Haigh Huddleston & Associates
99-103 Leeds Road
Dewsbury
WF12 7BU

Project				Job Ref.	
Persimmon South Yorkshire - Lundhill Road				8056	
Section				Sheet no./rev.	
Cover slab to Spillway				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
PW	March 23	MH	March 23		

SLAB TO SPAN BETWEEN CONCRETE PADS

LOADINGS

Slab to have a clear span of 1.0 Design for self weight and 10KN/m2 surcharge.

The formation for the mass concrete supports under the slab will be onto a suitable natural strata.

Design criteria:

1. Slab to be designed to support a superimposed load of 10kN/m^2 over the full slab surface
2. 150mm thick slab.
3. The slab has been designed as a simply supported one way spanning slab.

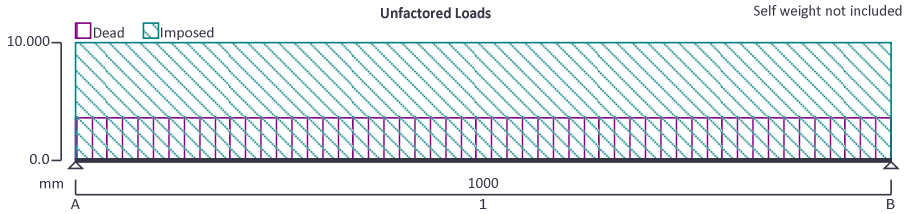
Therefore total loading to cover slab: 10 x 1.0 x 1.6 = 16 kN/m^2 (ULS) surcharge

+ 0.15x1.0 x24x1.4 = 5.04 kN/m^2 (ULS) concrete

Total = 21.04 kN/m^2 (ULS)

Haigh Huddleston & Associates 99-103 Leeds Road Dewsbury WF12 7BU	Project Persimmon South Yorkshire - Lundhill Road				Job Ref. 8056	
	Section Cover slab to Spillway				Sheet no./rev. 2	
	Calc. by PW	Date March 23	Chk'd by MH	Date March 23	App'd by	Date

SLAB ANALYSIS



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **27** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **1000** mm Cross-sectional area = **1000** mm^2 Moment of inertia = **1.00×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 UDL Dead load **3.6** kN/m

Load 2 UDL Imposed load **10.0** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Imposed

CONTINUOUS BEAM ANALYSIS - RESULTS

RESULTS FOR COMBINATION 1

Support Reactions and Deflections - Combination 1 :

Support A Reaction = **-10.5** kN Moment = **0.0** kNm Deflection = **0.0** mm Rotation = **1.87** deg

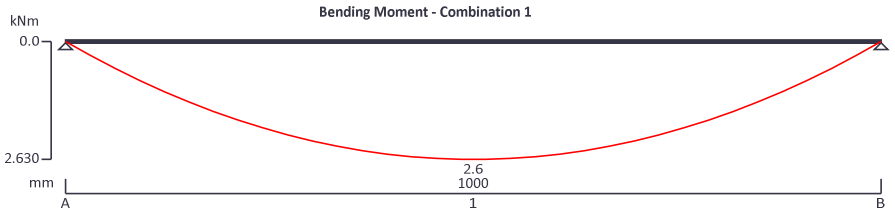
Support B Reaction = **-10.5** kN Moment = **0.0** kNm Deflection = **0.0** mm Rotation = **-1.87** deg

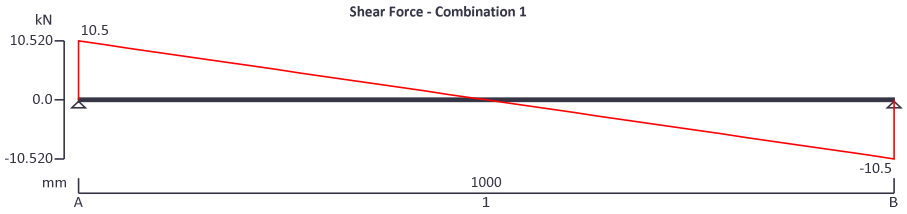
Beam Max/Min results - Combination 1 :

Maximum shear = **10.5** kN Minimum shear = **-10.5** kN

Maximum moment = **2.6** kNm Minimum moment = **0.0** kNm

Maximum deflection = **10.2** mm Minimum deflection = **0.0** mm





SLAB DESIGN

SLAB DESIGN

RC SLAB DESIGN (BS8110:PART1:1997)

TEDDS calculation version 1.0.04

CONCRETE SLAB DESIGN (CL 3.5.3 & 4)

SIMPLE ONE WAY SPANNING SLAB DEFINITION

Overall depth of slab h = **150** mm

Cover to tension reinforcement resisting sagging c_b = **50** mm

Trial bar diameter D_{tryx} = **10** mm

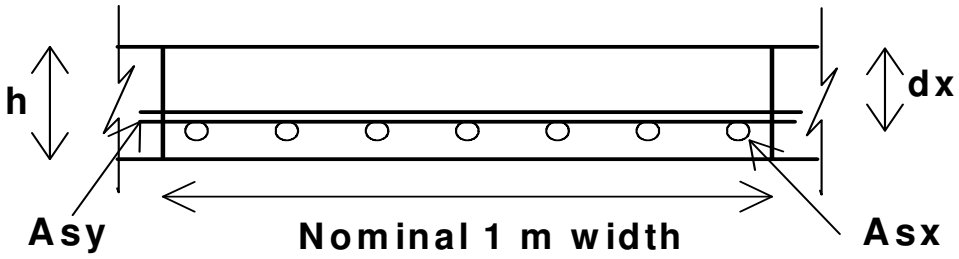
Depth to tension steel (resisting sagging)

$d_x = h - c_b - D_{tryx}/2$ = **95** mm

Characteristic strength of reinforcement f_y = **500** N/mm^2

Characteristic strength of concrete f_{cu} = **35** N/mm^2

Haigh Huddleston & Associates 99-103 Leeds Road Dewsbury WF12 7BU	Project Persimmon South Yorkshire - Lundhill Road				Job Ref. 8056	
	Section Cover slab to Spillway				Sheet no./rev. 4	
	Calc. by PW	Date March 23	Chk'd by MH	Date March 23	App'd by	Date



One-way spanning slab

(simple)

ONE WAY SPANNING SLAB (CL 3.5.4)

MAXIMUM DESIGN MOMENTS IN SPAN

Design sagging moment (per m width of slab) m_{sx} = **3.0** kNm/m

CONCRETE SLAB DESIGN – SAGGING – OUTER LAYER OF STEEL (CL 3.5.4)

Design sagging moment (per m width of slab) m_{sx} = **3.0** kNm/m

Moment Redistribution Factor β_{bx} = **1.0**

Area of reinforcement required

$K_x = abs(m_{sx}) / (d_x^2 \times f_{cu})$ = **0.009**

$K'_x = min (0.156 , (0.402 \times (\beta_{bx} - 0.4)) - (0.18 \times (\beta_{bx} - 0.4)^2))$ = **0.156**

Outer compression steel not required to resist sagging

One-way Spanning Slab requiring tension steel only (sagging) - mesh

$z_x = min ((0.95 \times d_x), (d_x \times (0.5+\sqrt{(0.25-K_x/0.9)})))$ = **90** mm

Neutral axis depth $x_x = (d_x - z_x) / 0.45$ = **11** mm

Area of tension steel required

$A_{sx_req} = abs(m_{sx}) / (1/\gamma_{ms} \times f_y \times z_x)$ = **76** mm²/m

Tension steel

Use A393 Mesh

$A_{sx_prov} = A_{sl}$ = **393** mm²/m $A_{sy_prov} = A_{st}$ = **393** mm²/m

$D_x = d_{sl}$ = **10** mm $D_y = d_{st}$ = **10** mm

Area of tension steel provided sufficient to resist sagging

Check min and max areas of steel resisting sagging

Total area of concrete $A_c = h$ = **150000** mm²/m

Minimum % reinforcement k = **0.13** %

$A_{st_min} = k \times A_c$ = **195** mm²/m

A_{st_max} = 4 % × A_c = **6000** mm²/m

Steel defined:

Outer steel resisting sagging A_{sx_prov} = **393** mm²/m

Area of outer steel provided (sagging) OK

Inner steel resisting sagging A_{sy_prov} = **393** mm²/m

Area of inner steel provided (sagging) OK

SHEAR RESISTANCE OF CONCRETE SLABS (CL 3.5.5)

Outer tension steel resisting sagging moments

Depth to tension steel from compression face d_x = **95** mm

Area of tension reinforcement provided (per m width of slab) A_{sx_prov} = **393** mm^2/m

Design ultimate shear force (per m width of slab) V_x = **11** kN/m

Characteristic strength of concrete f_{cu} = **35** N/mm^2

Applied shear stress

$v_x = V_x / d_x$ = **0.11** N/mm^2

Check shear stress to clause 3.5.5.2

$v_{allowable}$ = min ((0.8 $N^{1/2}/mm$) × √(f_{cu}), 5 N/mm^2) = **4.73** N/mm^2

Shear stress - OK

Shear stresses to clause 3.5.5.3

Design shear stress

f_{cu_ratio} = if (f_{cu} > 40 N/mm^2 , 40/25 , $f_{cu}/(25\ N/mm^2)$) = **1.400**

v_{cx} = 0.79 N/mm^2 × min(3,100 × $A_{sx_prov} / d_x)^{1/3}$ × max(0.67,(400 mm / $d_x)^{1/4}$) / 1.25 × $f_{cu_ratio}^{1/3}$

v_{cx} = **0.75** N/mm^2

Applied shear stress

v_x = **0.11** N/mm^2

No shear reinforcement required

CONCRETE SLAB DEFLECTION CHECK (CL 3.5.7)

Slab span length l_x = **1.000** m

Design ultimate moment in shorter span per m width m_{sx} = **3** kNm/m

Depth to outer tension steel d_x = **95** mm

Tension steel

Area of outer tension reinforcement provided A_{sx_prov} = **393** mm^2/m

Area of tension reinforcement required A_{sx_req} = **76** mm^2/m

Moment Redistribution Factor β_{bx} = **1.00**

Modification Factors

Basic span / effective depth ratio (Table 3.9) $ratio_{span_depth}$ = **20**

The modification factor for spans in excess of 10m (ref. cl 3.4.6.4) has not been included.

$f_s = 2 \times f_y \times A_{sx_req} / (3 \times A_{sx_prov} \times \beta_{bx})$ = **64.8** N/mm^2

$factor_{tens}$ = min (2 , 0.55 + (477 N/mm^2 - f_s) / (120 × (0.9 N/mm^2 + m_{sx} / d_x^2))) = **2.000**

Calculate Maximum Span

This is a simplified approach and further attention should be given where special circumstances exist. Refer to clauses 3.4.6.4 and 3.4.6.7.

Maximum span l_{max} = $ratio_{span_depth} \times factor_{tens} \times d_x$ = **3.80** m

Check the actual beam span

Actual span/depth ratio l_x / d_x = **10.53**

Span depth limit ratio$_{span_depth}$ × factor$_{tens}$ = **40.00**

Span/Depth ratio check satisfied

CHECK OF NOMINAL COVER (SAGGING) – (BS8110:PT 1, TABLE 3.4)

Slab thickness h = **150** mm

Effective depth to bottom outer tension reinforcement d_x = **95.0** mm

Diameter of tension reinforcement D_x = **10** mm

Diameter of links L_{diax} = **0** mm

Cover to outer tension reinforcement

$c_{tenx} = h - d_x - D_x / 2$ = **50.0** mm

Nominal cover to links steel

$c_{nomx} = c_{tenx} - L_{diax}$ = **50.0** mm

Permissable minimum nominal cover to all reinforcement (Table 3.4)

c_{min} = **35** mm

Cover over steel resisting sagging OK

Note main bars sufficient to avoid shear reinforcement.