Input Data

Load data

Applied load w*	=	4.15	kN/m²

Fire data

Time equivalent (user defined value)	=	60	min

Slab mesh reinforcement and concrete strength

fc`20 (at 20°C)	=	35	MPa
Rib height or depth, hrc	=	75	mm
Total slab thickness, t0	=	140	mm
Slab type	=	Trapezoidal deck profile	

Layer 1

fyr20, reinforcement (at 20°C)	=	420	MPa
TOP cover x direction, Cxreo	=	51	mm
TOP cover y direction, Cyreo	=	45	mm
bar spacing in x, Sxreo	=	150	mm
bar diameter in x, dxreo	=	6	mm
bar spacing in y, Syreo	=	150	mm
bar diameter in y, dyreo	=	6	mm
Reinforcement type	=	Cold-worked mesh	

Secondary beams

Secondary Beam	=	yes	
Beam direction	=	Lx	
Beam top flange yield stress, fytfsb20 (at 20°C)	=	355	MPa
Beam web yield stress, fywsb20 (at 20°C)	=	355	MPa
Beam top flange width, bf,tf	=	10.1	mm
Beam top flange thickness, tf,tf	=	8.9	mm
Beam web thickness, tw	=	6	mm
Beam depth, d	=	308	mm
Beam spacing, Ssb	=	2.54	mm
Depth of web openings	=	8.9	mm
Beam shear capacity, phi Vv (at 20°C)	=	420	kN

Slab panel and support beam dimensions

Lx, slab panel	=	7.62	m
Ly, slab panel	=	7.62	m
Lxb, max	=	7.62	m
Lyb, max	=	7.62	m
Total slab thickness, t0	=	140	mm

Slab panel edge conditions

Side 1	=	fixed
Side 2	=	simple
Side 3	=	simple
Side 4	=	fixed

Slab reinforcement interior support bars, x-direction

fyr20,isbx (value at 20°C)	=	420	MPa
bar diameter	=	8	mm
bar spacing	=	150	mm
Top Cover	=	51	mm

Slab reinforcement interior support bars, y-direction

fyr20, isby (value at 20°C)	=	420	MPa
bar diameter	=	8	mm
bar spacing	=	150	mm

Slab reinforcement deck trough bars

fyr20,dtb (value at 20°C)	=	0	MPa
bar diameter	=	0	mm
bar spacing	=	0	mm

BOTTOM covers for heat flow calculation

c1	=	0	mm
c2	=	0	mm
c3	=	0	mm

Secondary beam to primary beam connection

No. of bolts in each secondary beam to primary beam connection	=	3	
Ambient temperature design shear capacity of bolt, (phi Vfn)	=	90	kN

Research Data

Limiting deflection d limit	=	305	mm

Table 2 - Design Temperatures of Unprotected Secondary Beam Elements

	Bottom Flange	Web	Top Flange
FHC 1, NWC	750	750	650
FHC 2, NWC	850	800	750
FHC 3, NWC	900	850	800
FHC 1, LWC	850	850	750
FHC 2, LWC	1000	950	900
FHC 3, LWC	1050	1000	950

Output Data

Temperatures

Layer 1, reinforcement x direction	=	448	°C
Layer 1, reinforcement y direction	=	411	°C
Layer 2, reinforcement x direction	=	0	°C
Layer 2, reinforcement y direction	=	0	°C
Interior support bars x direction	=	455	°C
Interior support bars y direction	=	411	°C
Deck trough bars	=	0	°C
Rib bars	=	0	°C

Areas of the reinforcement

Arx, Layer 1	=	188	mm²/m
Ary, Layer 1	=	188	mm²/m
Arx, Layer 2	=	0	mm²/m
Ary, Layer 2	=	0	mm²/m
Interior support bars, x	=	335	mm²/m
Interior support bars, y	=	335	mm²/m
Deck trough bars	=	0	mm²/m
Rib bars	=	0	mm²/m

Yieldline load-carrying capacity of the slab panel

mx	=	11	kN/m
my	=	3	kN/m
Negative moment capacity mx'	=	0	kN/m
Negative moment capacity my'	=	0	kN/m
Yieldline dimension L1	=	2	m
Yieldline load carrying capacity wyl, theta	=	2	kN/m²
wyl, theta,ss	=	2	kN/m²
Limiting deflection d limit	=	305	mm
Maximum deflection dmax	=	381	mm
Tensile membrane enhancement factor e	=	1	

Moment internal actions

ax	=	2	mm
ay	=	2	mm
erx	=	131	mm
ery	=	48	mm
Rtsx,total	=	88	kN/m
Rtsy,total	=	66	kN/m
Rtssx,total	=	0	kN/m

Design load-carrying capacity of the slab panel

wu	=	5	kN/m²
w*	=	4	kN/m²

Panel moment/tension membrane capacity is adequate.

Shear capacity per metre

Through the slab (vu,slab)	=	11	kN/m
Through the secondary beam (vu,sb,min)	=	16	kN/m
Total design shear capacity (vu)	=	27	kN/m
Design shear (v*)	=	15	kN/m

The shear capacity is ok.

Time equivalent fire severity

Time equivalent (user defined value)	=	60	min
Fire Hazard Category	=	2	

Concrete compression check

Cc	=	224	kN
Ccr	=	0	kN
T,cr	=	20	°C
ac,sp	=	62	mm

The concrete passed the compression test

Integrity

The area of reinforcement is sufficient
Bar spacing in layer 1 is sufficient

Calculation Sheet

w* = 4,15	kN/m²	Equation A1
teq = 60	min	Equation A2
FRR,reo = 60	min	Equation A3
U3x,reoL1 = 11	mm	Equation A4.1.1 / A50.1
U3x,reoL2 = 65	mm	Equation A4.1.1 / A50.1
U3y,reoL1 = 17	mm	Equation A4.2.1 / A50.3
U3y,reoL2 = 65	mm	Equation A4.2.1 / A50.3
θsx,reoL1 = 447,92	°C	Equation A6
θsx,reoL2 = 195,36	°C	Equation A6
U3,isbx = 10	mm	Equation A8.1 / A51.1
U3,dtb = 0	mm	Equation A4.1.1
Rtsx,reoL1 = 59,23	kN/m	Equation A11.1 / A53
Rtsx,reoL2 = 0	kN/m	Equation A11.1
Rtsx,sfj = 0	kN/m	Equation A52 - Speedfloor
Rtsbx,tf = 2,14	kN/m	Equation A11.2
Rtsbx,w = 25,95	kN/m	Equation A11.3
Rtsbx,bf = 1,07	kN/m	Equation A11.4
Rtsx,total = 88,39	kN/m	Equation A11.5 / A54
erx = 131,35	mm	Equation A12 / A56
ax = 2,97	mm	Equation A13 / A55
mx = 11,48	kNm/m	Equation A14 / A57
fysbθ,tf = 60,35	MPa	Equation A15
fysbθ,w = 39,05	MPa	Equation A15
fysbθ,bf = 30,17	MPa	Equation A15
Rt,crb = 0	kN/m	Equation A15.1
Rtsy,reoL1 = 66,73	kN/m	Equation A16.1 / A58
Rtsy,reoL2 = 0	kN/m	Equation A16.1
Rtsy,dtb = 0	kN/m	Equation A16.2
Rtsy,total = 66,73	kN/m	Equation A16.3
ery = 48	mm	Equation A17
ay = 2,24	mm	Equation A18 / A59
my = 3,13	kNm/m	Equation A19 / A60
m'x = 0	kNm/m	Equation A20.2 / A62
m'y = 0	kNm/m	Equation A21
Wylθ = 2,86	kN/m²	Equation A22
Wylθ,ss = 2,86	kN/m²	Equation A22
Δlimit = 305	mm	Equation A23.3
Δmax = 381,2	mm	Equation A23.6
L1 = 2,56	mm	Equation A24
mu = 3,67		Equation A14/A19
a = 1		Equation A25
n = 0,34		Equation A26
K = 1,32		Equation A27
k = 1,3		Equation B2
fcu = 41,18		
A = 0,55		Equation B3.1
B = 0,34		Equation B3.2
b = 1,04		Equation B3
m = 0,02		Equation B4

gox = 0,95		Equation 33.1
goy = 0,91		Equation 33.2
ax = 0,48		Equation 34.1
ay = 0,46		Equation 34.2
bx = 0,01		Equation 35.1
by = 0,02		Equation 35.2

b > F1 (Inelastic stress away from tensile membrane)

v = 0		Equation B11.1
e1mx = 0,99		Equation B12.1
e2my = 1,04		Equation B12.1
e1bx = 0,88		Equation B13.1
e2by = 1,08		Equation B13.2
e1 = 1,87		Equation B7.1
e2 = 2,12		Equation B7.2
e = 1,94		Equation B8

wu = e . wylq	kN/m²	Equation 43
5,56 = 2,86 . 1,94		
vu = 11,29	kN/m	Equation 44 / 63
vu,sb-pb = 42,14	kN/m	Equation 47.1
vu,vsb = 79,25	kN/m	Equation 47.2
vu,sb = 42,14	kN/m	Equation 47.3
V* = 15,81	kN/m	Equation 48 / A65