

## COMPUTATIONS

### PROJECT

8X16M GANTRY PLATFORM WITH Alimak and scaffolding over

### ADDRESS

412 St. Kilda Road, Melbourne

Job No.: 18-42.23  
Designed: Z.S.  
Date: May 2018

### CLIENT

Mclver Contractors

### CODES OF PRACTICE

AS 1170.1 - Minimum design loads on structures - Dead and live loads and load combinations

AS1170.2 - Minimum design loads on structures - Wind loads

AS1720.1 - Timber structures - Design methods

AS4100 - Steel structures

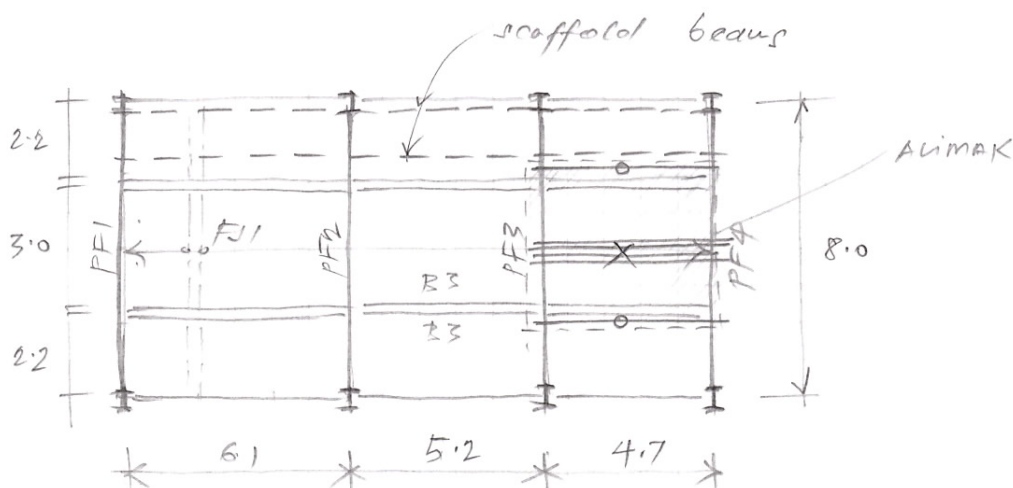
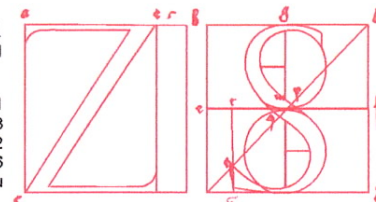
### STRUCTURAL DESIGN OF

Gantry platforms for fall protection live load over, Alimak and scaffold supporting beams (over)

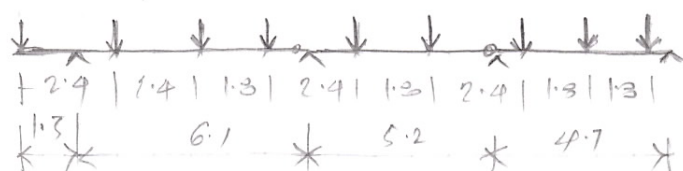
Job No. 18-42.23  
 Address 412 St. Kilda Rd Melbourne  
 Designed by ZS  
 Sheet No. 1  
 Date May 2018

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Scaffold beams:  
 31 kN per leg (total)



$R_g$       ↑ 56                      ↑ 54                      ↑ 54                      33↑  
 $q$             ↑ 26                      ↑ 24                      ↑ 25

all beams are released  
 (single spanning)

$$P_g/q = 31 \text{ kN}$$

$$P_g = 21 \text{ kN}$$

$$q = 10 \text{ kN}$$

} assumption  
 made with  
 ratio of 2:1

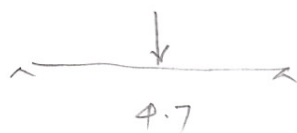
15 All scaffold supporting beams  
 are 310 UB 46.2

no restraint required to top  
 flange

It is assumed that the scaffold  
 supporting beams rest over the  
 portal frame via a steel slab.

Alimak beam:  
 - assumption:

max load = 25 t  
 vertic. pipes = 5 t

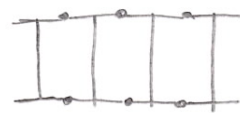


$$P_g = 10 \text{ kN}$$

$$q = 150 \text{ kN}$$

$P_g$  12  
 $q$  125

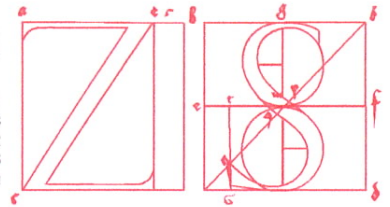
Adopt: 4 no. 460 UB 75



Job No. 18-42.23  
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floor joists  
 max span = 3m adopt : 150 x 45 F7 Oregon joists @ 450 ctr.

Gantry beams

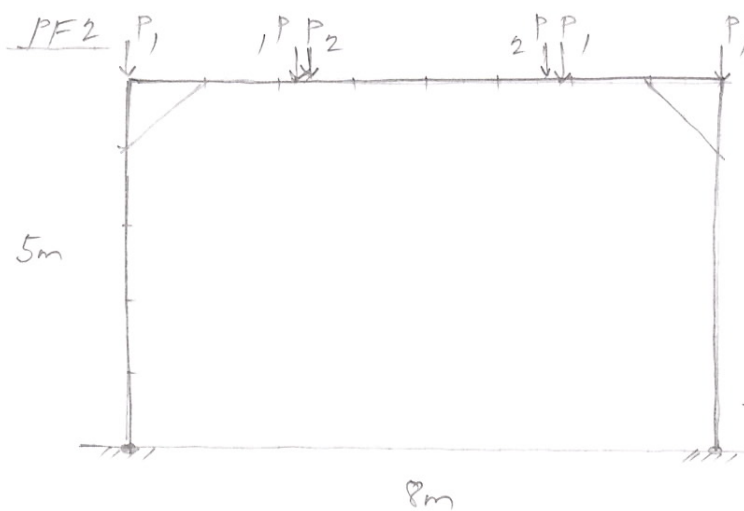
BS spec = 6.1

R<sub>G</sub> 4  
 φ 52

$$w_g = 1.7 \times 1.5 + \text{self} = 2.55 + \text{self}$$

$$q = 1.7 \times 10 = 17$$

Adopt : 310 UB 46.2



$$P_2 G = 4 \left( \frac{6.1 + 5.2}{6.1} \right)^{1.9} = 7.6 \text{ kN}$$

$$q = 52 \times 1.9 = 99$$

$$P_3 G = 4 \left( \frac{2.2}{3} \right)^{1.7} \times 1.9 = 5.3$$

$$q = 52 \times 1.7 \times 1.9 = 69$$

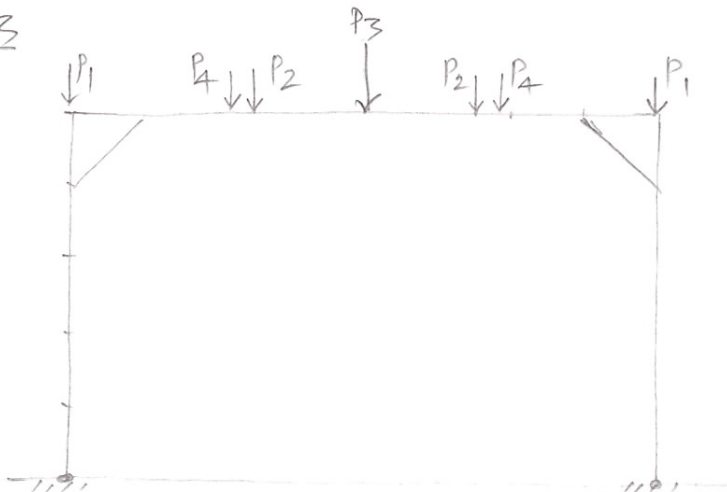
beam: 530 UB 82.0  
 columns: 200 UC 46.2  
 knee brace : 75 x 10 EA

R<sub>G</sub> ↑ 25  
 φ ↑ 237

$$G + 0.4q \uparrow 120 \rightarrow \sigma_{all} = 150 \text{ kPa} \quad A_{required} = 0.48 \text{ m}^2$$

700 x 700 plate &  
 as footing

PF3



P<sub>1</sub> as per PF2

$$P_3 G = 10 \text{ kN}$$

$$q = 175 \text{ kN}$$

P<sub>2</sub> G = 4  
 φ = 52

$$P_4 G = 4 \times \frac{2.2}{3} \times 1.7 = 2.8$$

$$q = 52 \times 1.7 = 36.4$$

beam : 530 UB 92.4  
 columns : 200 UC 52.2  
 knee : 100 x 10 EA

R<sub>G</sub> ↑ 31  
 φ ↑ 220  
 G + 0.4q ↑ 118

foot as per PF2

# ZS Consulting

civil and structural engineers

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**Project Title:** Proposed rectangular gantry platform

**Project Address:** 412 St. Kilda Street, Melbourne

**Project Number:** 18-42.23

## **Design Report**

Given are the following parameters:

$q = 10\text{kPa}$  (fall protection Live load)

Each leg of scaffold exerts 31kN of TOTAL load on the scaffold supporting beams

ALIMAK point loadthrough mast = 25t

through pipes = 5t

## **Scaffold supporting beams**

### **Checking the 6.1m + cantilever beam**

cantilever portion check

Group: UB

Section: 310UB46.2

**Load Case: 1.25G+1.5Q (Strength Limit State)**

**Design Checks**

$M_x^* \leq \phi M_{sx}$ ,  $54.104 \leq 196.83$  OK 73% under

$M_x^* \leq \phi M_{bx}$ ,  $54.104 \leq 196.83$  OK 73% under

$V_x^* \leq \phi V_{vx}$ ,  $41.986 \leq 333.218$  OK 87% under

**Load Case: G + 0.7Q (Serviceability Limit State)**

**Deflection Checks**

Major axis deflection,  $\Delta \leq L/400$ ,  $2.811 \leq 3.25$  mm OK 14% under

portion between supports check

Group: UB

Section: 310UB46.2

**Load Case: 1.25G+1.5Q (Strength Limit State)**

**Design Checks**

$M_x^* \leq \phi M_{sx}$ ,  $79.328 \leq 196.83$  OK 60% under

$M_x^* \leq \phi M_{bx}$ ,  $79.328 \leq 79.921$  OK 1% under

$V_x^* \leq \phi V_{vx}$ ,  $67.4 \leq 333.218$  OK 80% under

**Load Case: G + 0.7Q (Serviceability Limit State)**

**Deflection Checks**

Major axis deflection,  $\Delta \leq L/400$ ,  $8.6 \leq 15.25$  mm OK 44% under

### **Checking 5.2m span**

Group: UB

Section: 310UB46.2

**Load Case: 1.25G+1.5Q (Strength Limit State)**

**Design Checks**

$M_x^* \leq \phi M_{sx}$ ,  $73.127 \leq 196.83$  OK 63% under

$M_x^* \leq \phi M_{bx}$ ,  $73.127 \leq 78.972$  OK 7% under

$V_x^* \leq \phi V_{vx}$ ,  $44.309 \leq 333.218$  OK 87% under

**Load Case: G + 0.7Q (Serviceability Limit State)**

**Deflection Checks**

Major axis deflection,  $\Delta \leq L/400$ ,  $7.102 \leq 13.0$  mm OK 45% under

### **Checking 4.7m span**

Group: UB

Section: 310UB46.2

**Load Case: 1.25G+1.5Q (Strength Limit State)**

**Design Checks**

$M_x^* \leq \phi M_{sx}$ ,  $72.654 \leq 196.83$  OK 63% under

$M_x^* \leq \phi M_{bx}$ ,  $72.654 \leq 93.431$  OK 22% under

$V_x^* \leq \phi V_{vx}$ , 64.522 ≤ 333.218 OK 81% under

### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/400$ , 5.254 ≤ 11.75 mm OK 55% under

## Alimak supporting beam

### Beam under the mast

Span = 4.7m

Pg = 10kN

Pq = 250kN

Group: Custom1

Section: 4no460ub75



### Load Case: 1.25G+1.5Q (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ , 465.447 ≤ 1268.644 OK 63% under

$M_x^* \leq \phi M_{bx}$ , 465.447 ≤ 1268.644 OK 63% under

$V_x^* \leq \phi V_{vx}$ , 202.375 ≤ 1261.915 OK 84% under

### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/330$ , 1.566 ≤ 14.242 mm OK 89% under

## Gantry

### Floor joists

span = 3m

spacing = 450

Group: Timber (F7)

Section: 250x50 F7 Oregon

### Load Case: G+Q

#### Design Member 1, G+Q, Major Bending

$f_b = 1.4 \cdot F_y \cdot 1.3 = 12.558$  MPa Tensile  $S_{bz}' = 10.168$  MPa OK 19% under

#### Design Member 1, G+Q, Major Shear

$F_s = 1.4 \cdot F_u \cdot (2/3) = 0.653$  MPa  $S_y' = 0.565$  MPa OK 14% under

#### Design Member 1, G+Q, Major Deflection

Deflection limit =  $L/300 = 10.000$  mm  $d_y' = 9.653$  mm OK 3% under

### Load Case: 2G

#### Design Member 1, 2G, Major Deflection

Deflection limit =  $L/300 = 10.000$  mm  $d_y' = 0.851$  mm OK 91% under

### B3 (typ)

span = 6.1m

Group: UB

Section: 310UB46.2

### Load Case: 1.25G+1.5Q (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ , 126.474 ≤ 196.83 OK 36% under

$M_x^* \leq \phi M_{bx}$ , 126.474 ≤ 196.83 OK 36% under

$V_x^* \leq \phi V_{vx}$ , 82.934 ≤ 333.218 OK 75% under

### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/300$ , 11.947 ≤ 20.333 mm OK 41% under

### PF2

span = 8m

Group: UB

Section: 530UB82.0



### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/300$ ,  $17.844 \leq 26.667$  mm OK 33% under

### Load Case: 1.25G+1.5Q (P-d,P-D) (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ ,  $513.643 \leq 558.9$  OK 8% under

$M_x^* > \phi M_{bx}$ ,  $513.643 > 481.064$  FAILED 7% over - acceptable

$V_x^* \leq \phi V_{vx}$ ,  $274.446 \leq 821.146$  OK 67% under

#### COLUMN CHECK

design height = 5m

Group: UC

Section: 200UC46.2

### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/250$ ,  $5.72 \leq 14.0$  mm OK 59% under

### Load Case: 1.25G+1.5Q (P-d,P-D) (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ ,  $114.715 \leq 133.593$  OK 14% under

$M_x^* \leq \phi M_{bx}$ ,  $114.715 \leq 133.593$  OK 14% under

$V_x^* \leq \phi V_{vx}$ ,  $139.238 \leq 240.068$  OK 42% under

## PF3

span = 8m

Group: UB

Section: 530UB92.4

### Load Case: G + 0.7Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/300$ ,  $16.081 \leq 26.667$  mm OK 40% under

### Load Case: G+0.7Q-alimak and part Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/300$ ,  $16.204 \leq 26.667$  mm OK 39% under

### Load Case: 1.25G+1.5Q (P-d,P-D) (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ ,  $533.445 \leq 639.9$  OK 17% under

$M_x^* \leq \phi M_{bx}$ ,  $533.445 \leq 639.9$  OK 17% under

$V_x^* \leq \phi V_{vx}$ ,  $281.081 \leq 880.729$  OK 68% under

### Load Case: 1.2G+1.5Q-alimak and part Q (P-d,P-D) (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ ,  $625.38 \leq 639.9$  OK 2% under

$M_x^* \leq \phi M_{bx}$ ,  $625.38 \leq 639.9$  OK 2% under

$V_x^* \leq \phi V_{vx}$ ,  $254.261 \leq 880.729$  OK 71% under

#### COLUMN CHECK

Group: UC

Section: 200UC52.2

### Load Case: G+0.7Q-alimak and part Q (Serviceability Limit State)

#### Deflection Checks

Major axis deflection,  $\Delta \leq L/250$ ,  $5.115 \leq 14.0$  mm OK 63% under

### Load Case: 1.2G+1.5Q-alimak and part Q (P-d,P-D) (Strength Limit State)

#### Design Checks

$M_x^* \leq \phi M_{sx}$ ,  $115.88 \leq 153.9$  OK 25% under

$M_x^* \leq \phi M_{bx}$ ,  $115.88 \leq 153.9$  OK 25% under

$V_x^* \leq \phi V_{vx}$ ,  $143.813 \leq 266.976$  OK 46% under