| | |
|---|---|
| Load duration factor | $k_t$ = **0.4** |
| Effective area of concrete in tension | $A_{c.eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$ |
| | $A_{c.eff}$ = **90958** $mm^2/m$ |
| Mean value of concrete tensile strength | $f_{ct.eff} = f_{ctm}$ = **2.9** $N/mm^2$ |
| Reinforcement ratio | $\rho_{p.eff} = A_{bb.prov} / A_{c.eff}$ = **0.015** |
| Modular ratio | $\alpha_e = E_s / E_{cm}$ = **6.091** |
| Bond property coefficient | $k_1$ = **0.8** |
| Strain distribution coefficient | $k_2$ = **0.5** |
| | $k_3$ = **3.4** |
| | $k_4$ = **0.425** |
| Maximum crack spacing - exp.7.11 | $s_{r.max} = k_3 \times c_{bb} + k_1 \times k_2 \times k_4 \times \phi_{bb} / \rho_{p.eff}$ = **440** mm |
| Maximum crack width - exp.7.8 | $w_k = s_{r.max} \times \max(\sigma_s - k_t \times (f_{ct.eff} / \rho_{p.eff}) \times (1 + \alpha_e \times \rho_{p.eff}), 0.6 \times \sigma_s) / E_s$ |
| | $w_k$ = **0.217** mm |
| | $w_k / w_{max}$ = **0.722** |

***PASS - Maximum crack width is less than limiting crack width***

**Rectangular section in shear - Section 6.2**

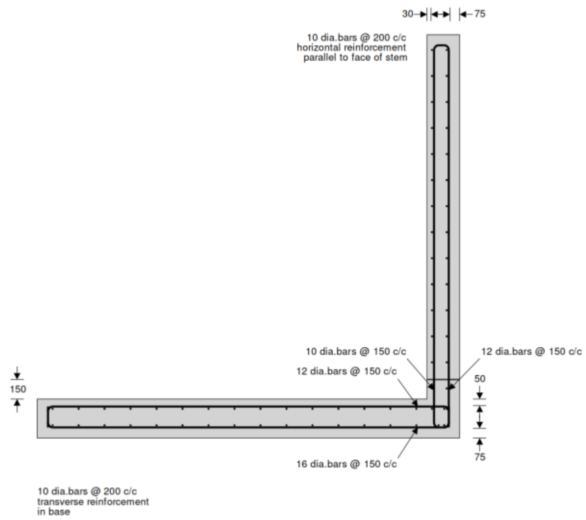
| | |
|---|---|
| Design shear force | V = **46.5** kN/m |
| | $C_{Rd,c} = 0.18 / \gamma_C$ = **0.120** |
| | $k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2)$ = **1.960** |
| Longitudinal reinforcement ratio | $\rho_l = \min(A_{bb.prov} / d, 0.02)$ = **0.006** |
| | $v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5}$ = **0.526** $N/mm^2$ |
| Design shear resistance - exp.6.2a & 6.2b | $V_{Rd.c} = \max(C_{Rd.c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$ |
| | $V_{Rd.c}$ = **135.1** kN/m |
| | $V / V_{Rd.c}$ = **0.344** |

***PASS - Design shear resistance exceeds design shear force***

**Secondary transverse reinforcement to base - Section 9.3**

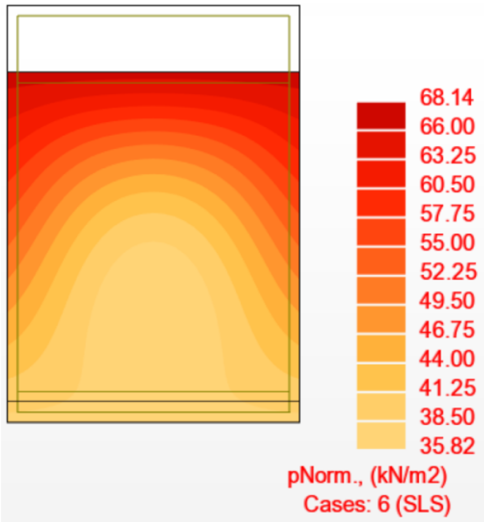
| | |
|---|---|
| Minimum area of reinforcement – cl.9.3.1.1(2) | $A_{bx.req} = 0.2 \times A_{bb.prov}$ = **268** $mm^2/m$ |
| Maximum spacing of reinforcement – cl.9.3.1.1(3) | $s_{bx\_max}$ = **450** mm |
| Transverse reinforcement provided | 10 dia.bars @ 200 c/c |
| Area of transverse reinforcement provided | $A_{bx.prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx})$ = **393** $mm^2/m$ |

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

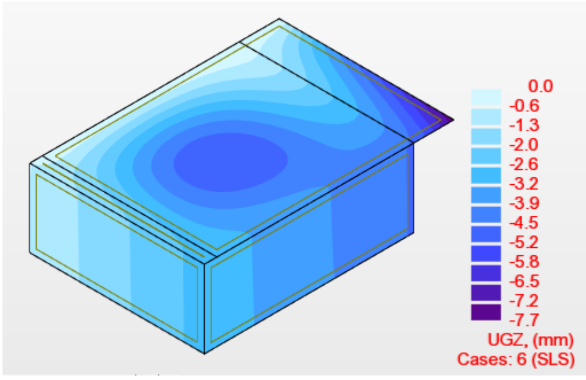



**Reinforcement details**

## Basement 3D analysis




Bearing Pressure < 100kPa




Deformation < 10mm

## Base Slab

300 thick slab. Strength OK as max stresses due to retained loads.
Approximate long term heave potential:
= 0.5 x depth of excavation x density of soil = 0.5*2.2x18 = 19.8kN/$m^2$

Weight of basement RC slabs + screeds = (.3+.2+.15)*25 = 16.5kN/$m^2$
Weight of basement walls = 20*25*2.5*0.25/5/10 = 6.25kN/$m^2$
Weight of superstructure = 1.5kN/$m^2$

Total new structure = 24.25kN/$m^2$ > 19.8kN/$m^2$

∴OK

## Ground Slab

200 thick two-way spanning slab, spanning 5.5m. From Concrete Centre Economic Concrete Elements guide [extract below] the overall depth required ~140mm < 200mm

∴OK

**Table 3.6a**
**Data for two-way solid slabs: single span**

| SINGLE span, m | 4.0 | 5.0 | 6.0 |
|---|---|---|---|
| **Overall depth, mm** | | | |
| IL = 2.5 kN/$m^2$ | 125 | 129 | 153 |
| IL = 5.0 kN/$m^2$ | 125 | 144 | 170 |
| IL = 7.5 kN/$m^2$ | 128 | 156 | 183 |
| IL = 10.0 kN/$m^2$ | 138 | 168 | 197 |