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Pad Footing Design Verification

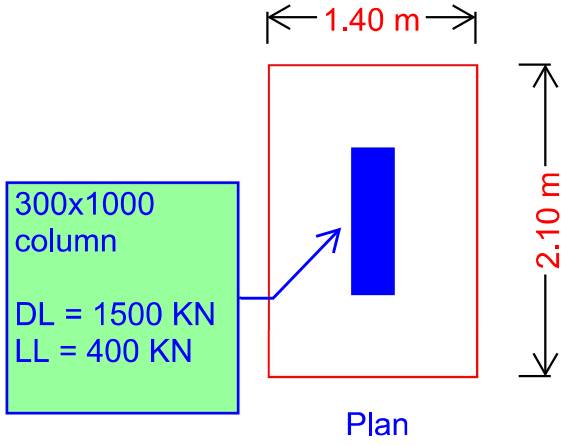
This verification study benchmarks RKALC against an independently prepared design example for a reinforced concrete pad footing designed in accordance with AS 3600. The comparison covers flexural design in the critical direction together with column bearing, punching shear and one-way shear assessments. By verifying multiple limit states within a single example, the study demonstrates the accuracy and consistency of the RKALC design implementation for isolated footing design.

Materials

- f'c = 40 MPa
- fy = 500 MPa

Applied Loads

- N DL = 1500 KN
- NLL = 400 kN
- N uls = 2400 KN
- N sls = 1900 KN

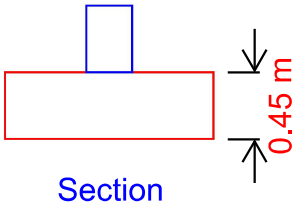


Applied Stressess

- Bearing Capacity = 700 kPa

Applied soil stress = 1900 / (1.4 × 2.1) = 646 kPa

Ultimate soil stress = 646 × (2400 / 1900) = 816 kPa



Outstand Checks

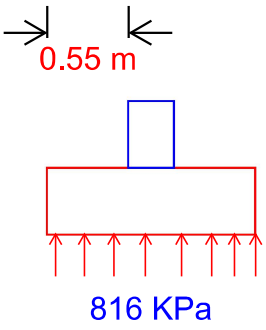
Cover to centre = 84 mm
Effective depth = 450 − 84 = 366 mm

Span-depth ratio = 550 / 366 = 1.503 > 1.5

Hence footing can be designed as flexural member
[Ref. 12.1.1 AS 3600-2018]

Flexural Design

M* = 816 × (0.55² / 2) = 123 kN·m (per meter)



As min= 0.19 × (D=450 / d=366)² × (0.6‹3240 / 500) (see sec 9

As/bd = 0.218% = 798 mm² ----Ref. 21.3.1

As Req = 123 E+6/0.7/500/366 = 960

Therefore
As = N16-200 EW

(Note: if the footing width is less than one metre, this 960 is to be provided within that width, or design the "beam" from first principles.)

Punching Shear Check

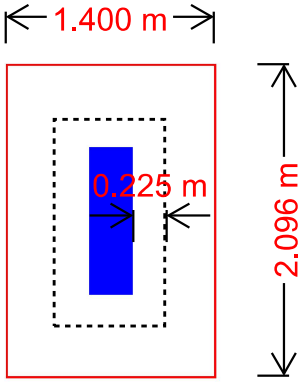
Critical shear perimeter

u = [(300+d)+(1000+d)] × 2 = 4064 mm

Punching reduction area @ d/2 =
((300+d)(1000+d) × 816)/10†66 = 742 kN

therefore punching shear force = 2400 − 742 = 1658 kN

Stress = (1658×10³)/(4064×366) = 1.115 MPa



fi*Fcv = 0.7 × 0.17 × (1 + 2×300/1000) × 40^0.5 = 1.204 MPa - ref 9.3.3

Utilisation = 1.115 / 1.205 = 93%

One Way Shear

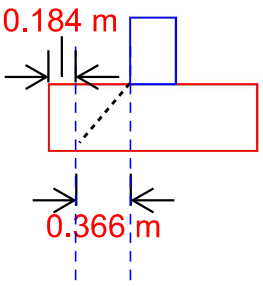
Applied shear = V* = 816 × 0.184

V* = 150 kN

Stress = (150×10³)/(1000×326) = 0.46 MPa
(note effective depth for shear is 0.72 * Depth for one way shear)

epsilon = 0.000376
kdg = 0.888888
dv = 326

therefore kv = 0.257 (see clause 8.2.4.2.1)
therefore vc = 0.257 * 40^ 0.5 * 0.7 = 1.137 MPa > 0.46



NOTE: RKALC app still uses AS3600-2009 which is more conservative (gives allowable shear stress of 0.89 using Beta factors

Column Bearing Check

Ref. 12.6

A1 = 300 × 1000 = 300000

A2 = (300 + 2×366)(1000 + 2×366) = 1,787,424

(A2/A1)^0.5 = 2.44 (max = 2)

Stress @ A1 = 8 MPa

Allowable stress = 0.6 × 0.9 × 40 × 2 = 43.20 MPa

Development Length of Rebar (Column)

Rebar dia: say N16

Compression length ›10 20 dia = 320 mm

Pad Footings

Do Not Use for Span/Depth Ratio < 1.5

Use STM Wall for Footing on Rock

Footing Capacity | Calculations | My Footings

Inputs

Materials

f'c (N/mm²)	40
fy (N/mm²)	500

Geometry (Units mm)

Width	1400
Length	2100
Depth	450
Cover to Centre	84
Soil Bearing Capacity KPa	700
Column Width	300
Column Length	1000
Column's rebar size	16

Loads (KN , m)

Dead Load	1500
Live Load	400
Ultimate Load	2400

Calculate

RKALC Assistant New

Send to Database

General

Effective Depth	366
Span-Depth Ratio	1.5
Max Outstand	550
Soil Pressure	646

Flexure-Critical Dir.

Design Moment KN.m/m	123
Bottom REO (mm² / m)	950
Min Depth (Development)*	548

**(anchorage length of Column reo that is needed for section capacity at face of footing, excercise judgement)*

Column Bearing

Stress under Col (A1)	8
Max Bearing Stress	43.2
Bearing Utilisation	19 %

Punching Shear

Punching Stress	1.11
Conc Punching Capacity	1.2
Punching Utlilsation	93 %

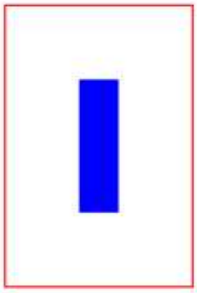
One Way Shear

(AS3600-2009 formulae 8.2.7.1)

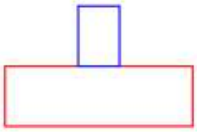
Applied Shear KN/m	150
Applied Shear MPa/m	0.41
Shear Cpacity MPa	0.89

Graphics

Plan



Section



Pad Footing Design - AS3600-2018

Flexural, bearing, punching shear and one-way shear assessment

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Calculations by
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1. Introduction

This document provides analysis and design of Pad Fotting in accordance with the Australian Standard AS3600-2009.

The following outcomes are provided:

- Felxural Design of Critical Direction
- Column Bearing Check
- Punching Shear Check
- One Way Shear Check

The design ensures structural integrity and compliance with the standard under the specified loading conditions. For detailed guidelines and requirements, refer to the relevant sections of AS3600-2018-A2.

> This calculation can be reproduced and checked independently. For more details, refer to the **RKALC website**.

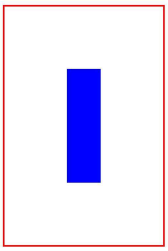
2. Material Properties

Property	Value	Unit
Concrete Strength f'c	**40**	MPa
Rebar fy	**500**	MPa

3. Geometry and Applied Loads

Geometry

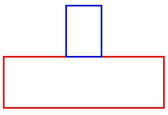
Geometry Parameter	Value	Unit
Footing Width	**1400**	
Footing Length	**2100**	
Footing Depth	**450**	
Cover to Centre of Reo	**84**	
Soil Bearing Capacity	**700**	
Column Width	**300**	
Column Length	**1000**	
Column Rebar Size	**16**	



Footing Plan

Applied Loads

Load Parameter	Value	Unit
DL	**1500**	KN
LL	**400**	KN
Ultimate Load	**2400**	KN



Footing Section

4. Results

General

General Result	Value	Unit
Effective Depth	**366**	KN
Span-Depth Ratio	**1.5**	KN
Max Outstand	**550**	mm^2
Soil Pressure (SLS)	**646**	KN

Fexural Check - Critical Direction

Flexural Result	Value	Unit
Design Moment	**123**	KN.m/m
Bottom REO	**950**	(mm^2 / m)
Min Depth (Development)	**548**	mm

Column Bearing Check

Bearing Result	Value	Unit
Stress under Col (A1) - Clause 12.6	**8**	MPa
Max Bearing Stress	**43.2**	MPa
Bearing Utilisation	**19 %**	

Punching Shear Check

Punching Shear Result	Value	Unit
Punching Stress	**1.11**	MPa
Conc Punching Capacity	**1.2**	MPa
Punching Utilisation	**93 %**	

One Way Shear Check - (AS3600-2009 formulae 8.2.7.1)

One Way Shear Result	Value	Unit
Applied Shear	**150**	KN/m
Applied Shear	**0.41**	MPa/m
Shear Cpacity	**0.89**	MPa