HEROLD ENGINEERING

CALCULATION SHEET

Project #:	Client:	Discipline:	Date:	SKETCH #
Project Title:		❑ Structural – Buildings ❑ Structural – Bridges ❑ Civil - Municipal ❑ Industrial - Marine ❑ Building Envelope ❑ _____	Drawn:	
Subject:			Design:	SHEET
			Check:	____ of ____

Metric Grid

Situation

450mm thick slab
30 MPa concrete
Anchor Bolt with 100mm×100mm washer & 300mm embed
centroid of top steel is 50mm from top of slab
Far away from any edges

2-Way Shear method

$V_r = \left(1+\frac{2}{\beta_c}\right)0.19\lambda\phi_c\sqrt{f'_c}$

$= \left(\frac{\alpha_s d}{b_o}+0.19\right)\lambda\phi_c\sqrt{f'_c}$

$= 0.38\lambda\phi_c\sqrt{f'_c}$

$d = 300-50 = 250mm$ I'm using the embed depth of the anchors minus the concrete above the top steel as my effective depth

$\beta_c = 1.0$ because washer is square

$b_o = 4(100+250) = 1400mm$ ← washer width plus embed depth, all 4 sides

$\alpha_s = 4$ $\lambda = 1.0$

$\left(1+\frac{2}{1}\right)0.19(1.0)(0.65)\sqrt{30} = 2.03$ MPa

$\left(\frac{4\times250}{1400}+0.19\right)1.0(0.65)\sqrt{30} = 3.22$ MPa

$0.38\times1.0\times0.65\sqrt{30} = 1.35$ MPa ← governs

$V_r = 1.35\text{ MPa}\times1400mm\times250mm = 473$ kN

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Anchor Breakout Method

$N_{cbr} = \frac{A_{Nc}}{A_{Nco}} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_{br}$ $\qquad \frac{A_{Nc}}{A_{Nc_o}} = 1.0$ (no edges)

$\psi_{ed,N} = \psi_{c,N} = \psi_{cp,N} = 1.0$ Assuming no edge effects, concrete is cracked, and anchors are cast-in-place

$N_{br} = k_c \phi_c \lambda_a \sqrt{f'_c}\, h_{ef}^{1.5} R$ $\qquad k_c = 10$ $\qquad R = 1.0$ (no supplementary reinforcing)

$h_{eff} = 300 + 100 \times \frac{1}{3} = 333\,mm$ ← anchor embed plus extra to account for washer on 35°

$N_{br} = 10 \times 0.65 \times 1.0\sqrt{30} \times 333^{1.5} \times 1.0 = 216\ kN$

$N_{cbr} = 1.0 \times 1.0 \times 1.0 \times 1.0 \times 216 = \boxed{216\ kN}$