

## SECTION 2: FIRE DESIGN USING SPM COMPUTER PROGRAM

This example is based on 90mm thick slab comprising of two bays:

Slab panel dimension =  $L_x = 8\text{m}$  (joist span)

$L_y = 27.0\text{m}$

The fire rating required is 30 min

Applied load  $W_{(G+Q_u)} = 3.8\text{ kPa}$

This example requires 661 mesh and internal support bars H.D.12 at 250crs

**Input Tab Data:**

- Fire data:** Fire load energy density: 400 MJ/m<sup>2</sup>; Inside height of firecell, H: 1.7 m; Area of vertical openings, A<sub>v</sub>: 37.5 m<sup>2</sup>; Floor area of firecell, A<sub>f</sub>: 300 m<sup>2</sup>; Thermal inertia for firecell, b: 1700 J/m<sup>2</sup>°C<sup>0.5</sup>; Time equivalent, t<sub>eq</sub>: 30 min.
- Secondary beam input:** Beam flange yield stress, f<sub>yfb20</sub>: 0 MPa; Beam web yield stress, f<sub>ywb20</sub>: 0 MPa; Beam flange width, b<sub>f</sub>: 0 mm; Beam flange thickness, t<sub>f</sub>: 0 mm; Beam web thickness, t<sub>w</sub>: 0 mm; Beam depth, d: 0 mm.
- Slab reinforcement interior support bars:** f<sub>y20,slb</sub>: 500 MPa; bar diameter: 12 mm; bar spacing: 250 mm.
- Slab reinforcement deck trough bars:** f<sub>y20,slb</sub>: 0 MPa; bar diameter: 0 mm; bar spacing: 0 mm.
- Slab mesh reinforcement and concrete strength:** f<sub>y20,mesh</sub>: 500 MPa; f<sub>c20</sub>: 25 MPa; X direction mesh bar TOP cover: 37 mm; Y direction mesh bar TOP cover: 44.5 mm; bar spacing in x: 150 mm; bar spacing in y: 150 mm; bar diameter: 7.5 mm; Enmesh: 200000 MPa; Slab type: Flat slab (Speedfloor); Mesh: Cold-worked; Rib height: 0 mm.
- Applied load:** w<sup>u</sup>: 3.8 kPa.
- Speedfloor Joist Input:** Joist spacing: 1.23 m.
- Slab panel dimensions:** L<sub>x</sub>: 8 m; L<sub>x2</sub>: 8 m; L<sub>y</sub>: 27 m; t<sub>0</sub>: 90 mm.
- Slab panel edge conditions:** Side 1: simple; Side 3: fixed.

**Description Tab Results:**

- Temperatures:** Mesh x direction: 100 °C; Mesh y direction: 157 °C; Interior support bars: 56 °C; Deck trough bars: - °C.
- Areas of the Reinforcement:** Mesh area x: 295 mm<sup>2</sup>/m; Mesh area y: 295 mm<sup>2</sup>/m; Deck trough bars: 0 mm<sup>2</sup>/m; Interior support bars: 452 mm<sup>2</sup>/m.
- Moment internal actions:** m<sub>x</sub>: 10.97 kN/m; m<sub>y</sub>: 6.93 kN/m; m<sub>int</sub>: 51.65 kN/m; m<sub>ext</sub>: 40.25 kN/m; R<sub>int</sub>,total: 233.2 kN/m; R<sub>ext</sub>,total: 147.3 kN/m; R<sub>int</sub>,x,total: 65.9 kN/m.
- Yieldline load-carrying capacity of slab panel:** m<sub>x</sub>: 10.77 kN/m; m<sub>y</sub>: 6.6 kN/m; Negative moment capacity m<sub>u</sub><sup>l</sup>: 8.48 kN/m; Yieldline dimension L1: 4.74 m; Yieldline load carrying capacity w<sub>yl</sub>:theta<sub>ss</sub>: 2.31 kN/m<sup>2</sup>; Limiting deflection d<sub>max</sub>: 1.76 kN/m<sup>2</sup>; Tensile membrane enhancement factor: 624 mm; 1.69.
- Design load-carrying capacity of the slab panel:** w<sub>u</sub>: 3.87 kPa; w<sup>u</sup>: 3.8 kPa.
- Integrity:** The integrity reinforcement is sufficient.
- Shear capacity per metre:** Through the slab: 31.06 kN/m; Through the secondary beam: 0 kN/m; Total shear design capacity (v<sub>u</sub>): 31.06 kN/m; Design shear (v<sup>u</sup>): 15.2 kN/m.
- Time equivalent fire severity:** t<sub>eq</sub> (User defined value): 30 min; Fire Hazard Category: 1.

# SPEEDFLOOR