\right)$ = 3.7 m²

New length of wall = 2.55m.

SLS Load = (3.7 × 8.50) + (2.55 × 16.99) = 74.8 kN → By Inspection ok.

ULS Load = (3.7 × 11.7) + (2.55 × 23.5) = 103.2 kN < 180 ∴ ok.

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3) Edge piles (side wall):

Loaded Area = $2.4 \times \left(\frac{3.2}{2} + 0.25\right) = 4.44 m^2$

Loaded wall length = 2.4m.

SLS Load = $(4.44 \times 8.5) + (2.4 \times 13.6) = 70.4 kN < 73$ ∴ ok.

ULS Load = $(4.44 \times 11.7) + (2.4 \times 18.9) = 97.3 kN < 180$ ∴ ok.

4) Corner Piles:

Loaded Area = $\left(\frac{2.4}{2} + 0.25\right) \times \left(\frac{2.55}{2} + 0.25\right) = 2.21 m^2$

wall length = $\frac{2.4}{2}$m (Side) + $\frac{2.55}{2}$m (Front)

SLS Load = $(2.21 \times 8.5) + \left(\frac{2.4}{2} \times 13.6\right) + \left(\frac{2.55}{2} \times 16.99\right) = 56 kN < 73$ ∴ ok.

ULS Load = $(2.21 \times 13.7) + (2.4/2 \times 18.9) + (2.55/2 \times 23.5) = 83 kN < 180$ ∴ ok.

Slab design:

Max internal moment = 21.2kNm. (Sagging)

$d = 200 - 35 - 10 = 155 mm$ $\quad M/bd^2 f_{ck} = 0.028$ ∴ $z = 0.95d$

$A_s = \frac{M}{0.87 f_y z} = \frac{21.2 \times 10^6}{0.87 \times 0.95 \times 155 \times 500} = 331 mm^2$.

$A_{s,min} = 0.13/100 \times 1000 \times 200 = 260 mm^2$ ∴ provide A393 mesh bottom.

At edge piles provide additional H12-200 (for moment + punching)

and at corner piles provide addit'l H20-200 (for punching).

over internal piles provide additional H10-200 (for Hogging Moment).

| | | | | | |
|---|---|---|---|---|---|
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| *Location* | New Dwelling E-W from grids A to D | | AD | 14-Dec-25 | - |
| | FLAT SLAB ANALYSIS & DESIGN to EN 1992-1 : 2004 | | Checked | Revision | Job No |
| | Originated from TCC33.xlsm v 4.12 on CD | © 2003-2025 TCC | - | - | 240510 |

## MATERIALS

| | | | | | | |
|---|---|---|---|---|---|---|
| fck | 32 | N/mm² | | | | |
| fyk | 500 | N/mm² | dg | 20 | mm | |
| fywk | 500 | N/mm² | γs | 1.15 | steel | |
| $\varphi_{(t-t0)}$ | 2 | | γc | 1.50 | concrete | |
| Steel class | B | | Wk | 0.3 | mm top | |
| | | | | 0.3 | mm btm | |

## COVERS

| | mm | TO LAYER |
|---|---|---|
| Top cover | 35 | 1 |
| Btm cover | 35 | 1 |
| $\Delta_{c,dev}$ | 10 | mm |

## SPANS

| | L (m) |
|---|---|
| SPAN 1 | 3.190 |
| SPAN 2 | 3.190 |
| SPAN 3 | 3.190 |
| SPAN 4 | 3.190 |
| SPAN 5 | |
| SPAN 6 | |

## GEOMETRY

| | | |
|---|---|---|
| Bay type | INTERNAL | |
| Slab depth, h | 200 | mm |
| Int Panel width, b | 2412 | mm |
| End distance | 275 | from supt 1 |
| End distance | 275 | from supt 5 |

## PERIMETER LOADS *characteristic*

13.60 *kN/m outside supports 1 & 5*

## LOADING PATTERN

| | min | max |
|---|---|---|
| DEAD | 1.35 | 1.35 |
| IMPOSED | | 1.50 |

*BS EN 1990: (6.10)*

## SUPPORTS

| | ABOVE (m) | H (mm) | B (mm) | End Cond | BELOW (m) | H (mm) | B (mm) | End Cond |
|---|---|---|---|---|---|---|---|---|
| Support 1 | | | | | 1 | 60 | 60 | P |
| Support 2 | | | | | 1 | 60 | 60 | P |
| Support 3 | | | | | 1 | 60 | 60 | P |
| Support 4 | | | | | 1 | 60 | 60 | P |
| Support 5 | | | | | 1 | 60 | 60 | P |
| Support 6 | | | | | | | | |
| Support 7 | | | | | | | | |

*Usage: Vehicle<= 30kN* *With brittle partitions*

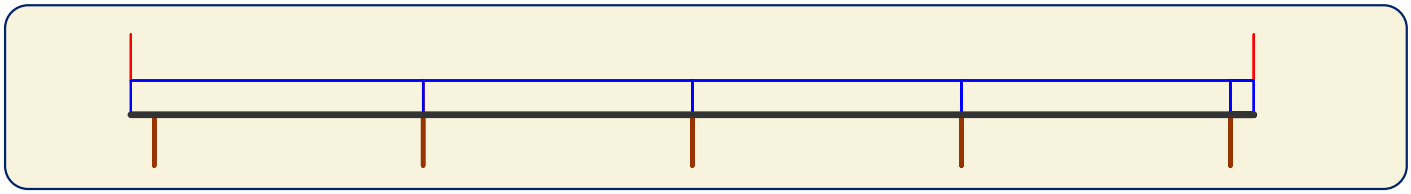
## LOADING

*UDLs (kN/m²)* *PLs (kN/m)* *Position (m)*

| | Dead Load | Imposed Load | Position from left | Loaded Length |
|---|---|---|---|---|
| **Span 1** | | | | |
| UDL | 8.50 | 1.50 | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |
| **Span 2** | | | | |
| UDL | 8.50 | 1.50 | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |
| **Span 3** | | | | |
| UDL | 8.50 | 1.50 | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |

| | Dead Load | Imposed Load | Position from left | Loaded Length |
|---|---|---|---|---|
| **Span 4** | | | | |
| UDL | 8.50 | 1.50 | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |
| **Span 5** | | | | |
| UDL | | | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |
| **Span 6** | | | | |
| UDL | | | ~~~~~ | ~~~~~ |
| PL 1 | | | | ~~~~~ |
| PL 2 | | | | ~~~~~ |
| Part UDL | | | | |

## LOADING DIAGRAM



| | | | | | |
|---|---|---|---|---|---|
| *Project* | Birchwood Gardens, Hedge End | The Concrete Centre | The Concrete Centre | | |
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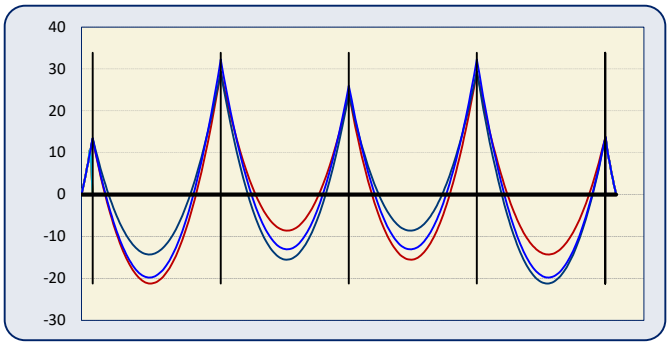
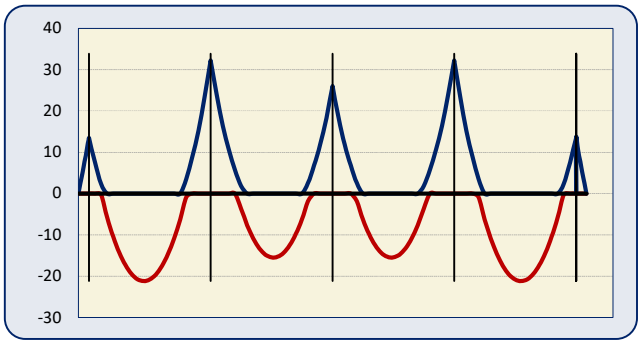
## BENDING MOMENT DIAGRAMS (kNm)




Elastic Moments

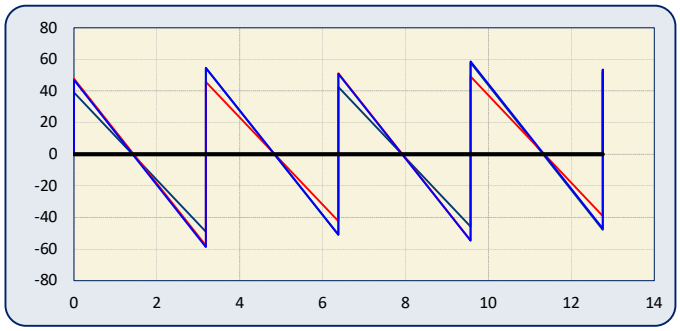



Redistributed Envelope

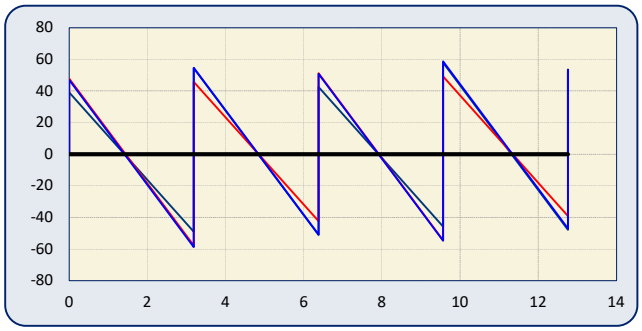
| SUPPORT No | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|
| Elastic M | 13.5 | 32.2 | 26.0 | 32.2 | 13.5 | ~ | ~ |
| Redistributed M | 13.5 | 32.2 | 26.0 | 32.2 | 13.5 | ~ | ~ |
| δ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | ~ | ~ |
| Redistribution | | | | | | | |
| End support reinf. Ø mm | 10 * | | | | 10 * | | |

| SPAN No | 1 | 2 | 3 | 4 | | |
|---|---|---|---|---|---|---|
| Elastic M | 21.2 | 15.5 | 15.5 | 21.2 | ~ | ~ |
| Redistributed M | 21.2 | 15.5 | 15.5 | 21.2 | ~ | ~ |
| δ | 1.000 | 1.000 | 1.000 | 1.000 | ~ | ~ |

## SHEAR FORCE DIAGRAMS (kN/m)




Elastic Shears




Redistributed Shears

| SPAN No | 1 | | 2 | | 3 | |
|---|---|---|---|---|---|---|
| Elastic V | 47.8 | 58.7 | 54.8 | 51.1 | 51.1 | 54.8 |
| Redistributed V | 47.8 | 58.7 | 54.8 | 51.1 | 51.1 | 54.8 |

| SPAN No | 4 | | | | | |
|---|---|---|---|---|---|---|
| Elastic V | 58.7 | 47.8 | ~ | ~ | ~ | ~ |
| Redistributed V | 58.7 | 47.8 | ~ | ~ | ~ | ~ |

## REACTIONS (kN/m)

| SUPPORT | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| ALL SPANS LOADED | 100.3 | 113.5 | 101.7 | 113.5 | 100.3 | |
| MAXIMUM | 100.3 | 113.5 | 101.7 | 113.5 | 100.3 | |
| Characteristic Dead | 68.1 | 69.5 | 63.4 | 69.5 | 68.1 | |
| Characteristic Imposed | 5.6 | 13.1 | 10.8 | 13.1 | 5.6 | |
| For punching ex /by | | 0.0002 | 0.0001 | 0.0002 | | (6.43) |
| $u_1 / u_1^*$ | 1.5028 | | | | 1.5028 | (6.44) |

| COLUMN MOMENTS (kNm) | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| ALL SPANS LOADED | Above | | | | | |
| | Below | 0.0 | 0.0 | | 0.0 | 0.0 |
| WITH MAX REACTION | Above | | | | | |
| | Below | 0.0 | 0.0 | | 0.0 | 0.0 |

| | | | |
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| SPAN 1 | | | LEFT | CENTRE | RIGHT |
|---|---|---|---|---|---|
| ACTIONS | δ | | 1.000 | 1.000 | 1.000 |
| | Be | | 365 | | 1206 |
| | Total M | kNm | 12.3 | 21.2 | 30.6 |
| | Mt max | kNm | 50.8 | | 165.9 |
| MIDDLE STRIP | Width | mm | 2047 | 1206 | 1206 |
| | M | kNm | 11.4 | 9.5 | 7.7 |
| | d | mm | 160.0 | 160.0 | 160.0 |
| | As | mm²/m | 84 | 120 | 96 |
| | As deflection | mm²/m | | 0 | |
| | | | *Provide B10 @ 300 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 300 T1* |
| | As prov | mm²/m | 262 | 262 | 262 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| COLUMN STRIP | Width | mm | 365 | 1206 | 1206 |
| | M | kNm | 12.3 | 11.7 | 23.0 |
| | d | mm | 160.0 | 160.0 | 159.0 |
| | As | mm²/m | 509 | 146 | 290 |
| | As deflection | mm²/m | | 0 | |
| | | | *Provide B10 @ 150 T1* | *Provide B10 @ 300 B1* | *Provide B12 @ 275:550 T1* |
| | As prov | mm²/m | 524 | 262 | 308 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| CHECKS | % As | | ok | ok | ok |
| | Singly reinforced | | ok | ok | ok |
| | σs | | ok | ok | ok |
| | max S | | ok | ok | ok |

| SPAN 2 | | | LEFT | CENTRE | RIGHT |
|---|---|---|---|---|---|
| ACTIONS | δ | | 1.000 | 1.000 | 1.000 |
| | Be | | 1206 | | 1206 |
| | Total M | kNm | 30.6 | 15.5 | 24.5 |
| | Mt max | kNm | 165.9 | | 168.0 |
| MIDDLE STRIP | Width | mm | 1206 | 1206 | 1206 |
| | M | kNm | 7.7 | 7.0 | 6.1 |
| | d | mm | 160.0 | 160.0 | 160.0 |
| | As | mm²/m | 96 | 88 | 77 |
| | As deflection | mm²/m | | 5 | |
| | | | *Provide B10 @ 300 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 300 T1* |
| | As prov | mm²/m | 262 | 262 | 262 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| COLUMN STRIP | Width | mm | 1206 | 1206 | 1206 |
| | M | kNm | 23.0 | 8.5 | 18.4 |
| | d | mm | 159.0 | 160.0 | 160.0 |
| | As | mm²/m | 290 | 107 | 230 |
| | As deflection | mm²/m | | 8 | |
| | | | *Provide B12 @ 275:550 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 225:450 T1* |
| | As prov | mm²/m | 308 | 262 | 262 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| CHECKS | % As | | ok | ok | ok |
| | Singly reinforced | | ok | ok | ok |
| | σs | | ok | ok | ok |
| | max S | | ok | ok | ok |

| | | | |
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| SPAN 3 | | | LEFT | CENTRE | RIGHT |
|---|---|---|---|---|---|
| ACTIONS | δ | | 1.000 | 1.000 | 1.000 |
| | Be | | 1206 | | 1206 |
| | Total M | kNm | 24.5 | 15.5 | 30.6 |
| | Mt max | kNm | 168.0 | | 165.9 |
| MIDDLE STRIP | Width | mm | 1206 | 1206 | 1206 |
| | M | kNm | 6.1 | 7.0 | 7.7 |
| | d | mm | 160.0 | 160.0 | 160.0 |
| | As | mm²/m | 77 | 88 | 96 |
| | As deflection | mm²/m | | 5 | |
| | | | *Provide B10 @ 300 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 300 T1* |
| | As prov | mm²/m | 262 | 262 | 262 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| COLUMN STRIP | Width | mm | 1206 | 1206 | 1206 |
| | M | kNm | 18.4 | 8.5 | 23.0 |
| | d | mm | 160.0 | 160.0 | 159.0 |
| | As | mm²/m | 230 | 107 | 290 |
| | As deflection | mm²/m | | 8 | |
| | | | *Provide B10 @ 225:450 T1* | *Provide B10 @ 300 B1* | *Provide B12 @ 275:550 T1* |
| | As prov | mm²/m | 262 | 262 | 308 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| CHECKS | % As | | ok | ok | ok |
| | Singly reinforced | | ok | ok | ok |
| | σs | | ok | ok | ok |
| | max S | | ok | ok | ok |

| SPAN 4 | | | LEFT | CENTRE | RIGHT |
|---|---|---|---|---|---|
| ACTIONS | δ | | 1.000 | 1.000 | 1.000 |
| | Be | | 1206 | | 365 |
| | Total M | kNm | 30.6 | 21.2 | 12.3 |
| | Mt max | kNm | 165.9 | | 50.8 |
| MIDDLE STRIP | Width | mm | 1206 | 1206 | 2047 |
| | M | kNm | 7.7 | 9.5 | 4.7 |
| | d | mm | 160.0 | 160.0 | 160.0 |
| | As | mm²/m | 96 | 120 | 35 |
| | As deflection | mm²/m | | 10 | |
| | | | *Provide B10 @ 300 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 300 T1* |
| | As prov | mm²/m | 262 | 262 | 262 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| COLUMN STRIP | Width | mm | 1206 | 1206 | 365 |
| | M | kNm | 23.0 | 11.7 | 12.3 |
| | d | mm | 159.0 | 160.0 | 160.0 |
| | As | mm²/m | 290 | 146 | 509 |
| | As deflection | mm²/m | | 15 | |
| | | | *Provide B12 @ 275:550 T1* | *Provide B10 @ 300 B1* | *Provide B10 @ 150 T1* |
| | As prov | mm²/m | 308 | 262 | 524 |
| | Top steel | | | *Provide B10 @ 300 T1* | |
| | Deflection | | L/d = 3,190 /160 = 19.94 < 40K = 48.00 | | OK |
| CHECKS | % As | | ok | ok | ok |
| | Singly reinforced | | ok | ok | ok |
| | σs | | ok | ok | ok |
| | max S | | ok | ok | ok |

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|---|---|---|---|---|
| Client | Glen Crump | Made by: AD | Date: 14-Dec-25 | Page: #VALUE! |
| Location | New Dwelling E-W, from grids A to D | Checked: - | Revision: - | Job No: 240510 |
| | FLAT SLAB ANALYSIS & DESIGN to EN 1992-1 : 2004 | | | |
| | Originated from TCC33.xlsmv 4.12 on CD | © 2003-2025 TCC | | |

| WEIGHT of REINFORCEMENT | | No Mid Strip | No Col Strip | Type | Dia | Length | Unit wt | Weight |
|---|---|---|---|---|---|---|---|---|
| TOP STEEL | Support 1 | 7 | | T | 10 | 1500 | 0.617 | 6.5 |
| | | | 4 | T | 10 | 1500 | 0.617 | 3.7 |
| | Span 1 | 5 | | T | 10 | 2725 | 0.617 | 8.4 |
| | | | 5 | T | 10 | 2725 | 0.617 | 8.4 |
| | Support 2 | 5 | | T | 10 | 1600 | 0.617 | 4.9 |
| | | | 4 | T | 12 | 1600 | 0.888 | 5.7 |
| | Span 2 | 5 | | T | 10 | 2725 | 0.617 | 8.4 |
| | | | 5 | T | 10 | 2725 | 0.617 | 8.4 |
| | Support 3 | 5 | | T | 10 | 1600 | 0.617 | 4.9 |
| | | | 5 | T | 10 | 1600 | 0.617 | 4.9 |
| | Span 3 | 5 | | T | 10 | 2725 | 0.617 | 8.4 |
| | | | 5 | T | 10 | 2725 | 0.617 | 8.4 |
| | Support 4 | 5 | | T | 10 | 1600 | 0.617 | 4.9 |
| | | | 4 | T | 12 | 1600 | 0.888 | 5.7 |
| | Span 4 | 5 | | T | 10 | 2725 | 0.617 | 8.4 |
| | | | 5 | T | 10 | 2725 | 0.617 | 8.4 |
| | Support 5 | 7 | | T | 10 | 1500 | 0.617 | 6.5 |
| | | | 4 | T | 10 | 1500 | 0.617 | 3.7 |
| BTM STEEL | Span 1 | 5 | | T | 10 | 3075 | 0.617 | 9.5 |
| | | | 5 | T | 10 | 3575 | 0.617 | 11.0 |
| | Span 2 | 5 | | T | 10 | 2950 | 0.617 | 9.1 |
| | | | 5 | T | 10 | 3350 | 0.617 | 10.3 |
| | Span 3 | 5 | | T | 10 | 2950 | 0.617 | 9.1 |
| | | | 5 | T | 10 | 3350 | 0.617 | 10.3 |
| | Span 4 | 5 | | T | 10 | 3075 | 0.617 | 9.5 |
| | | | 5 | T | 10 | 3575 | 0.617 | 11.0 |

**SUMMARY** *Rebar for single direction only. All figures approximate - see User Guide.*

TOTAL REINFORCEMENT IN BAY (kg) **198** REINFORCEMENT DENSITY (kg/m$^3$) **30.9**

| Project | Birchwood, Hedge End | The Concrete Centre | Made by | Date | Page |
|---|---|---|---|---|---|
| Client | Glen Crump | | AD | 14-Dec-2025 | - |
| Location | Typical Internal Pile | | Checked | Revision | Job No |
| | PUNCHING SHEAR to BS EN 1992-1:2004 | INTERNAL | - | - | 240510 |

Originated from TCC13.xlsm v4.42 © 2003-25 TCC

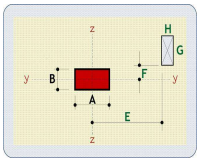
| Project | Spreadsheets | The Concrete Centre | Made by | Date | Page |
|---|---|---|---|---|---|
| Client | Advisory Group | | ra | 14-Dec-2025 | 198 |
| Location | ECBP Typical Floor Column B3 | | Checked | Revision | Job No |
| | PUNCHING SHEAR to BS EN 1992-1: 2004 | INTERNAL COLUMN | chg | - | FB625 |

Originated from TCC13.xlsm v on CD © 2003-00 TCC

**DATA** $f_{ck}$ N/mm$^2$ 32 — **VALID DESIGN**

$f_{yk}$ N/mm$^2$ 500 — Class B — Legs Stud

RC Density kN/m$^3$ 25 — *normal weight* — T1 — z dir ↔




**DIMENSIONS** Slab h mm 200 Cov mm 35

A mm 60 C mm N/A E mm 0 G mm 0

B mm 60 D mm N/A F mm 0 H mm 0

v(L1/L2) No

**ULT LOADING** $V_{ed}$ kN 90

Edge w kN/m N/A u kN/m$^2$ 0.0

Axial ↔kN/m 0 ↕ KN/m 0

β Using Factors = 1.150

braced, adj spans diff <= 25%

**SLAB z dir** 10 dia @ 200 ctrs dz **160** mm Asz mm$^2$/m **393** in B + 6d **%ρz 0.245**

**y dir** 10 dia @ 200 ctrs dy **150** mm Asy mm$^2$/m **393** in A + 6d **%ρy 0.262**

Spur Layout 12 %ρ <= 2 Yes d **155** mm **%ρ 0.253**

**RESULTS** 1.5Aswfyd ,ef / SrU1 **6.494** 0.75vRd,c = **0.420** N/mm$^2$ Uout xd **0.98**

$V_{E0}$ = β($V_{Ed}$ - UDL) = **104** kN At **2.00** x d vRd,c = **0.560** N/mm$^2$ vRd,cs **6.914**

At column face, vEd = **2.782** N/mm$^2$ At **2.0** x d vEd = **0.305** N/mm$^2$ vEd/vRd,c **0.545**

vEd / vRd,c max = **2.0** $V_{E,out}$ = **104** kN Gross Uout = **1192** mm Gross U1 mm **2188**

σcz & σcy **0.000** **0.000** k1 σcp **0.000**

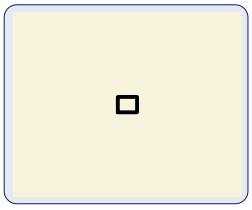
$V_{ed}$ Max No legs = **165** kN Legs **330**

**No Legs** Control Perim at **310** mm

Leg Dia 20

Auto x d 0.5

8 Spur Perim No



**HOLE DEDUCTION** **By Interpolation & Extrapolation - See adjacent detailed check**

Total Deduction at 2d = **0** mm

Total Deduction at 4d = **0** mm

Total Deduction at 6d = **0** mm

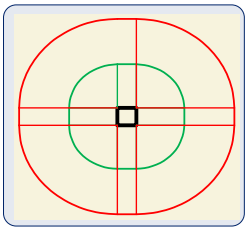
Total Deduction at Uout at 0.98d = **0** mm

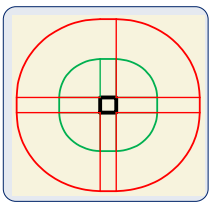
Net U1 = **2188** - **0** = **2188** mm

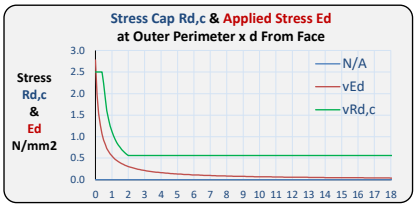
Net Uout = **1192** - **0** = **1192** mm

**Perimeter at U1**

**Perimeter at Uout**








**Deductions at 2d** Sides 0 **0** mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Deductions at 4d** Sides 0 **0** mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Deductions at 6d** Sides 0 **0** mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Check Deductions at 0.98d** Sides 0 **0** mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

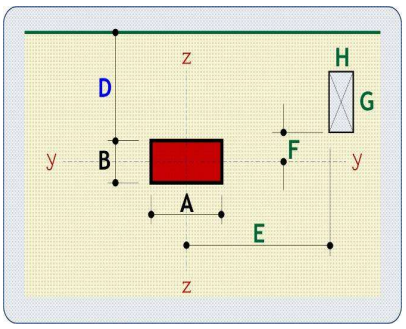
Sides

| | | | | | |
|---|---|---|---|---|---|
| Project | Birchwood, Hedge End | The Concrete Centre | | | |
| Client | Glen Crump | Made by | Date | Page | |
| Location | Typical Edge Column | ra | 14-Dec-2025 | #VALUE! | |
| | PUNCHING SHEAR to BS EN 1992-1:2004 EDGE | Checked | Revision | Job No | |
| | Originated from TCC13.xlsm v4.42 © 2003-25 TCC | - | - | 240510 | |

## DATA

VALID DESIGN

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $f_{ck}$ N/mm$^2$ | 32 | | | | | | |
| $f_{yk}$ N/mm$^2$ | 500 | Class | B | Legs | Bar | | |
| RC Density kN/m$^3$ | 25 | *normal weight* | | T1 | z dir | ↔ | |




## DIMENSIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Slab | | h mm | 200 | Cov mm | 35 | | |
| A mm | 60 | C mm | N/A | E mm | 0 | G mm | 0 |
| B mm | 60 | D mm | 240 | F mm | 0 | H mm | 0 |
| | | | | √(L1/L2) | Yes | | |

## ULT LOADING

| | | | |
|---|---|---|---|
| | | $V_{ed}$ kN | 103 |
| Edge w kN/m | 0.0 | u kN/m$^2$ | 0.0 |
| Axial ↔kN/m | 0 | ↕ KN/m | 0 |

β Using Factors = **1.400**

**braced, adj spans diff <= 25%**

## SLAB

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **z dir** | 10 12 | dia @ | 100 | ctrs | dz | **159.5** | mm | Asz mm$^2$/m | **958** | in B + 3d | **%ρz** | **0.601** |
| **y dir** | 10 12 | dia @ | 100 | ctrs | dy | **147.5** | mm | Asy mm$^2$/m | **958** | in A + 6d | **%ρy** | **0.650** |
| Spur Layout | All | %ρ <= 2 | Yes | | d | **153.5** | mm | | | | **%ρ** | **0.625** |

## RESULTS

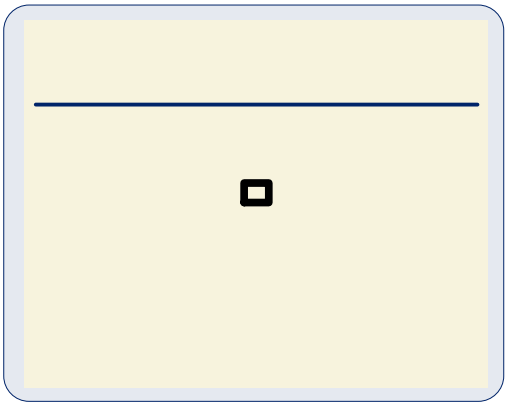
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.5Aswfyd ,ef / SrU1 | **1.038** | | | 0.75vRd,c = | **0.489** | N/mm$^2$ | Uout xd | **1.62** |
| $V_{E0}$ = β($V_{Ed}$ - UDL) = | **144** | kN | At | **2.0** | x d | vRd,c = | **0.651** | N/mm$^2$ | vRd,cs | **1.527** |
| At column face, vEd = | **5.219** | N/mm$^2$ | At | **2.0** | x d | vEd = | **0.578** | N/mm$^2$ | vEd/vRd,c | **0.888** |
| vEd / vRd,c max = | **2.0** | $V_{E,out}$ = | **144** | kN | Gross b0.5,out | **1442** | mm | Gross U1 mm | | **1624** |

| | | | | |
|---|---|---|---|---|
| σcz & σcy | **0.000** | **0.000** | k1 σcp | **0.000** |
| $V_{ed}$ Max | No legs = | **116** | kN Legs | **232** |

## No Legs

Control Perim at **535** mm

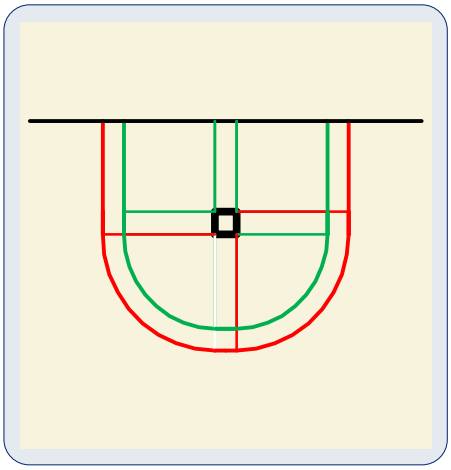
| | |
|---|---|
| Leg Dia | Auto |
| Auto x d | 0.5 |
| 5 Spur Perim | No |



## HOLE DEDUCTION

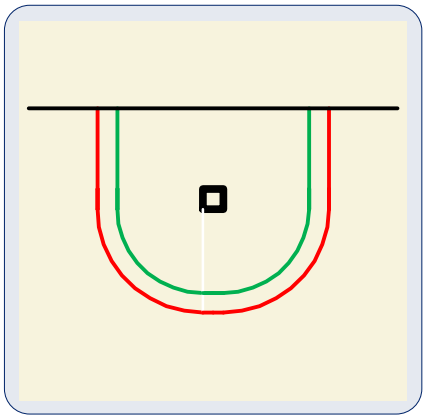
| | | | |
|---|---|---|---|
| Total Deduction at 2d | = | **0** | mm |
| Total Deduction at 4d | = | **0** | mm |
| Total Deduction at 6d | = | **0** | mm |
| Total Deduction at Uout at 1.62d | = | **0** | mm |

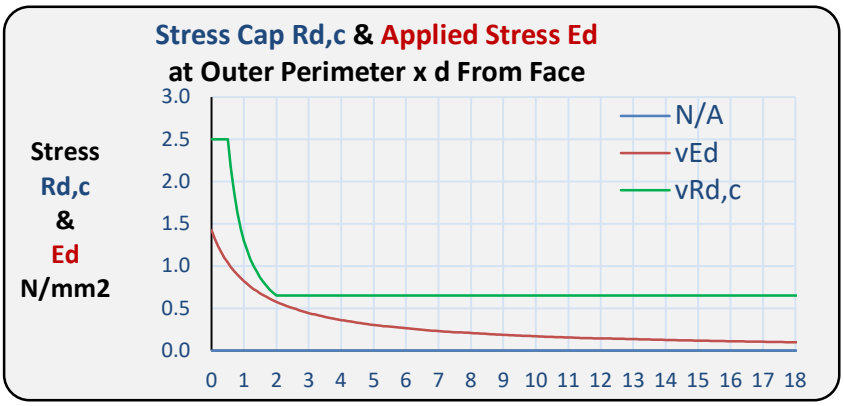
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Net U1 | = | **1624** | - | **0** | = | **1624** | mm |
| Net Uout | = | **1442** | - | **0** | = | **1442** | mm |



**Perimeter at U1**

**Perimeter at Uout**






| | | | | | |
|---|---|---|---|---|---|
| | **Deductions at 2d** | Sides | 0 | **0** | mm |
| Quads | Distance 1 - 2 | | | | |
| | Distance 1 - 3 | | | | |
| | Deduction | | | | |
| Sides | | | | | |
| | **Deductions at 4d** | Sides | 0 | **0** | mm |
| Quads | Distance 1 - 2 | | | | |
| | Distance 1 - 3 | | | | |
| | Deduction | | | | |
| Sides | | | | | |
| | **Deductions at 6d** | Sides | 0 | **0** | mm |
| Quads | Distance 1 - 2 | | | | |
| | Distance 1 - 3 | | | | |
| | Deduction | | | | |
| Sides | | | | | |
| | **Check at 1.62d** | Sides | 0 | **0** | mm |
| Quads | Distance 1 - 2 | | | | |
| | Distance 1 - 3 | | | | |
| | Deduction | | | | |
| Sides | | | | | |

| Project | Birchwood, Hedge End | The Concrete Centre | Made by | Date | Page |
|---|---|---|---|---|---|
| Client | Glen Crump | | ra | 14-Dec-2025 | #VALUE! |
| Location | Typical Corner Column | | Checked | Revision | Job No |
| | PUNCHING SHEAR to BS EN 1992-1:2004 | CORNER | - | - | 240510 |

Originated from TCC13.xlsm v4.42 © 2003-25 TCC

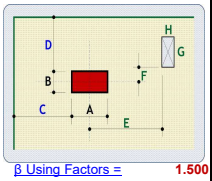
| Project | Spreadsheets | The Concrete Centre | Made by | Date | Page |
|---|---|---|---|---|---|
| Client | Advisory Group | | ra | 14-Dec-2025 | 200 |
| Location | Columns A1, D1, A5 & D5 | | Checked | Revision | Job No |
| | PUNCHING SHEAR to BS EN 1992-1: 2004 | CORNER COLUMN | chg | - | FB625 |

Originated from TCC13.xlsm v4.42 © 2003-25 TCC

**DATA** $f_{ck}$ N/mm² 32 — VALID DESIGN

$f_{yk}$ N/mm² 500 — Class B — Legs Stud

RC Density kN/m³ 25 — normal weight — T1 — z dir ↔




**DIMENSIONS** Slab h mm 250 — Cov mm 35

A mm 60 — C mm 240 — E mm 0 — G mm 0

B mm 60 — D mm 240 — F mm 0 — H mm 0

√(L1/L2) No

**ULT LOADING** $V_{ed}$ kN 85

Edge w kN/m 0.0 — u kN/m² 0.0

Axial ↔kN/m 0 — ↕ KN/m 0

β Using Factors = 1.500

braced, adj spans diff <= 25%

**SLAB** z dir 10 20 — dia @ 100 — ctrs dz 207.1 mm — Asz mm²/m 1963 — in B + 3d — %ρz 0.948

y dir 10 20 — dia @ 100 — ctrs dy 187.1 mm — Asy mm²/m 1963 — in A + 3d — %ρy 1.049

Spur Layout 8 & 12 — %ρ <= 2 Yes — d 197.1 mm — %ρ 0.997

**RESULTS** 1.5Aswfyd ,ef / SrU1 0.626 — 0.75vRd,c = 0.571 N/mm² — Uout xd 0.81

$V_{E0}$ = β($V_{Ed}$ - UDL) = 128 kN — At 2.0 x d — vRd,c = 0.761 N/mm² — vRd,cs 1.197

At column face, vEd = 5.391 N/mm² — At 2.0 x d — vEd = 0.531 N/mm² — vEd/vRd,c 0.697

vEd / vRd,c max = 2.0 — $V_{E,out}$ = 128 kN — Gross Uout = 850 mm — Gross U1 mm 1219

σcz & σcy 0.000 0.000 — k1 σcp 0.000

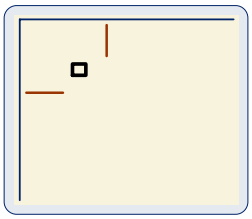
$V_{ed}$ Max No legs = 122 — kN Legs 244

**No Legs** Control Perim at 394 mm

Leg Dia Auto

Auto x d 0.625

3 Spur Perim No



**HOLE DEDUCTION** By Interpolation & Extrapolation - See adjacent detailed check

Total Deduction at 2d = 0 mm

Total Deduction at 4d = 0 mm

Total Deduction at 6d = 0 mm

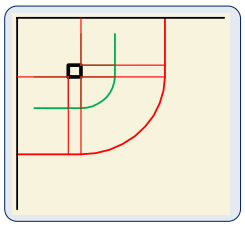
Total Deduction at Uout at 0.81d = 0 mm

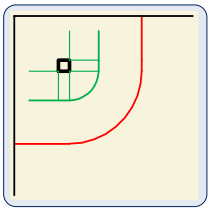
Net U1 = 1219 - 0 = 1219 mm

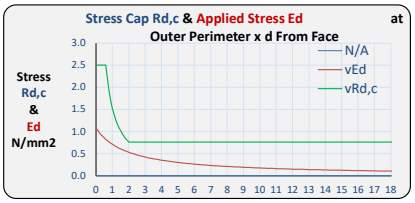
Net Uout = 850 - 0 = 850 mm

Perimeter at U1

Perimeter at Uout








**Deductions at 2d** Sides 0 — 0 mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Deductions at 4d** Sides 0 — 0 mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Deductions at 6d** Sides 0 — 0 mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides

**Check Deductions at 0.8d** Sides 0 — 0 mm

Quads Distance 1 - 2

Distance 1 - 3

Deduction

Sides