# หลักการออกแบบฐานราก Tower Crane

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# ขั้นตอนการออกแบบฐานราก Tower Crane

1. รวบรวมข้อมูลสภาพหน้างาน

2. รวบรวมข้อมูลทางเทคนิคของ Tower Crane (Tower Crane's Specification)

3. ออกแบบฐานรากและตัวค้ำยัน Tower Crane

# 1. รวบรวมข้อมูลสภาพหน้างาน

1.1 ตำแหน่งการติดตั้ง Tower Crane

1.2 ความสูงของ Tower Crane ที่ต้องการใช้งาน

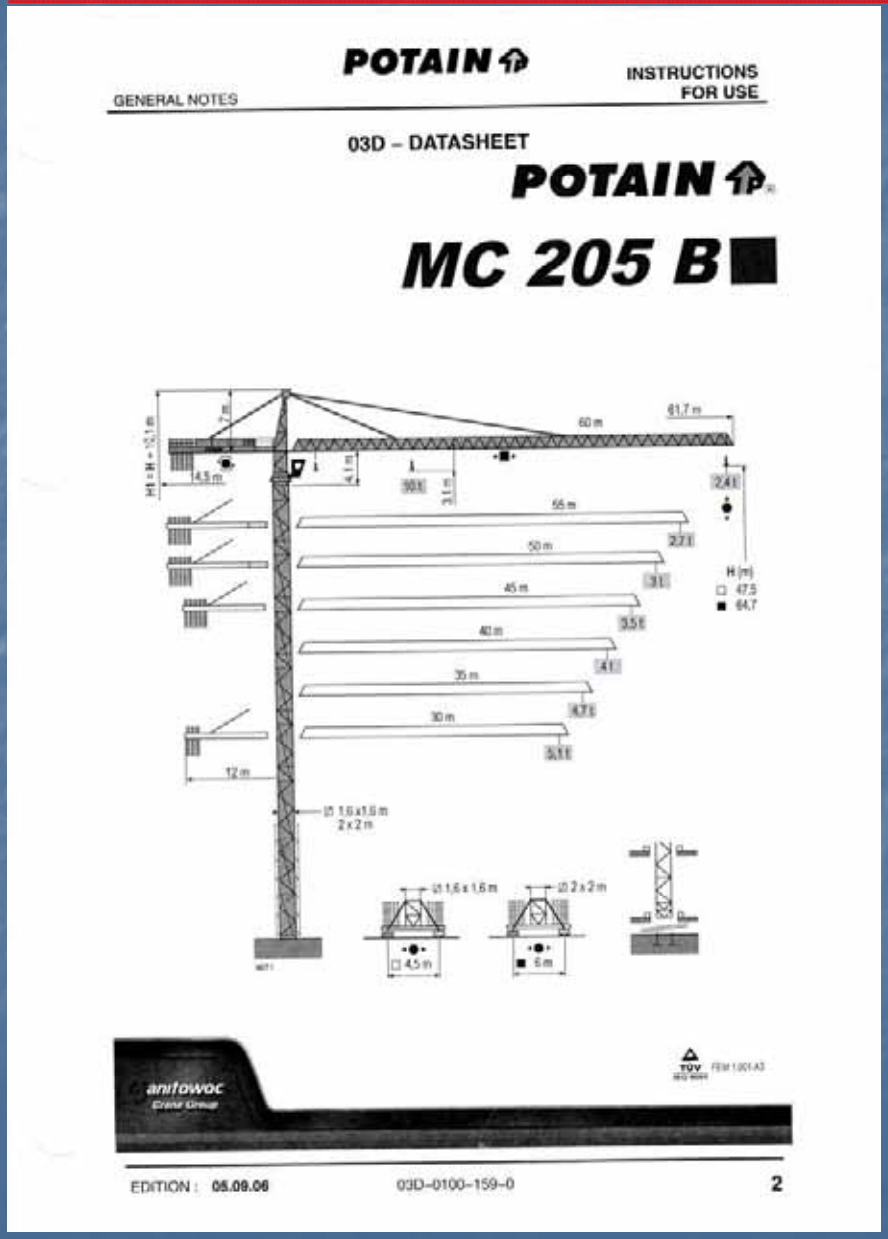
1.3 รุ่นของ Tower Crane ที่จะใช้

1.4 ตำแหน่งติดตั้งตัวค้ำยัน (Bracing)

1.5 วิธีการรื้อถอน

1.6 อื่น ๆ

# 2. รวบรวมข้อมูลทางเทคนิคของ Tower Crane



POTAIN

GENERAL NOTES

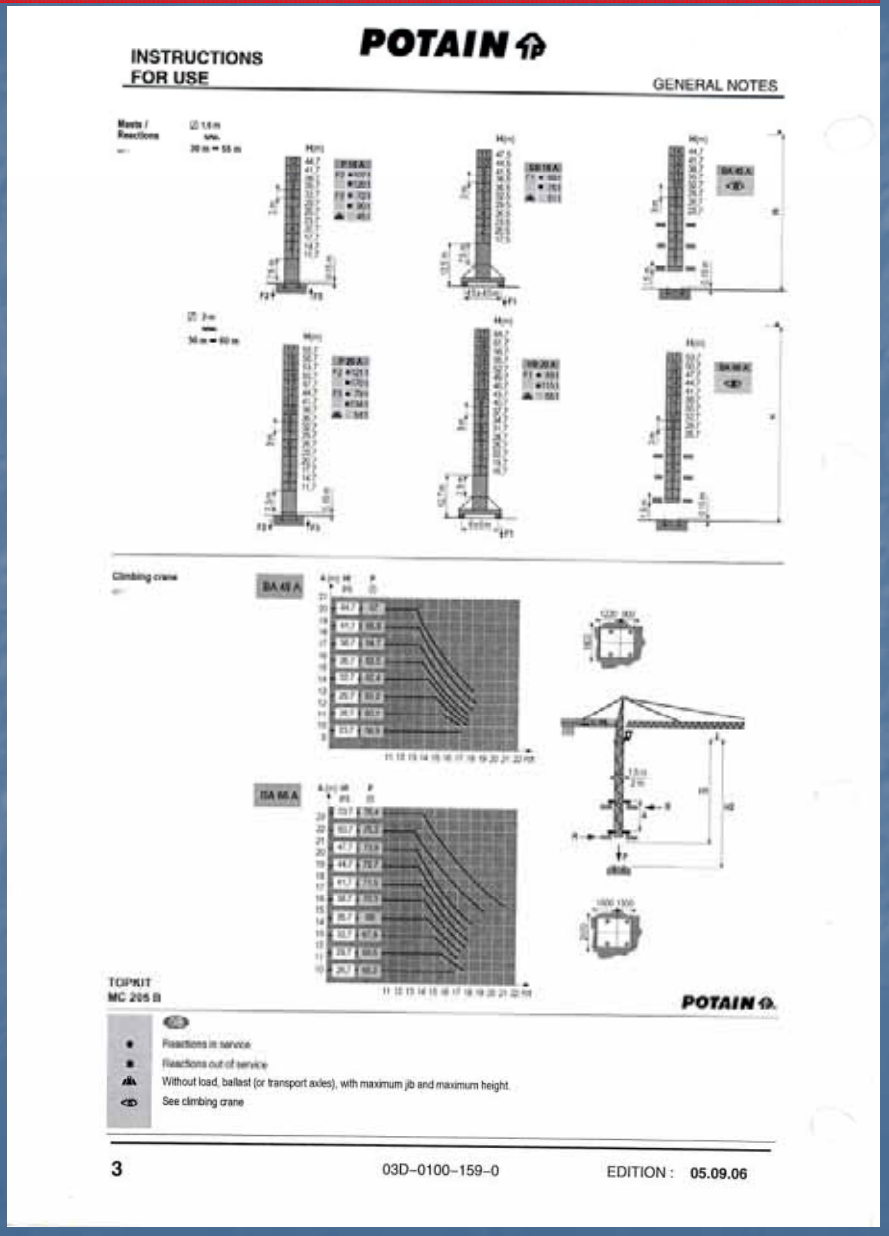
INSTRUCTIONS FOR USE

03D – DATASHEET

POTAIN

MC 205 B





POTAIN

INSTRUCTIONS FOR USE

GENERAL NOTES

TOPKIT MC 205 B

POTAIN

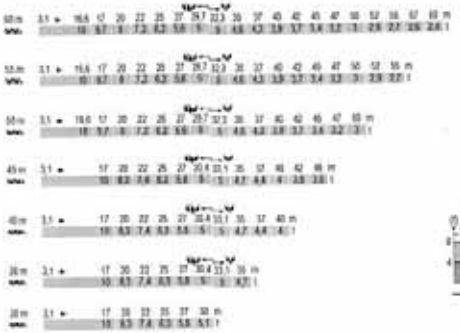
Reactions in service

Reactions out of service

Without load, ballast (or transport axles), with maximum jib and maximum height.

See climbing crane

Load diagrams

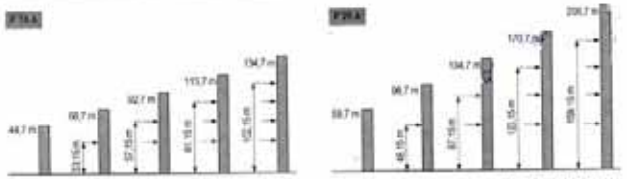


Counter-jib ballast

| | | |
|---|---|---|
| 60 m | 14.5 m | 18 000 |
| 55 m | 14.5 m | 15 800 |
| 50 m | 14.5 m | 14 400 |
| 45 m | 12 m | 17 200 |
| 40 m | 12 m | 14 800 |
| 35 m | 12 m | 13 000 |
| 30 m | 12 m | 11 000 |

Base ballast

Anchorages



TOPKIT MC 205 B

| | |
|---|---|
| A | Distance between collars |
| H1 | Crane height |
| P | Crane weight (in service) |
| R | Horizontal reaction |





## 2. 3. WEIGHT OF THE MAIN COMPONENTS

### 2. 3. 1. SLEWING CRANE PART

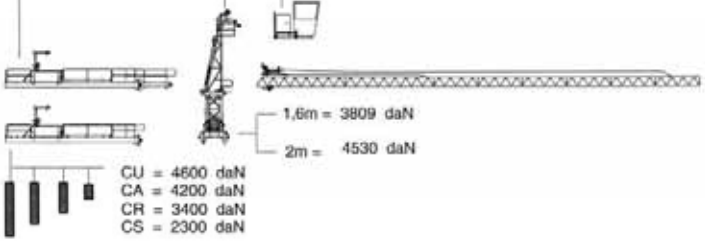
55RCS 14,5m = 6650 daN

75LVF25SP 14,5m = 6860 daN

12m = 5723 daN

12m = 5933 daN

The weights given include grab rails, wind-sail and advertising plates, hoist winch with rope, tie bars and powered derrik.




| | 2C | 1C |
|---|---|---|
| Dec 5 | 60m = 9234 daN | 60m = 8859 daN |
| | 55m = 8622 daN | 55m = 8247 daN |
| | 50m = 8321 daN | 50m = 7946 daN |
| | 45m = 7706 daN | 45m = 7331 daN |
| | 40m = 77091 daN | 40m = 6716 daN |
| | 35m = 6809 daN | 35m = 6438 daN |
| | 30m = 6238 daN | 30m = 5867 daN |

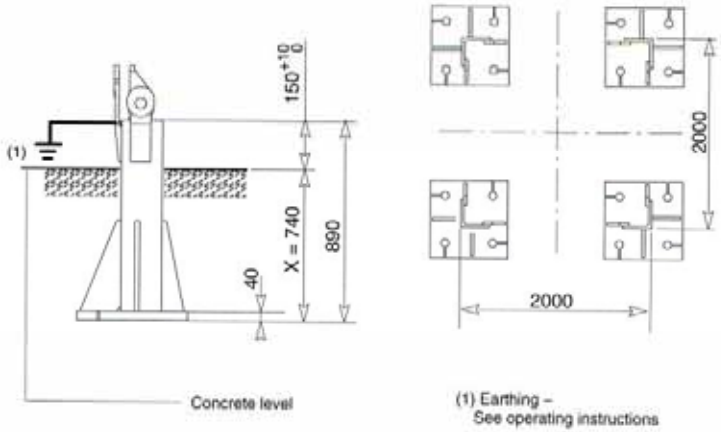
The weights given include the assembled jib with trolley winch and rope, trolley at the jib foot, without hoist rope, with wind-sail plates, with tie bar lines placed onto the upper member and with safety rope.

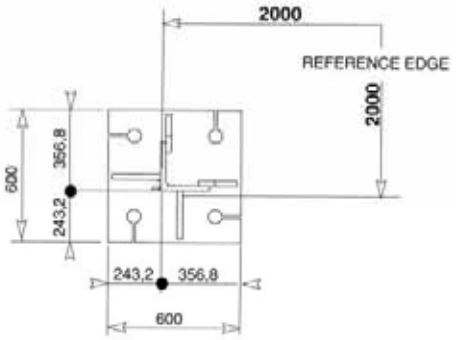
Tolerance on the weight ± 5%

Tolerância nos pesos: ±5%

## 2. FITTING THE NOT REUSABLE FIXING ANGLES

### 2. 1. DIMENSIONS OF THE FIXING ANGLES








– Outside or inside the ditch, arrange the fixing angles (1) by observing their distance (Detail A – Figure 1).

– Engage the template (2) into the 4 fixing angles; lower it until it comes to rest onto the fishplates (Detail B – Figure 1). Pin-connect the template using 4 x 2 shafts (3), drifts and split-pins (Detail C).

– Engage the standard mast section (4) into the fishplates of the fixing angles (Detail D – Figure 1).Connect this mast section using 4 x 2 shafts (5), insert locking pins and split-pin them, see (Detail D – Figure 1).

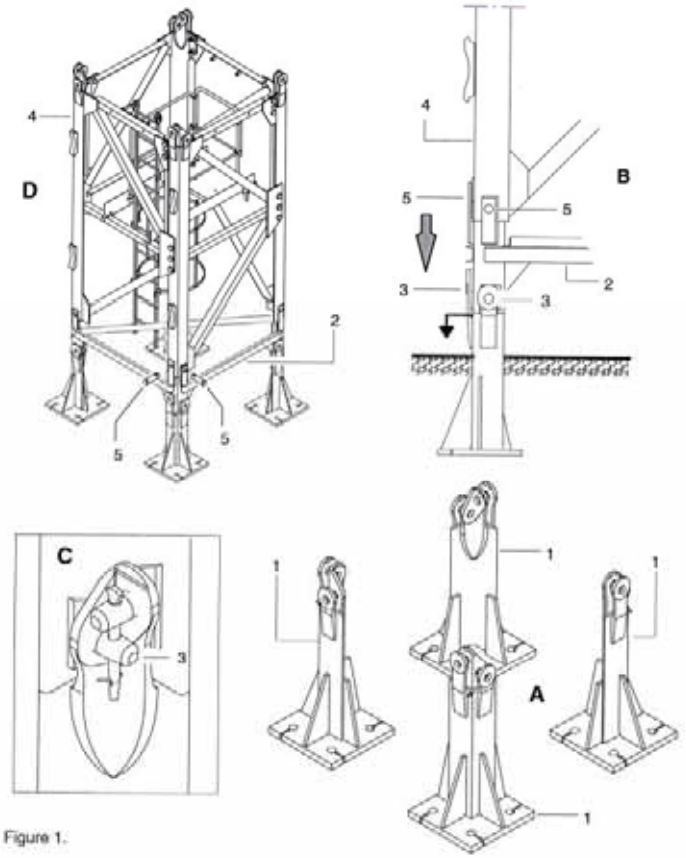



Figure 1.

- Position the assembly comprising the fixing angles, the template and standard mast section in the reinforcement arranged in the ditch and carry out an adjustable wedging (1) under the plates of the fixing angles (Detail A – Figure 2).

  IT IS ESSENTIAL TO OBSERVE THE DIMENSION OF 150 mm (Detail B – Figure 2).
- Check the perpendicularity of the assembly by means of the sighting device.
- Pour the concrete block and wait that it is completely dry before dismantling the template and the standard mast section.

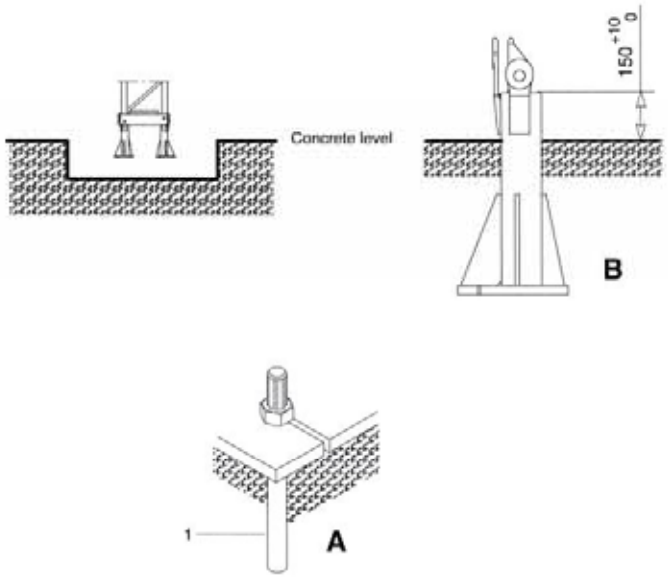


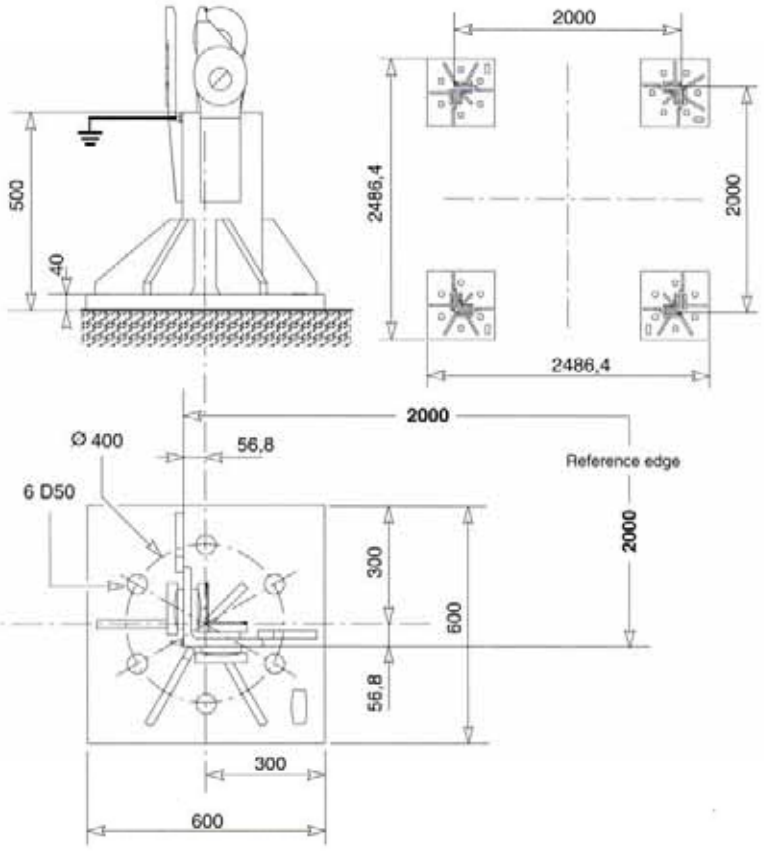

Figure 2.





## 3. FITTING THE REUSABLE FIXING ANGLES

### 3. 1. DIMENSIONAL CHARACTERISTICS OF THE FIXING ANGLES




Dimensions in mm

### 3. 2. FITTING THE FIXING ANGLES

The dimension, number and fitting of the fixing rods of the fixing angles onto the concrete block (or any other structure ...) are on the user's responsibility. The loads and reactions are given in chapter 17A.

It is possible to use the constructor's standard of concrete blocks for the informations of mass, dimensions and ground pressure. The concrete blocks are defined for the plate-type fixing angles. Therefore, it is COMPULSORY to adapt them to the reusable fixing angles and to the connecting method between the fixing angles and the concrete block. The adaptation of the reusable fixing angles to these concrete blocks is on the user's responsibility (the reinforcement type is to be adapted to the fixing rods used).

Near the fixing angle, NEVER CUT REINFORCING STEELS NOR REDUCE THEIR NUMBER GIVEN.

The fixing angles can be supplied before the delivery of the crane in order to use them as positioning jig for the fixing rods of the fixing angles. The template can also be supplied before the delivery of the crane.

The template is only used for fitting the fixing angles.

Fitting this equipment increases the hook height by 290 mm in comparison with the standard fixing angles to be set in concrete.

Take care that the fixing angles are correctly earthed (see Operating Instructions).

### 3. 2. 1. DETERMINATION OF A FIXING

The tables of the chapter 17A give the tensile load, compression and shearing forces applied on the fixing angles for the various working heights. These informations allow carrying out the calculation of the fitting of the fixing angles adapted to your case of use, knowing that the shearing force is always taken up by two fixing angles.

In general, it can be indicated that, in case of fixing by screw connections or by high-strength tie rod, class 10-9 (elastic limit of 90 kg/mm$^2$), a correct assembling will be obtained by observing the following data, that is to say:

- F – maximum static load under tensile strength on 1 fixing angle.
- Fe – the capacity corresponding to the elastic limit of the tie rod.
- Definition of the number of rods (N) to be used per fixing angle.

$$\frac{F}{0{,}3\ Fe} = \text{N to be rounded}$$

The number of the rods is always even: 4 or 6, and symmetrical with respect to the upright.

**NOTE:** Considering a permissible load per rod, equal to 0.3 of the elastic limit, taking up the moment given by the shearing force and the various dynamic coefficients are integrated.

- Prestress Fp to be applied on the high-strength rod (Fp = 0,5 Fe)

**IMPORTANT:** Besides these informations concerning the number and the quality of the rods, choosing and fitting workmanlike the fixings are entirely on the user's responsibility.





### 3. 2. 2. FITTING THE RODS

Fitting the rods varies depending on the number of rods used:

- 4 rods – use the holes 1, 3, 4, 6 (Figure 1)
- 6 rods – use the holes 1, 2, 3, 4, 5, 6 (Figure 1)

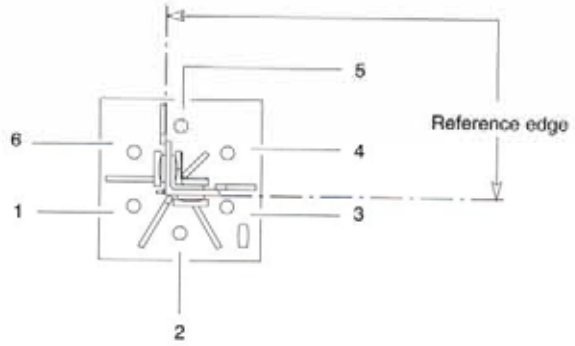



Figure 1

# LOADS AND REACTIONS ON FIXING ANGLES

## 1. INSTALLATION ON FIXING ANGLES

The following tables define:

- the loads and the reactions applied on the fixing angles in service and out of service.
- the calculation of the concrete blocks
- the choice of the concrete blocks and the pressure under the concrete blocks

There is one table for each type of installation as described in the DATA SHEETS.

The dimensions of the fixing angles, the setting of the fixing angles in the concrete blocks as well as the execution plans are shown in a brochure corresponding to this type of installation.

### 1. 1. CONDITIONS OF EXECUTION

#### 1. 1. 1. BY THE CUSTOMER

The tables of reactions and loads, the dimensions of the fixing angles and the setting of the fixing angles in the concrete block are necessary and sufficient in order to determine a concrete block (dimensions and reinforcement).

The indicated reactions and loads do not include coefficients for dead weights nor dynamic coefficient for the lifting load.

It is appropriate to take into consideration the usual or standardized safety coefficients valid for the indicated loads and reactions. If not, it is advised to apply at least a safety coefficient of 1,5.

For the crane stability requirements, compulsorily observe the minimum dimensions on the ground as well as the minimum mass which are equal to those of the smallest permissible concrete block, which is compatible with the ground pressure at the erection site.

***FIXING ANGLE – PREPARATION OF THE CONCRETE BLOCK***

*Pressure under the concrete blocks – during erection*

*Pressure under the concrete blocks – in service – out of service*

18 A

For any other dimensions which do not observe these recommendations, please consult us.

#### 1. 1. 2. ACCORDING TO THE PRESCRIPTION OF POTAIN: in compliance with French Standards

If not usable abroad, prepare the concrete block according to the paragraph 1. 1. 1. or consult us.

##### *1. 1. 2. 1. Choosing procedure*

The permissible ground pressure of the site determines the optimum type of concrete block to be used for the final height to be obtained and for the each type of installation and crane. For all cases of height, choose the concrete block which has a ground pressure less than or equal to the ground pressure of the site.

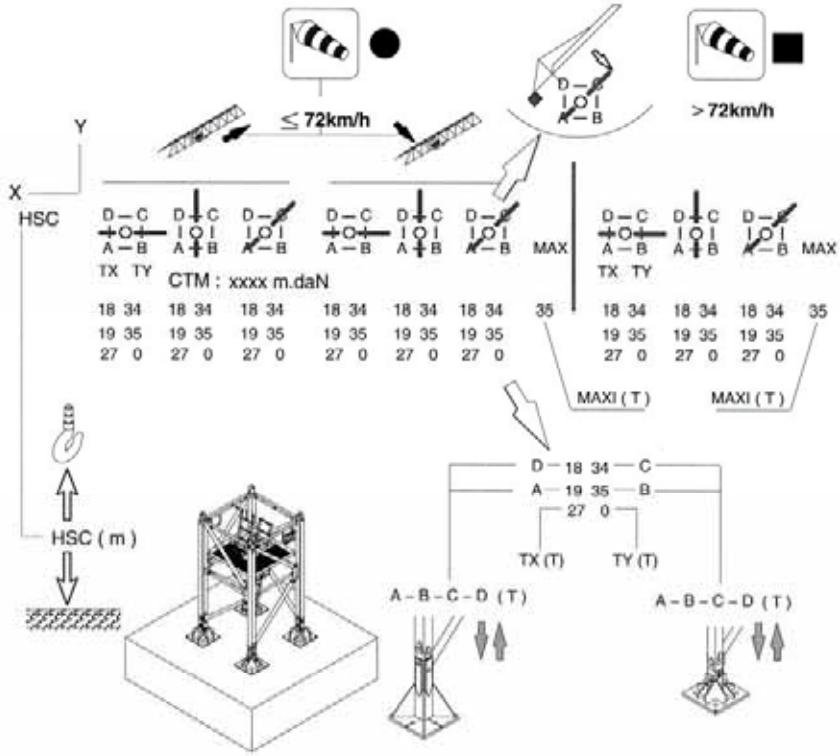
##### *1. 1. 2. 2. Execution of the concrete blocks*

The plan described in chapter 18A is in compliance with the maximum loads given for each case.





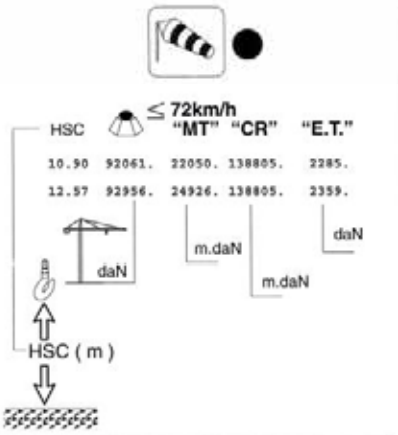
### 1. 2. EXPLANATION AND LEGENDS OF THE REACTION TABLES

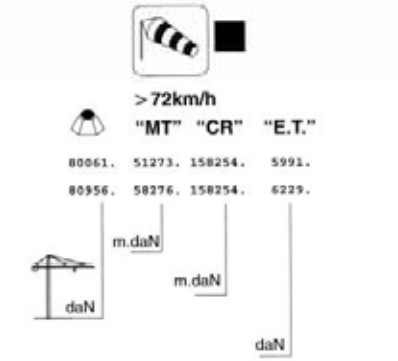


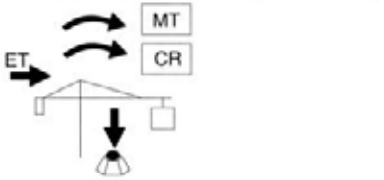

CTM = Maximum torsional moment

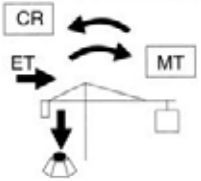
TX – TY = Total shearing force (torsion not included)

## 1. 3. EXPLANATION AND LEGENDS OF THE TABLES CONCRETE BLOCK CALCULATION.




Cumulated moment = MT + CR

Cumulated shearing force on fixing angle $= \frac{ET}{2} + \frac{CTM}{d}$

CTM = Max. torsional moments on the masts (see 17A – § 1.5)

d = mast width

Adding the moments depend on the values of the dead weight moment (CR) and the wind moment (MT):
If MT < 2 x CR then max. moment = CR
If MT > 2 x CR then max. moment = MT– CR

Max. cumulated shearing force on fixing angle $= \frac{ET}{2}$

In out of service condition, the crane is in weathervaning position. CTM = 0

MT – Maximum moment in m.daN

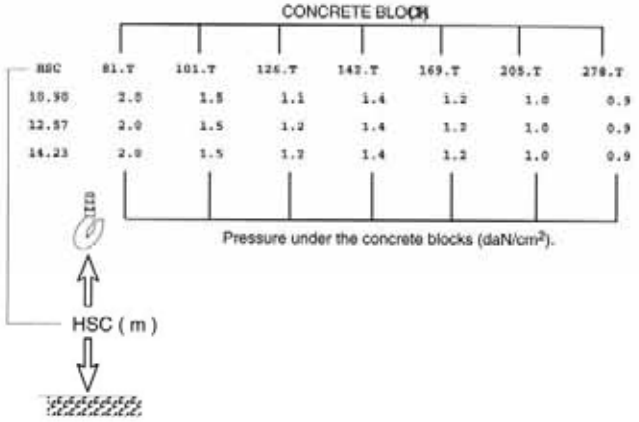
CR – Moment resulting from dead weight + load in m.daN

ET – Shearing force except the mast torsional moment in daN



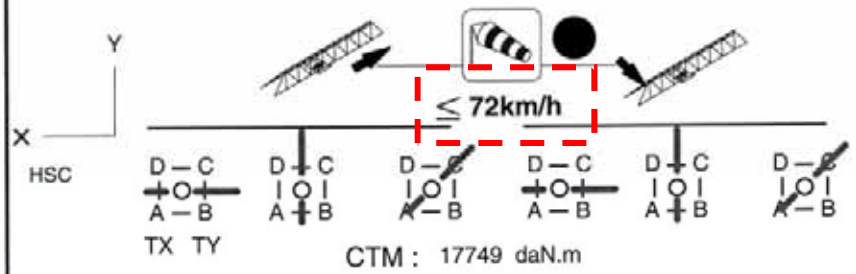


## 1. 4. EXPLANATION AND LEGENDS OF THE TABLES PRESSURE UNDER CONCRETE BLOCKS



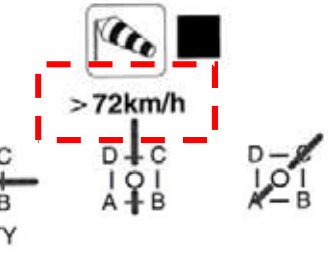
## 1. 5. REACTIONS ON THE FIXING ANGLES

### MC205B – P20A – CHINE

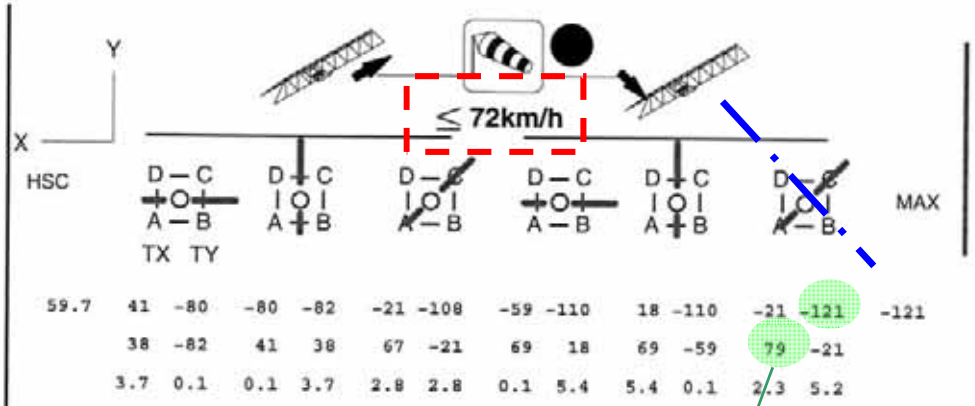


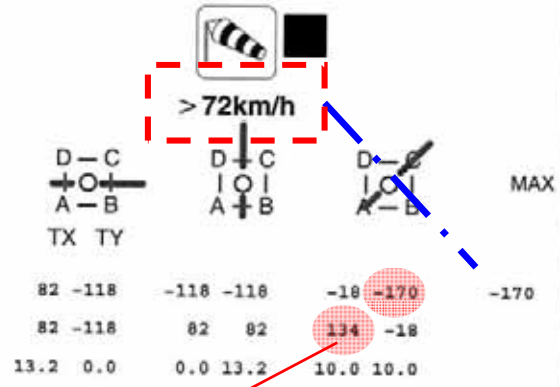

CTM : 17749 daN.m

| HSC | D–C A–B TX | D–C A–B TY | D+C A+B TX | D+C A+B TY | D–C A–B TX | D–C A–B TY | D–C A–B TX | D–C A–B TY | D+C A+B TX | D+C A+B TY | D–C A–B TX | D–C A–B TY | MAX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.6 | 14 | -44 | -44 | -44 | -15 | -56 | 0 | -50 | -31 | -50 | -15 | -53 | -56 |
| | 13 | -44 | 14 | 13 | 26 | -15 | 19 | -31 | 19 | 0 | 22 | -15 | |
| | 1.8 | 0.1 | 0.1 | 1.8 | 1.4 | 1.3 | 0.1 | 3.5 | 3.5 | 0.1 | 1.4 | 3.3 | |
| 11.6 | 15 | -45 | -45 | -46 | -16 | -58 | -3 | -53 | -28 | -53 | -16 | -55 | -58 |
| | 14 | -46 | 15 | 14 | 27 | -16 | 21 | -28 | 21 | -3 | 24 | -16 | |
| | 1.9 | 0.1 | 0.1 | 1.9 | 1.5 | 1.4 | 0.1 | 3.7 | 3.7 | 0.1 | 1.2 | 3.6 | |
| 14.6 | 16 | -47 | -47 | -48 | -16 | -60 | -6 | -56 | -26 | -56 | -16 | -57 | -60 |
| | 15 | -48 | 16 | 15 | 29 | -16 | 24 | -26 | 24 | -6 | 25 | -16 | |
| | 2.0 | 0.1 | 0.1 | 2.0 | 1.5 | 1.5 | 0.1 | 3.8 | 3.8 | 0.1 | 3.8 | 0.9 | |
| 17.6 | 17 | -48 | -48 | -49 | -16 | -63 | -9 | -59 | -24 | -59 | -16 | -59 | -63 |
| | 16 | -49 | 17 | 16 | 30 | -16 | 26 | -24 | 26 | -9 | 27 | -16 | |
| | 2.2 | 0.1 | 0.1 | 2.2 | 1.6 | 1.6 | 0.1 | 3.9 | 3.9 | 0.1 | 0.6 | 3.9 | |
| 20.6 | 18 | -50 | -50 | -51 | -17 | -65 | -12 | -62 | -22 | -62 | -17 | -62 | -65 |
| | 17 | -51 | 18 | 17 | 32 | -17 | 29 | -22 | 29 | -12 | 29 | -17 | |
| | 2.3 | 0.1 | 0.1 | 2.3 | 1.7 | 1.7 | 0.1 | 4.0 | 4.0 | 0.1 | 0.4 | 4.1 | |



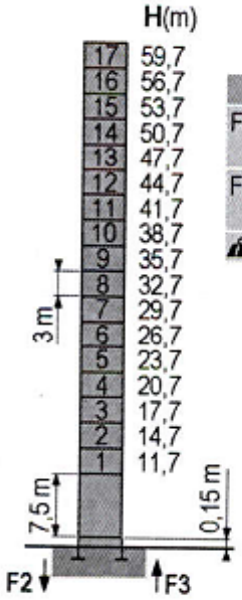

| D–C A–B TX | D–C A–B TY | D+C A+B TX | D+C A+B TY | D–C A–B TX | D–C A–B TY | MAX |
|---|---|---|---|---|---|---|
| -37 | 11 | 11 | 11 | -13 | 21 | -47 |
| -37 | 11 | -37 | -37 | -47 | -13 | |
| 4.6 | 0.0 | 0.0 | 4.6 | 3.4 | 3.4 | |
| -37 | 11 | 11 | 11 | -13 | 21 | -47 |
| -37 | 11 | -37 | -37 | -47 | -13 | |
| 4.9 | 0.0 | 0.0 | 4.9 | 3.7 | 3.7 | |
| -38 | 11 | 11 | 11 | -13 | 21 | -47 |
| -38 | 11 | -38 | -38 | -47 | -13 | |
| 5.3 | 0.0 | 0.0 | 5.3 | 4.0 | 4.0 | |
| -38 | 10 | 10 | 10 | -14 | 20 | -48 |
| -38 | 10 | -38 | -38 | -48 | -14 | |
| 6.5 | 0.0 | 0.0 | 6.5 | 4.8 | 4.8 | |
| -38 | 10 | 10 | 10 | -14 | 20 | -48 |
| -38 | 10 | -38 | -38 | -48 | -14 | |
| 6.8 | 0.0 | 0.0 | 6.8 | 5.1 | 5.1 | |



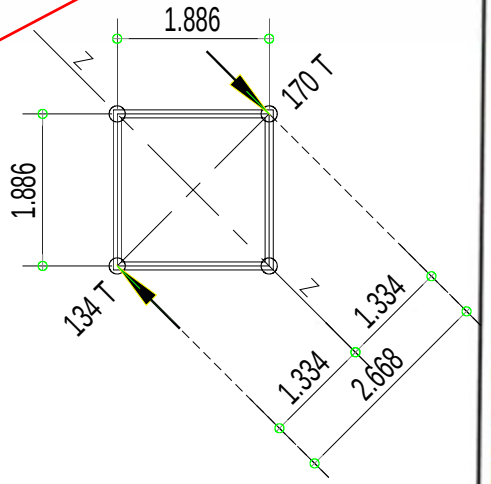




2 m

30 m ➡ 60 m




| P 20 A | |
|---|---|
| F2 | ● 121 t |
| | ■ 170 t |
| F3 | ● 79 t |
| | ■ 134 t |
| | 54 t |




**Moment about Z-Z axis = (170)(1.334)+(134)(1.334)**
**= 405.5 T-m.**

**Sum Fy = -170 -18-18+134**
**= -72 T**

## 1. 6. CALCULATION OF THE CONCRETE BLOCKS

**Design moment = MT - CR**
**= 496314 – 90757**
**= 405557 kg-m**
**= 405.6 T-m.**

| HSC | ≤ 72km/h "MT" | "CR" | "E.T." | > 72km/h "MT" | "CR" | "E.T." |
|---|---|---|---|---|---|---|
| 8.65 | 61335. | 15604. | 93162. | 1835. | 51335. 37416. | 90757. 4807. |
| 11.65 | 62565. | 19777. | 93162. | 1958. | 52565. 47574. | 90757. 5199. |
| 14.65 | 63795. | 24318. | 93162. | 2080. | 53795. 58910. | 90757. 5592. |
| 17.65 | 65025. | 29227. | 93162. | 2203. | 55025. 88456. | 90757. 6805. |
| 20.65 | 66255. | 34504. | 93162. | 2326. | 56255. 104609. | 90757. 7198. |
| 23.65 | 67485. | 40149. | 93162. | 2448. | 57485. 124712. | 90757. 7720. |
| 26.65 | 68715. | 46162. | 93162. | 2571. | 58715. 146775. | 90757. 8260. |
| 29.65 | 69945. | 52543. | 93162. | 2694. | 59945. 170456. | 90757. 8800. |
| 32.65 | 71175. | 59291. | 93162. | 2816. | 61175. 195756. | 90757. 9339. |
| 35.65 | 72405. | 66408. | 93162. | 2939. | 62405. 222676. | 90757. 9879. |
| 38.65 | 73635. | 73893. | 93162. | 3062. | 63635. 251214. | 90757. 10419. |
| 41.65 | 74865. | 81745. | 93162. | 3184. | 64865. 281371. | 90757. 10958. |
| 44.65 | 76095. | 89966. | 93162. | 3307. | 66095. 313148. | 90757. 11498. |
| 47.65 | 77325. | 98554. | 93162. | 3430. | 67325. 346543. | 90757. 12038. |
| 50.65 | 78555. | 107511. | 93162. | 3552. | 68555. 381557. | 90757. 12577. |
| 53.65 | 79785. | 116835. | 93162. | 3675. | 69785. 418190. | 90757. 13117. |
| 56.65 | 81015. | 126527. | 93162. | 3797. | 71015. 456443. | 90757. 13657. |
| 59.65 | 82245. | 136588. | 93162. | 3920. | 72245. 496314. | 90757. 14196. |

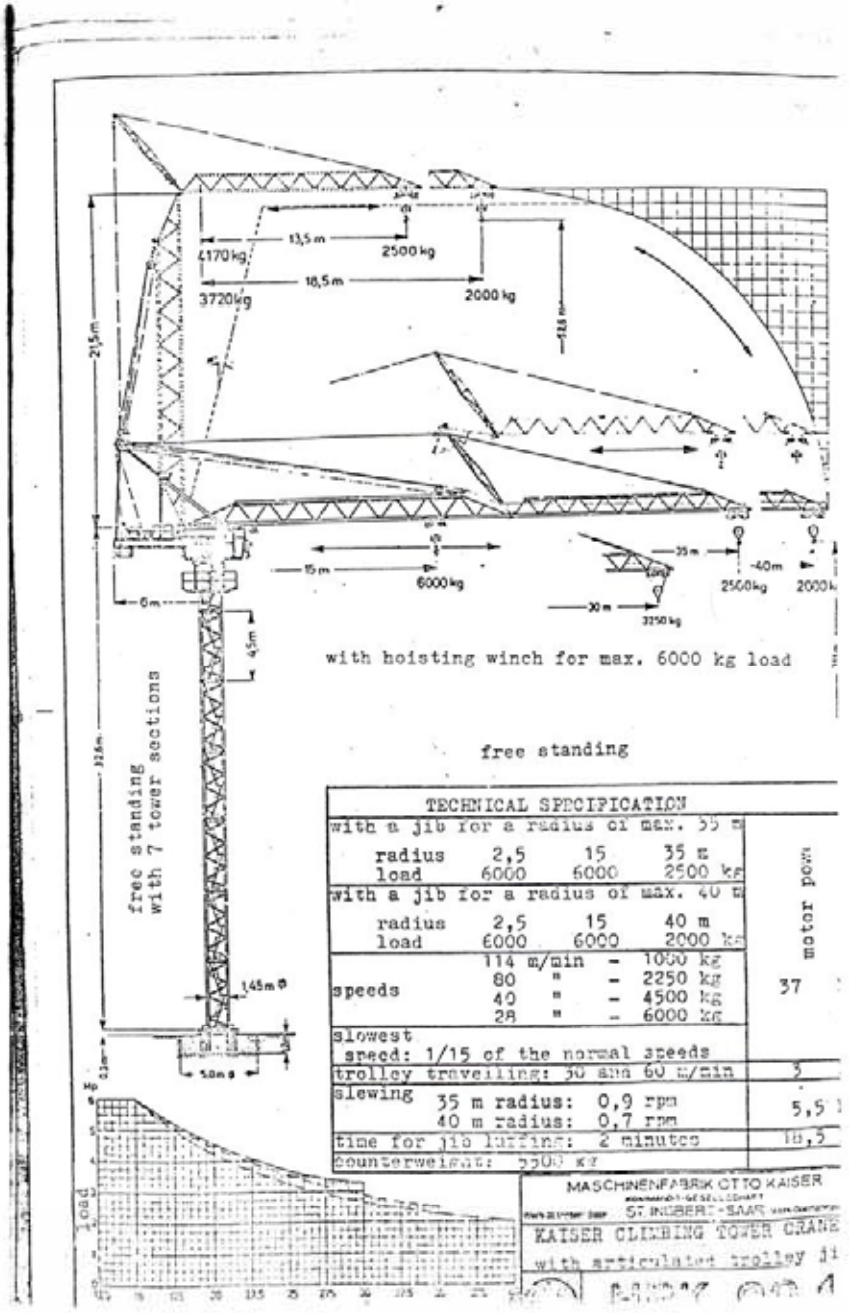
# HOCHBAUKRAN

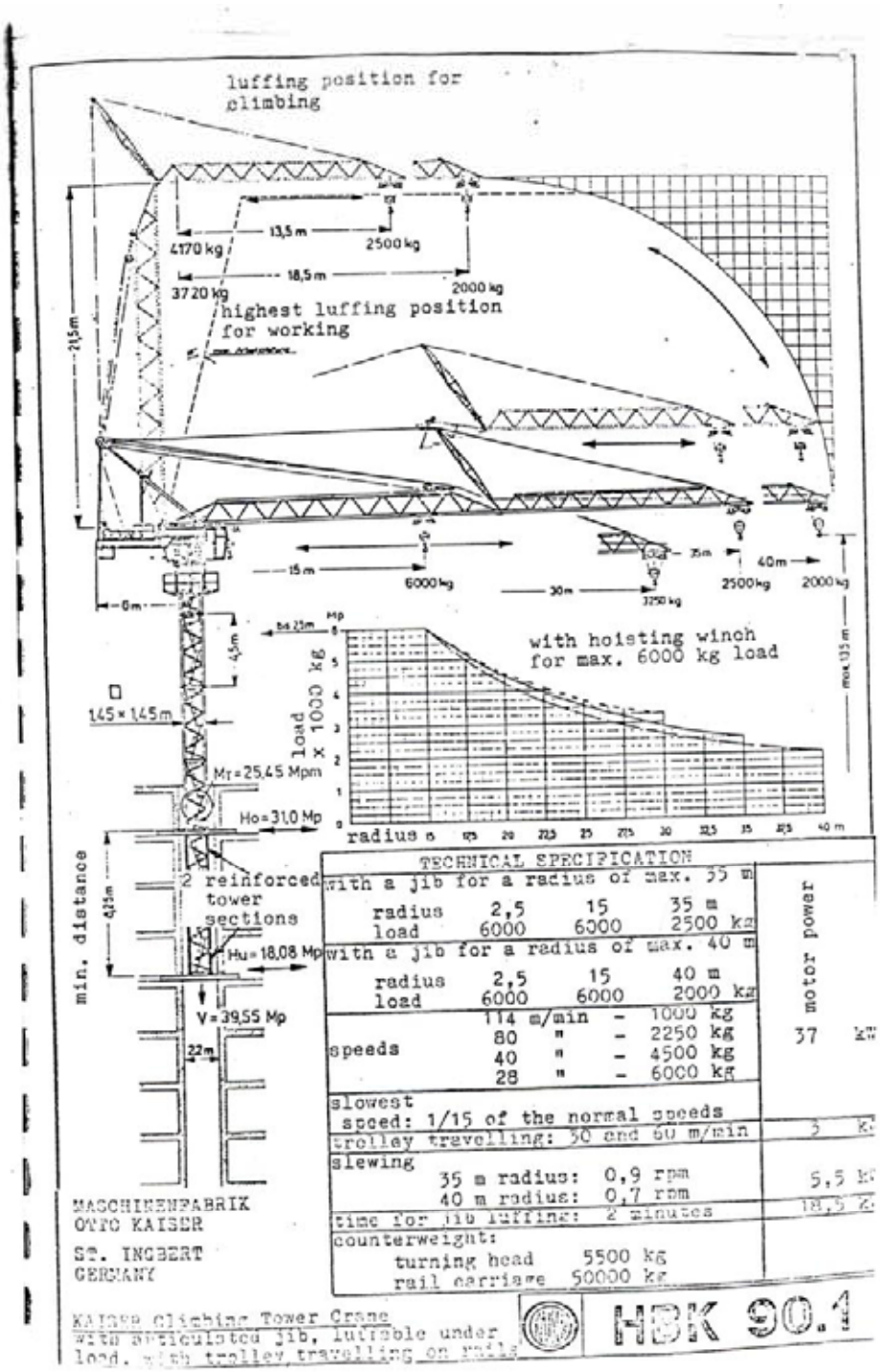
## HBK 90.1

Betriebsanleitung
operating instructions
instructions de service
manual de operaciones

**ELBA**

ELBA-Werk
Maschinen-Gesellschaft mbH
P.O.B. 1254 · D-7505 Ettlingen
Federal Republic of Germany
Tel. 07243/720 Telex 07 82879




luffing position for climbing
4170 kg
13,5 m
2500 kg
18,5 m
3720 kg
2000 kg
highest luffing position for working
21,5 m
15 m
6000 kg
30 m
3250 kg
35 m
40 m
2500 kg
2000 kg
0 m
4,5 m
1,45 × 1,45 m
with hoisting winch for max. 6000 kg load
load x 1000 kg
radius
max 135 m
MT = 25,45 Mpm
HO = 31,0 Mp
2 reinforced tower sections
min. distance
4,25 m
HU = 18,08 Mp
V = 39,55 Mp
22 m
TECHNICAL SPECIFICATION
with a jib for a radius of max. 35 m
radius 2,5 15 35 m
load 6000 6000 2500 kg
with a jib for a radius of max. 40 m
radius 2,5 15 40 m
load 6000 6000 2000 kg
speeds
114 m/min – 1000 kg
80 " – 2250 kg
40 " – 4500 kg
28 " – 6000 kg
motor power
37 kW
slowest speed: 1/15 of the normal speeds
trolley travelling: 50 and 60 m/min 3 kW
slewing
35 m radius: 0,9 rpm
40 m radius: 0,7 rpm 5,5 kW
time for jib luffing: 2 minutes 18,5 kW
counterweight:
turning head 5500 kg
rail carriage 50000 kg
MASCHINENFABRIK
OTTO KAISER
ST. INGBERT
GERMANY
KAISER climbing Tower Crane
with articulated jib, luffable under load, with trolley travelling on rails
HBK 90.1

**DESIGN FOUNDATION FOR**

**TOWER CRANE "HOCHBAU KLETTERKRAN" Series..HBK 90.1**

Crane in Service

| Post Height | Vertical Force (V) | Horizontal Force (H) | Max moment (M) |
|---|---|---|---|
| 1 | 31.740 | 0.810 | 125.248 |
| 2 | 33.740 | 1.035 | 129.399 |
| 3 | 35.740 | 1.260 | 134.563 |
| 4 | 37.740 | 1.485 | 140.739 |
| 5 | 39.740 | 1.710 | 147.928 |
| 6 | 41.740 | 1.935 | 156.129 |
| 7 | **43.740** | 2.160 | **165.343** |

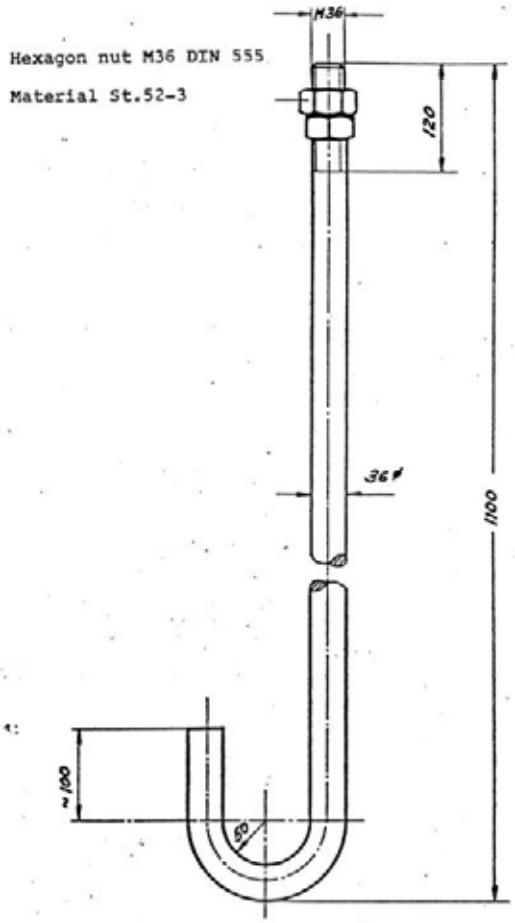
Crane out of Service

| Post Height | Vertical Force (V) | Horizontal Force (H) | Max moment (M) |
|---|---|---|---|
| 1 | 25.740 | 1.629 | 30.211 |
| 2 | 27.740 | 2.229 | 38.891 |
| 3 | 29.740 | 2.829 | 50.272 |
| 4 | 31.740 | 3.815 | 72.091 |
| 5 | 33.740 | 4.640 | 95.164 |
| 6 | 35.740 | 5.465 | 121.951 |
| 7 | 37.740 | **6.290** | 152.449 |

## ANCHOR BOLT

Hexagon nut M36 DIN 555

Material St.52-3

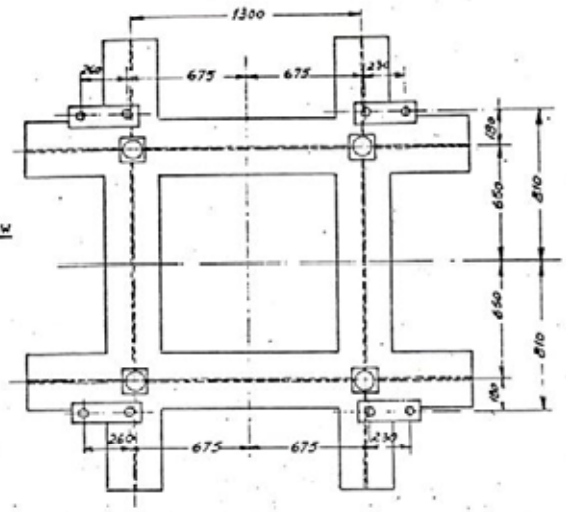



32 anchor bolts are required per crane

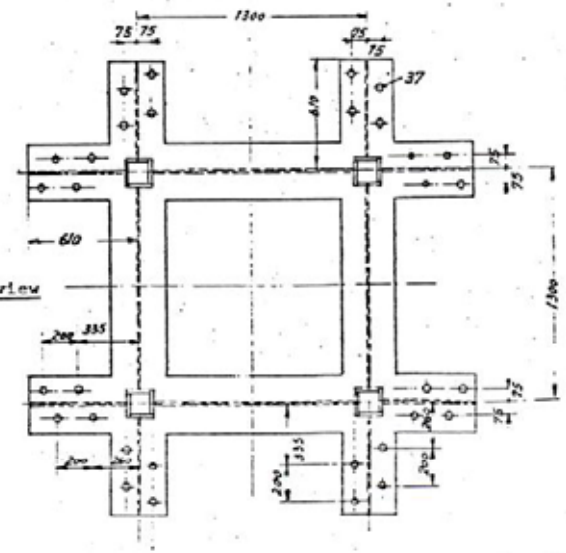
Sketch No. IVa

## FOUNDATION FRAME

Plan view



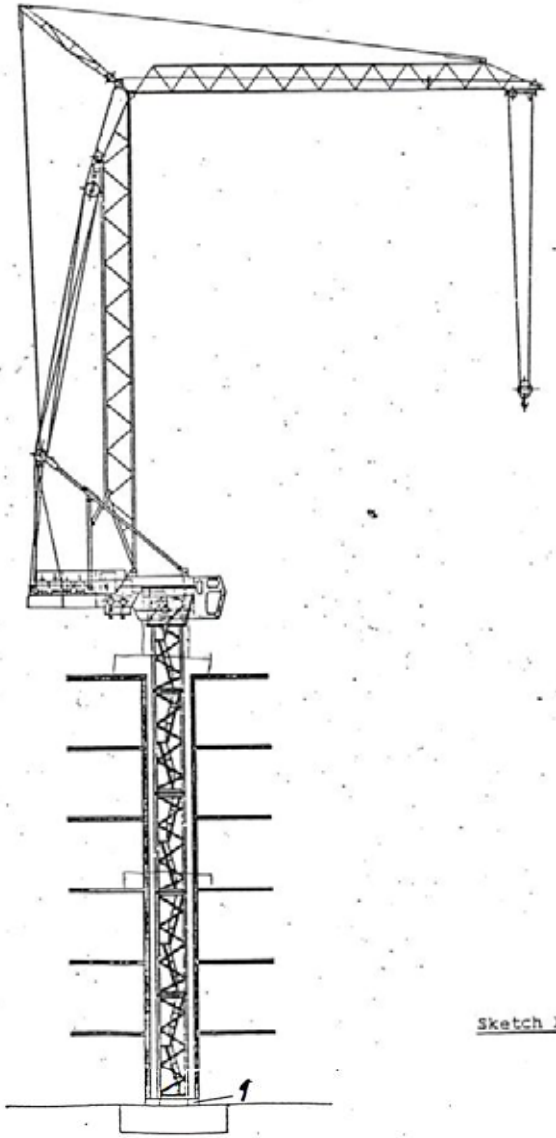

Bottom view




Sketch No. V

29

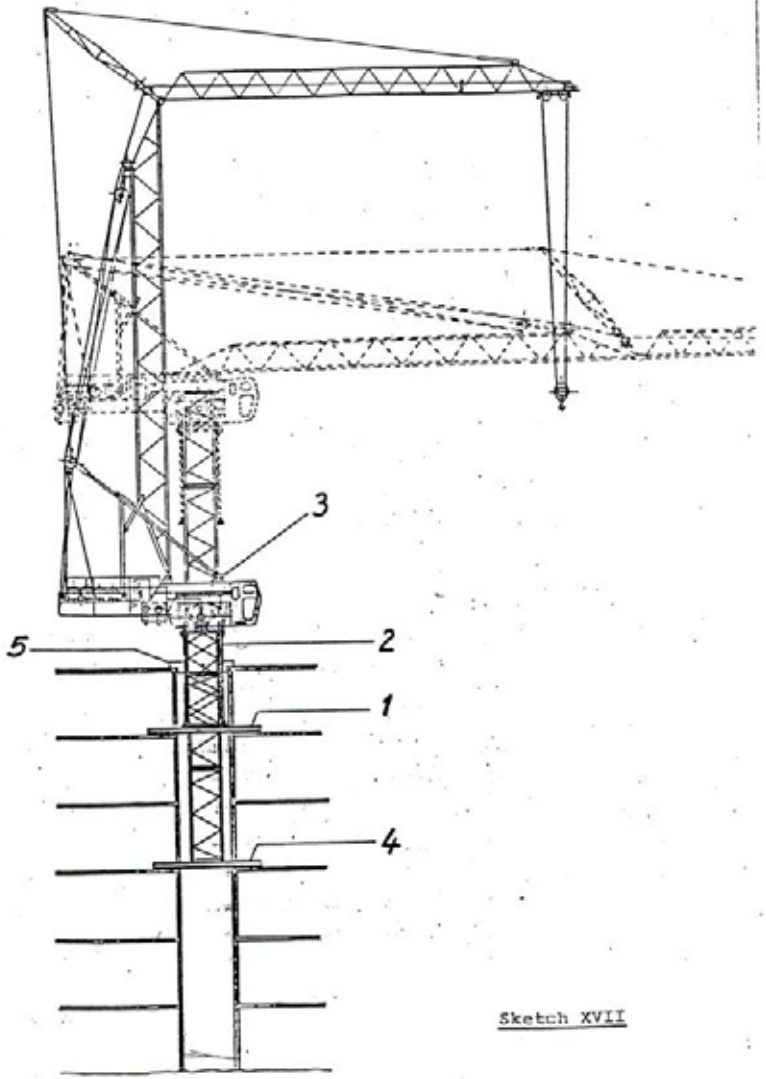
CRANE BEING USED AS A CLIMBING CRANE



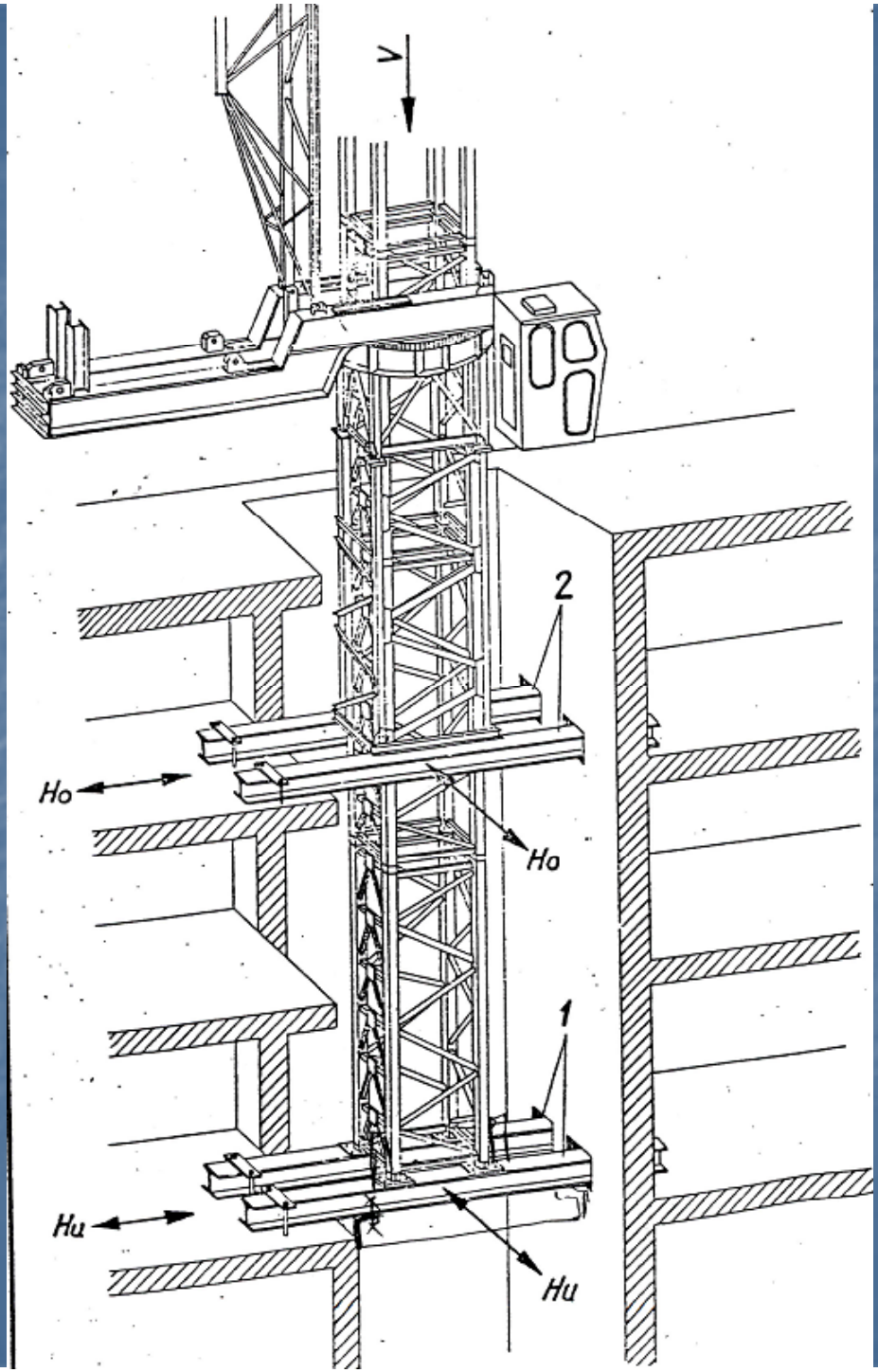

Sketch XVI

30

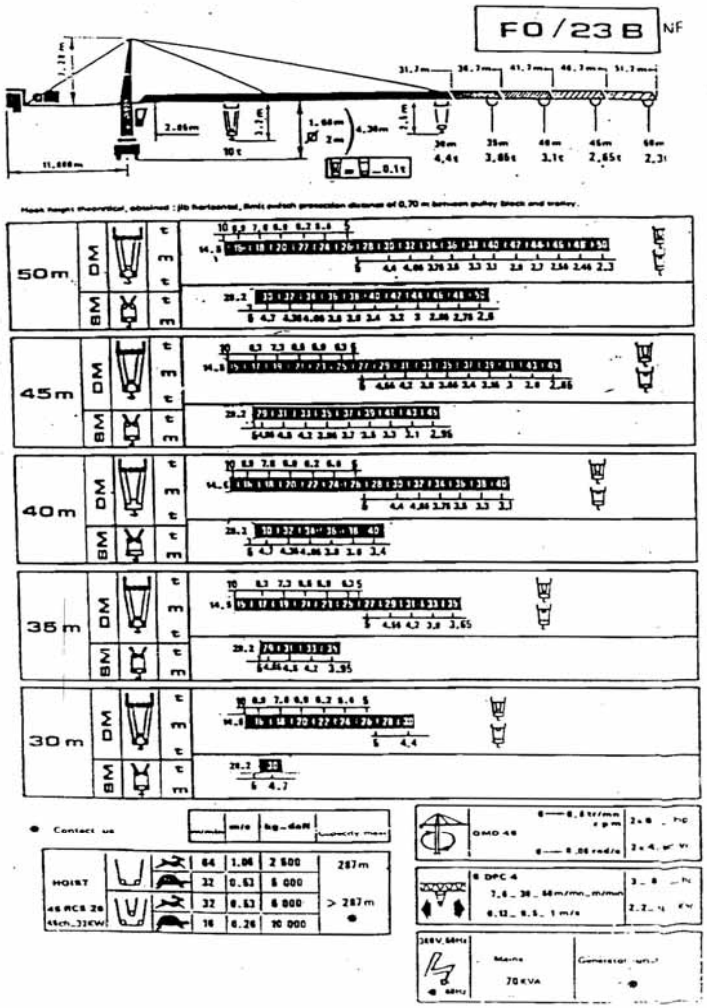
THE CLIMBING OPERATION

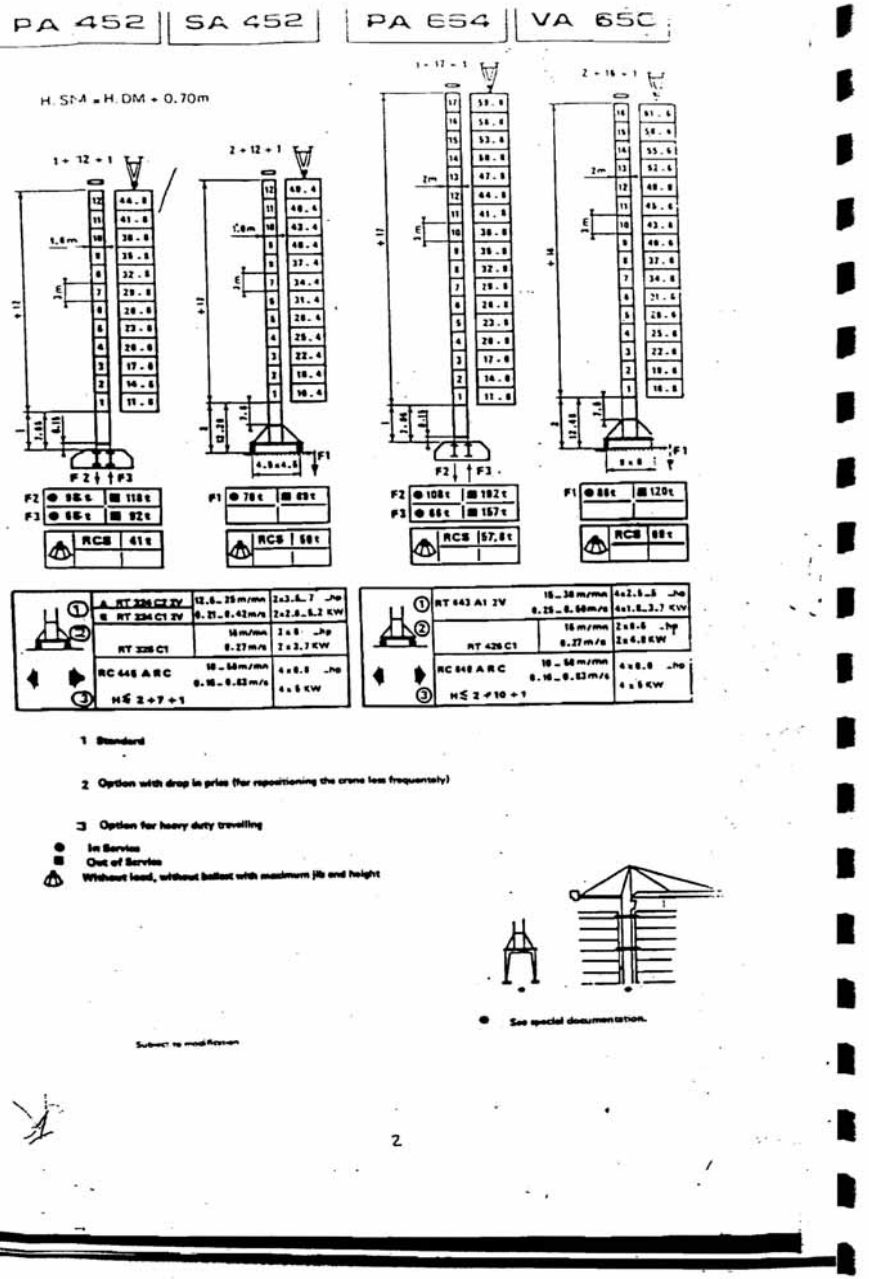



Sketch XVII

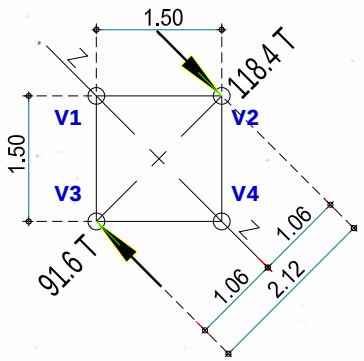

v
2
Ho
Ho
1
Hu
Hu

# POTAIN F0


F0/23B NF
50m
45m
40m
35m
30m
DM
BM
HOIST
287m
> 287m


PA 452
SA 452
PA 654
VA 65C
H.SM = H.DM + 0.70m
1 Standard
2 Option with drop in price (for repositioning the crane less frequently)
3 Option for heavy duty travelling
In Service
Out of Service
Without load, without ballast with maximum jib and height
See special documentation.
Subject to modification
2

C - Mast composition
H - Hook height in m - See data
P - Weight
M - Maximum moment
ET - Shearing stress
R - Stresses
TRACT - Tension
COMP - Compression
ES - In service
HS - Out of service




1,6 m

| C | H | P | M | ET | R | | P | M | ET | R | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TRACT | COMP | | | | TRACT | COMP |
| | m | kg | mkg | kg | kg | kg | kg | mkg | kg | kg | kg |
| 1 +0 +1 | 8,8 | 51200 | 98586 | 1631 | 33740 | 68340 | 41200 | 72760 | 3988 | 24045 | 44645 |
| 1 +1 +1 | 11,8 | 52350 | 102842 | 1764 | 35457 | 61632 | 42350 | 72760 | 4413 | 23757 | 44932 |
| 1 +2 +1 | 14,8 | 53500 | 107486 | 1897 | 37362 | 64112 | 43500 | 72760 | 4838 | 23470 | 45220 |
| 1 +3 +1 | 17,8 | 54650 | 112529 | 2030 | 39455 | 66780 | 44650 | 72760 | 5013 | 23182 | 45507 |
| 1 +4 +1 | 20,8 | 55800 | 117870 | 2162 | 41736 | 69636 | 45800 | 72760 | 5438 | 22895 | 45795 |
| 1 +5 +1 | 23,8 | 56770 | 123571 | 2284 | 44137 | 72522 | 46770 | 72760 | 5827 | 22652 | 46037 |
| 1 +6 +1 | 26,8 | 57740 | 129537 | 2406 | 46711 | 76581 | 47740 | 72760 | 7362 | 22410 | 46280 |
| 1 +7 +1 | 29,8 | 58710 | 135868 | 2527 | 48457 | 78812 | 48710 | 84478 | 7897 | 27609 | 52054 |
| 1 +8 +1 | 32,8 | 59680 | 142563 | 2648 | 52374 | 82214 | 49680 | 108852 | 8432 | 38962 | 63802 |
| 1 +9 +1 | 35,8 | 60650 | 149623 | 2770 | 56464 | 85789 | 50650 | 134832 | 8967 | 50982 | 76307 |
| 1 +10 +1 | 38,8 | 61620 | 157047 | 2892 | 58727 | 89537 | 51620 | 162416 | 9502 | 63760 | 89570 |
| 1 +11 +1 | 41,8 | 62590 | 164837 | 3013 | 62161 | 93456 | 52590 | 191603 | 10038 | 77295 | 103599 |
| 1 +12 +1 | 44,8 | 63560 | 172990 | 3135 | 65767 | 97547 | 53560 | 222396 | 10671 | 91588 | 118368 |
| 1 +13 +1 | | | | | | | | | | | |
| 1 +14 +1 | | | | | | | | | | | |
| 1 +15 +1 | | | | | | | | | | | |
| 1 +16 +1 | | | | | | | | | | | |
| 1 +17 +1 | | | | | | | | | | | |
| 1 +18 +1 | | | | | | | | | | | |
| 1 +19 +1 | | | | | | | | | | | |
| 1 +20 +1 | | | | | | | | | | | |

53560 | 222396 | 10671 | 91588 | 118368

**Moment about Z-Z axis = (118.4)(1.06)+(91.6)(1.06)**
**= 222.6 T-m.**

**P = 2(V2-V3)**
**= 2(118.4-91.6)**
**= 53.6 T**

FORCES – STRESSES

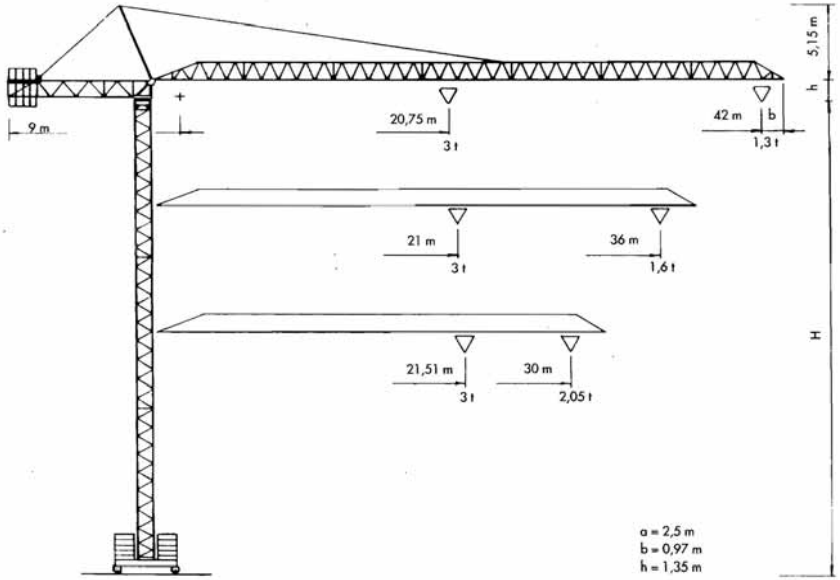
C - Mast composition
H - Hook height in m - See data
P - Weight
M - Maximum moment
ET - Shearing stress
R - Stresses
TRACT - Tension
COMP - Compression
ES - In service
HS - Out of service

2 m

| C | H | P | M | ET | R | | P | M | ET | R | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TRACT | COMP | | | | TRACT | COMP |
| | m | kg | mkg | kg | kg | kg | kg | mkg | kg | kg | kg |
| 1 +0 +1 | 8,8 | 64130 | 98376 | 1831 | 23725 | 60790 | 44130 | 72760 | 4828 | 16246 | 38311 |
| 1 +1 +1 | 11,8 | 65710 | 103850 | 1988 | 25008 | 62863 | 45710 | 72760 | 5133 | 15851 | 38706 |
| 1 +2 +1 | 14,8 | 67290 | 108788 | 2147 | 26488 | 65113 | 47290 | 72760 | 5438 | 15456 | 39101 |
| 1 +3 +1 | 17,8 | 68770 | 114071 | 2295 | 28076 | 67480 | 48770 | 72760 | 6862 | 15086 | 39471 |
| 1 +4 +1 | 20,8 | 70250 | 119786 | 2443 | 29648 | 69873 | 50250 | 72760 | 7335 | 14716 | 39841 |
| 1 +5 +1 | 23,8 | 71730 | 125846 | 2591 | 31787 | 62862 | 51730 | 72760 | 7809 | 14346 | 40211 |
| 1 +6 +1 | 26,8 | 73210 | 132250 | 2739 | 33883 | 65498 | 53210 | 72760 | 8460 | 13976 | 40581 |
| 1 +7 +1 | 29,8 | 74690 | 139587 | 2887 | 36105 | 68510 | 54690 | 89036 | 9111 | 23083 | 50428 |
| 1 +8 +1 | 32,8 | 76170 | 147088 | 3034 | 38804 | 71689 | 56170 | 125813 | 9762 | 33166 | 61250 |
| 1 +9 +1 | 35,8 | 77650 | 155023 | 3182 | 41209 | 75034 | 57650 | 165742 | 10413 | 43978 | 72804 |
| 1 +10 +1 | 38,8 | 79130 | 163402 | 3330 | 43881 | 78546 | 59130 | 207625 | 11063 | 55525 | 85090 |
| 1 +11 +1 | 41,8 | 70810 | 172225 | 3478 | 46818 | 82223 | 60610 | 221283 | 11714 | 67803 | 98108 |
| 1 +12 +1 | 44,8 | 72090 | 181491 | 3626 | 50023 | 86068 | 62090 | 256848 | 12365 | 80814 | 111856 |
| 1 +13 +1 | 47,8 | 73570 | 191201 | 3774 | 53283 | 90078 | 63570 | 294581 | 13016 | 94556 | 126341 |
| 1 +14 +1 | 50,8 | 75050 | 201356 | 3922 | 56730 | 94255 | 65050 | 334186 | 13667 | 109031 | 141556 |
| 1 +15 +1 | 53,8 | 76530 | 211954 | 4070 | 60334 | 98589 | 66530 | 375732 | 14318 | 124238 | 157503 |
| 1 +16 +1 | 56,8 | 78010 | 222996 | 4218 | 64104 | 103108 | 68010 | 419233 | 14969 | 140178 | 174183 |
| 1 +17 +1 | 59,8 | 79490 | 234481 | 4366 | 68040 | 107785 | 69490 | 464686 | 15620 | 156849 | 191594 |
| 1 +18 +1 | | | | | | | | | | | |
| 1 +19 +1 | | | | | | | | | | | |
| 1 +20 +1 | | | | | | | | | | | |

## Dati tecnici — *Technical data*

# GTS 421



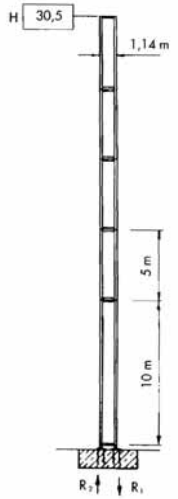

**Sbracci e portate - *Radius and capacity*** — m

| | | 16 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 t ÷ 20,75 m | (II) | 3 | 3 | 2,96 | 2,54 | 2,22 | 1,96 | 1,75 | 1,57 | 1,42 | 1,3 |
| 3 t ÷ 21 m | (II) | 3 | 3 | 3 | 2,58 | 2,25 | 1,99 | 1,77 | 1,6 | | |
| 3 t ÷ 21,51 m | (II) | 3 | 3 | 3 | 2,65 | 2,31 | 2,05 | | | | |

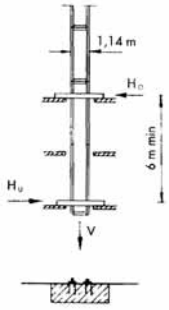
## CLIMBING

# GTS 421

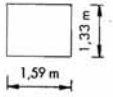
### N11




| | | |
|---|---|---|
| R1 | 67,7 t * | 74,5 t * |
| R2 | 50,5 t * | 59,3 t * |

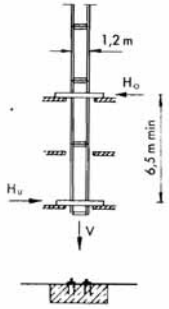



| | | |
|---|---|---|
| Ho | 14,3 t * | 20,9 t * |
| Hu | 12,8 t * | 13,7 t * |
| V | 37,2 t * | 33,4 t * |

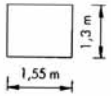



### S12


| | | |
|---|---|---|
| R1 | 71,6 t * | 99,2 t * |
| R2 | 52,8 t * | 81,6 t * |




| | | |
|---|---|---|
| Ho | 15,5 t * | 26,7 t * |
| Hu | 13,9 t * | 19,2 t * |
| V | 38,8 t * | 34,9 t * |



# 3. การออกแบบฐานรากและตัวค้ำยัน

3.1 กำหนด Design Loads และ Load Cases

- Static Tower Crane
- Climbing Crane

3.2 ออกแบบฐานรากตามประเภทของ Tower Crane

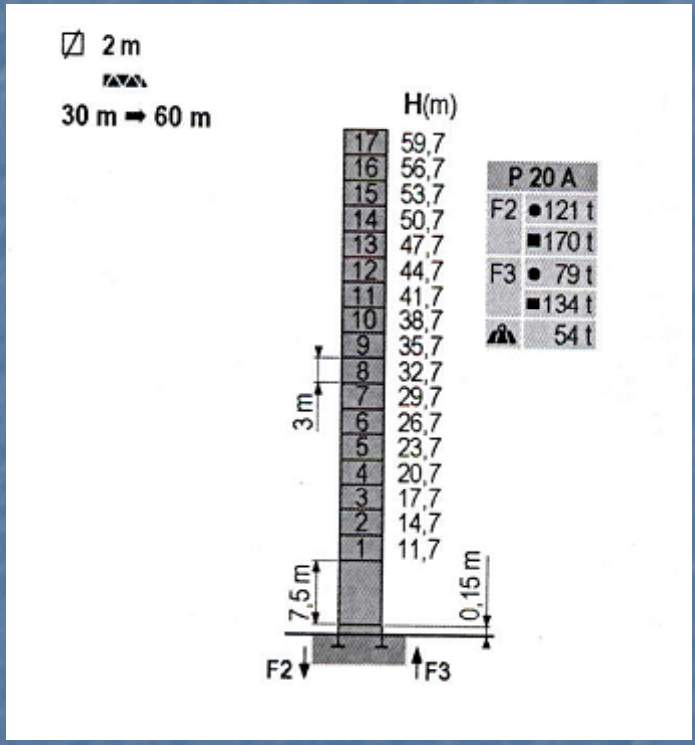
- Static Tower Crane
- Climbing Crane

3.3 ออกแบบตัวค้ำยัน (Bracing) สำหรับ Static Tower Crane

# 3.1 กำหนด Design Loads และ Load Cases

## - Static Tower Crane

- In Service




$$M = (F2 + F3)\left(\frac{\sqrt{2d^2}}{2}\right)$$

$$= (121 + 79)\left(\frac{\sqrt{2(2.0)^2}}{2}\right)$$

$$= 283 \quad \text{T-m.}$$

$$V = 2(F2 - F3)$$

$$= 2(121\text{-}79)$$

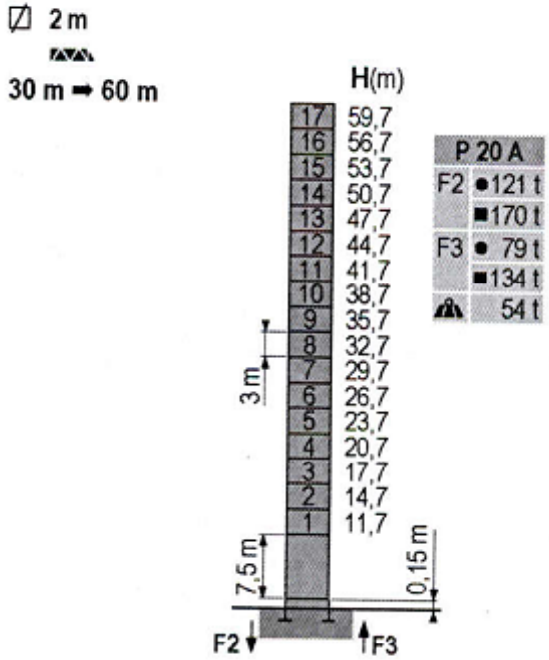
$$= 84 \quad \text{T}$$

Where d = mast width

# 3.1 กำหนด Design Loads และ Load Cases (ต่อ)

## - Static Tower Crane

- Out of Service




$$M = (F2 + F3)\left(\frac{\sqrt{2d^2}}{2}\right)$$

$$= (170 + 134)\left(\frac{\sqrt{2(2.0)^2}}{2}\right)$$

$$= 430 \text{ T-m.}$$

$$V = 2(F2 - F3)$$

$$= 2(170\text{-}134)$$

$$= 72 \text{ T}$$

Where d = mast width

# 3.1 กำหนด Design Loads และ Load Cases (ต่อ)

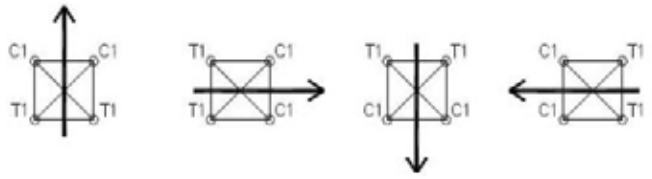
**DESIGN LOADS FOR FREE STANDING TOWER CRANE**

**MODEL : POTAIN MC205B-In Service**

| | | |
|---|---|---|
| Crane's specification | | |
| Leg spacing | = | 2.00 m. |
| Mast's weight | = | 0.5 ton./m. |
| Operating Height | = | 59.7 m. |
| Max. moment, M | = | 283 ton-m. |
| Max. vertical load, V | = | 84 ton. |
| Max. horizontal load, H | = | 8.5 ton. |
| Additional Safety factor | = | 1.2 |
| Design moment | = | 339.6 ton-m. |
| Design vertical load | = | 100.8 ton. |
| Design horizontal load | = | 10.2 ton. |

**CASE 1 TO CASE 4**

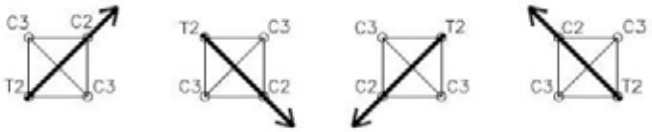
| | | |
|---|---|---|
| Max. compressive force, C1 | = | 110.10 ton. |
| Max. Tensile force, T1 | = | -59.70 ton. |




Case 1 Case 2 Case 3 Case 4

**CASE 5 TO CASE 8**

| | | |
|---|---|---|
| Max. compressive force, C2 | = | 145.27 ton. |
| Intermediate compressive force, C3 | = | 25.20 ton. |
| Max. Tensile force, T2 | = | -94.87 ton. |




Case 5 Case 6 Case 7 Case 8

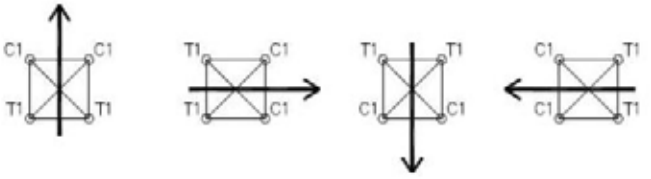
**DESIGN LOADS FOR FREE STANDING TOWER CRANE**

**MODEL : POTAIN MC205B-Out of Service**

| | | |
|---|---|---|
| Crane's specification | | |
| Leg spacing | = | 2.00 m. |
| Mast's weight | = | 0.5 ton./m. |
| Operating Height | = | 59.7 m. |
| Max. moment, M | = | 430 ton-m. |
| Max. vertical load, V | = | 72 ton. |
| Max. horizontal load, H | = | 12.9 ton. |
| Additional Safety factor | = | 1.2 |
| Design moment | = | 516 ton-m. |
| Design vertical load | = | 86.4 ton. |
| Design horizontal load | = | 15.48 ton. |

**CASE 1 TO CASE 4**

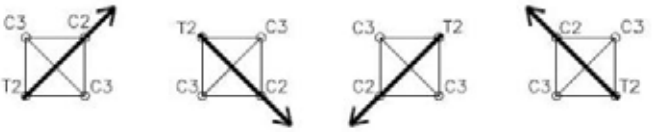
| | | |
|---|---|---|
| Max. compressive force, C1 | = | 150.60 ton. |
| Max. Tensile force, T1 | = | -107.40 ton. |




Case 1 Case 2 Case 3 Case 4

**CASE 5 TO CASE 8**

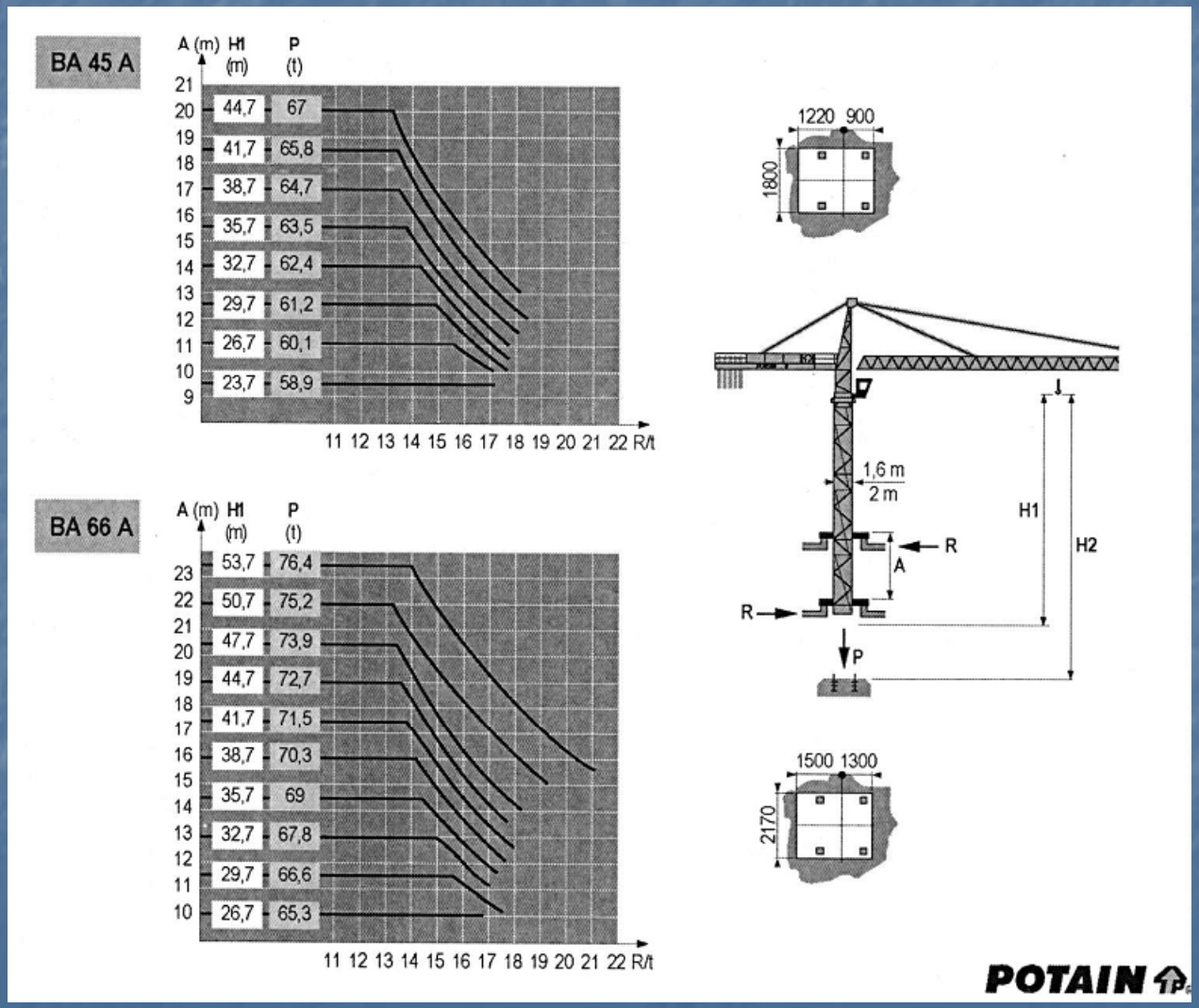
| | | |
|---|---|---|
| Max. compressive force, C2 | = | 204.03 ton. |
| Intermediate compressive force, C3 | = | 21.60 ton. |
| Max. Tensile force, T2 | = | -160.83 ton. |




Case 5 Case 6 Case 7 Case 8

# 3.1 กำหนด Design Loads และ Load Cases (ต่อ)

- Climbing Crane



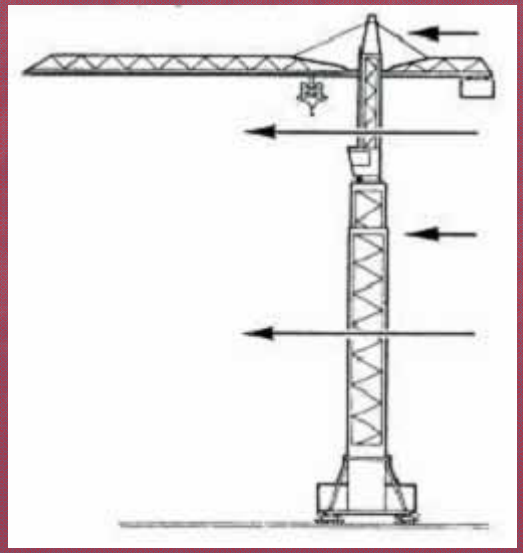
# 3.1 กำหนด Design Loads และ Load Cases (ต่อ)

ข้อควรระวังในการกำหนด Design Loads สำหรับการออกแบบฐานราก

- Tower Crane แต่ละยี่ห้อ ใช้ข้อมูลแรงลมที่แตกต่างกันออกไป ควรตรวจสอบค่าแรง (โมเมนต์) กระทำที่ฐาน ที่ระบุไว้ใน specification ว่าครอบคลุมค่าแรงกระทำที่ฐานที่ได้จากการใช้แรงลมในพื้นที่ที่ใช้งานจริงหรือไม่
- Tower Crane แต่ละรุ่นกำหนดความเร็วลมสูงสุดในกรณีใช้งาน (In service) ไว้แตกต่างกัน

# 3.1 กำหนด Design Loads และ Load Cases (ต่อ)

- ค่าแรงกระทำที่ฐานในกรณีหยุดใช้งาน (Out of service) ที่ระบุไว้ใน Specification เป็นกรณีที่ปล่อยให้ Tower Crane หมุนอย่างอิสระตามแรงลมเท่านั้น (Weathervaning Position) หาก Tower Crane ถูกล็อคหลังจากหยุดใช้งาน ควรพิจารณาผลของแรงลมที่จะพัดมาจากทิศทางอื่นเพิ่มเข้าไปด้วย



# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane

- Foundation for Static Tower Crane
  - Concrete Foundation
  - Steel Platform
- Support for Climbing Crane
  - Steel Platform

# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

## - Foundation for Static Tower Crane

- Concrete Foundation

# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

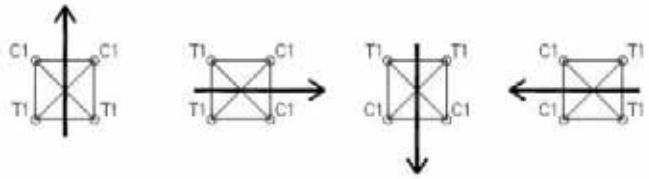
**DESIGN LOADS FOR FREE STANDING TOWER CRANE**

**MODEL : POTAIN MC205B-Out of Service**

| | | |
|---|---|---|
| Crane's specification | | |
| Leg spacing | = | 2.00 m. |
| Mast's weight | = | 0.5 ton./m. |
| Operating Height | = | 47.65 m. |
| Max. moment, M | = | 346.5 ton-m. |
| Max. vertical load, V | = | 67.3 ton. |
| Max. horizontal load, H | = | 12 ton. |
| Additional safety factor | = | 1.2 |
| Design moment | = | 415.8 ton-m. |
| Design vertical load | = | 80.76 ton. |
| Design horizontal load | = | 14.4 ton. |

**CASE 1 TO CASE 4**

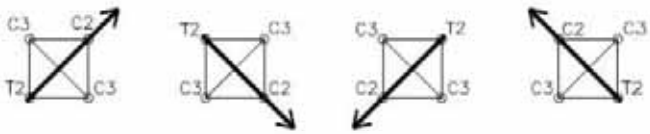
| | | |
|---|---|---|
| Max. compressive force, C1 | = | 124.14 ton. |
| Max. Tensile force, T1 | = | -83.76 ton. |




Case 1 Case 2 Case 3 Case 4

**CASE 5 TO CASE 8**

| | | |
|---|---|---|
| Max. compressive force, C2 | = | 167.20 ton. |
| Intermediate compressive force, C3 | = | 20.19 ton. |
| Max. Tensile force, T2 | = | -126.82 ton. |




Case 5 Case 6 Case 7 Case 8

# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

Note : MC205B-CASE 1 Name F8 7/24/2009

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| fc' | = | 240 | ksc | Column | c1 | = | 2.00 | m | Service Load | P | = 210.00 Ton |
| fy | = | 4000 | ksc | | c2 | = | 2.00 | m | | My | = 416.0 Ton-m |
| ϕvc | = | 6.98 | ksc | | | | | | | Mx | = 0.0 Ton-m |
| $\rho_{min}$ | = | 0.0020 | | | | | | | | | |
| $\rho_{max}$ | = | 0.0197 | | Footing | | | | | Ultimate Load | | |
| Pile diameter | = | 0.60 | m. | | H | = | 6.00 | m | | Pu | = 336.00 Ton |
| No. of piles | = | 8 | piles | | B | = | 6.00 | m | | Muy | = 665.6 Ton-m |
| Allowable capacity/Pile | = | 80 | Ton | | t | = | 1.50 | m | | Mux | = 0.0 Ton-m |
| Ultimate capacity/Pile | = | 200 | Ton F.S. = 2.5 | | Eff. D | = | 1.35 | m | | | |
| | | | | | bo | = | 1340 | cm | | L.F. | = 1.6 |
| | | | | | Wf | = | 129.60 | Ton | | | |

| Pile no. | x (m) | y (m) | Iy $(xb-x)^2$ | Ix $(yb-y)^2$ | Ixy (xb-x) X (yb-y) | M eccentric Mey (Ton-m) | M eccentric Mex (Ton-m) | M Total M Tot-y (Ton-m) | M Total M Tot-x (Ton-m) | Working React. (Ton) | Ultimate React. (Ton) | Internal My Left (Ton-m) | Internal My Right (Ton-m) | Internal Mx Upper (Ton-m) | Internal Mx Lower (Ton-m) | Beam Shear Left (Ton) | Beam Shear Right (Ton) | Beam Shear Upper (Ton) | Beam Shear Lower (Ton) | Reduced Punching Shear (Ton) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.250 | 2.250 | 5.063 | 5.063 | -5.063 | | | | | -4.56 | -7.30 | -9.13 | 0.00 | -9.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 2 | -2.250 | 0.000 | 5.063 | 0.000 | 0.000 | | | | | -4.56 | -7.30 | -9.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 3 | -2.250 | -2.250 | 5.063 | 5.063 | 5.063 | | | | | -4.56 | -7.30 | -9.13 | 0.00 | 0.00 | -9.13 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 4 | 0.000 | 2.250 | 0.000 | 5.063 | 0.000 | | | | | 26.25 | 42.00 | 0.00 | 0.00 | 52.50 | 0.00 | 0.00 | 0.00 | 14.00 | 0.00 | |
| 5 | 0.000 | -2.250 | 0.000 | 5.063 | 0.000 | 0.00 | 0.0 | 665.6 | 0.0 | 26.25 | 42.00 | 0.00 | 0.00 | 0.00 | 52.50 | 0.00 | 0.00 | 0.00 | 14.00 | |
| 6 | 2.250 | 2.250 | 5.063 | 5.063 | 5.063 | | | | | 57.06 | 91.30 | 0.00 | 114.13 | 114.13 | 0.00 | 0.00 | 30.43 | 30.43 | 0.00 | |
| 7 | 2.250 | 0.000 | 5.063 | 0.000 | 0.000 | | | | | 57.06 | 91.30 | 0.00 | 114.13 | 0.00 | 0.00 | 0.00 | 30.43 | 0.00 | 0.00 | |
| 8 | 2.250 | -2.250 | 5.063 | 5.063 | -5.063 | | | | | 57.06 | 91.30 | 0.00 | 114.13 | 0.00 | 114.13 | 0.00 | 30.43 | 0.00 | 30.43 | |

xbar = 0.000
ybar = 0.000

**Bending**

| About Axis | Moment (Ton-m) | Ru (ksc) | p | use p | Asx ($cm^2$) | Asy ($cm^2$) |
|---|---|---|---|---|---|---|
| Y | 342.39 | 3.48 | 0.0009 | 0.002 | 162.00 | |
| X | 157.50 | 1.60 | 0.0004 | 0.002 | | 162.00 |

**Beam Shear**

| Vu (Ton) | | ϕVc (Ton) | |
|---|---|---|---|
| 91.30 | < | 565.31 | OK |
| 44.43 | < | 565.31 | OK |

# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

Note : MC205B-CASE 2 Name F8 7/24/2009

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| fc' | = | 240 | ksc | Column | c1 | = | 2.00 | m | Service Load | P | = 210.00 Ton |
| fy | = | 4000 | ksc | | c2 | = | 2.00 | m | | My | = 294.0 Ton-m |
| ϕvc | = | 6.98 | ksc | | | | | | | Mx | = 294.0 Ton-m |
| $\rho_{min}$ | = | 0.0020 | | | | | | | | | |
| $\rho_{max}$ | = | 0.0197 | | Footing | | | | | Ultimate Load | | |
| Pile diameter | = | 0.60 | m. | | H | = | 6.00 | m | | Pu | = 336.00 Ton |
| No. of piles | = | 8 | piles | | B | = | 6.00 | m | | Muy | = 470.4 Ton-m |
| Allowable capacity/Pile | = | 80 | Ton | | t | = | 1.50 | m | | Mux | = 470.4 Ton-m |
| Ultimate capacity/Pile | = | 200 | Ton F.S. = 2.5 | | Eff. D | = | 1.35 | m | | | |
| | | | | | bo | = | 1340 | cm | | L.F. | = 1.6 |
| | | | | | Wf | = | 129.60 | Ton | | | |

| Pile no. | x (m) | y (m) | Iy $(xb-x)^2$ | Ix $(yb-y)^2$ | Ixy (xb-x) X (yb-y) | M eccentric Mey (Ton-m) | M eccentric Mex (Ton-m) | M Total M Tot-y (Ton-m) | M Total M Tot-x (Ton-m) | Working React. (Ton) | Ultimate React. (Ton) | Internal My Left (Ton-m) | Internal My Right (Ton-m) | Internal Mx Upper (Ton-m) | Internal Mx Lower (Ton-m) | Beam Shear Left (Ton) | Beam Shear Right (Ton) | Beam Shear Upper (Ton) | Beam Shear Lower (Ton) | Reduced Punching Shear (Ton) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.250 | 2.250 | 5.063 | 5.063 | -5.063 | | | | | -17.31 | -27.69 | -34.61 | 0.00 | -34.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 2 | -2.250 | 0.000 | 5.063 | 0.000 | 0.000 | | | | | 4.47 | 7.16 | 8.94 | 0.00 | 0.00 | 0.00 | 2.39 | 0.00 | 0.00 | 0.00 | |
| 3 | -2.250 | -2.250 | 5.063 | 5.063 | 5.063 | | | | | 26.25 | 42.00 | 52.50 | 0.00 | 0.00 | 52.50 | 14.00 | 0.00 | 0.00 | 14.00 | |
| 4 | 0.000 | 2.250 | 0.000 | 5.063 | 0.000 | | | | | 4.47 | 7.16 | 0.00 | 0.00 | 8.94 | 0.00 | 0.00 | 0.00 | 2.39 | 0.00 | |
| 5 | 0.000 | -2.250 | 0.000 | 5.063 | 0.000 | 0.00 | 0.0 | 470.4 | 470.4 | 48.03 | 76.84 | 0.00 | 0.00 | 0.00 | 96.06 | 0.00 | 0.00 | 0.00 | 25.61 | |
| 6 | 2.250 | 2.250 | 5.063 | 5.063 | 5.063 | | | | | 26.25 | 42.00 | 0.00 | 52.50 | 52.50 | 0.00 | 0.00 | 14.00 | 14.00 | 0.00 | |
| 7 | 2.250 | 0.000 | 5.063 | 0.000 | 0.000 | | | | | 48.03 | 76.84 | 0.00 | 96.06 | 0.00 | 0.00 | 0.00 | 25.61 | 0.00 | 0.00 | |
| 8 | 2.250 | -2.250 | 5.063 | 5.063 | -5.063 | | | | | 69.81 | 111.69 | 0.00 | 139.61 | 0.00 | 139.61 | 0.00 | 37.23 | 0.00 | 37.23 | |

xbar = 0.000
ybar = 0.000

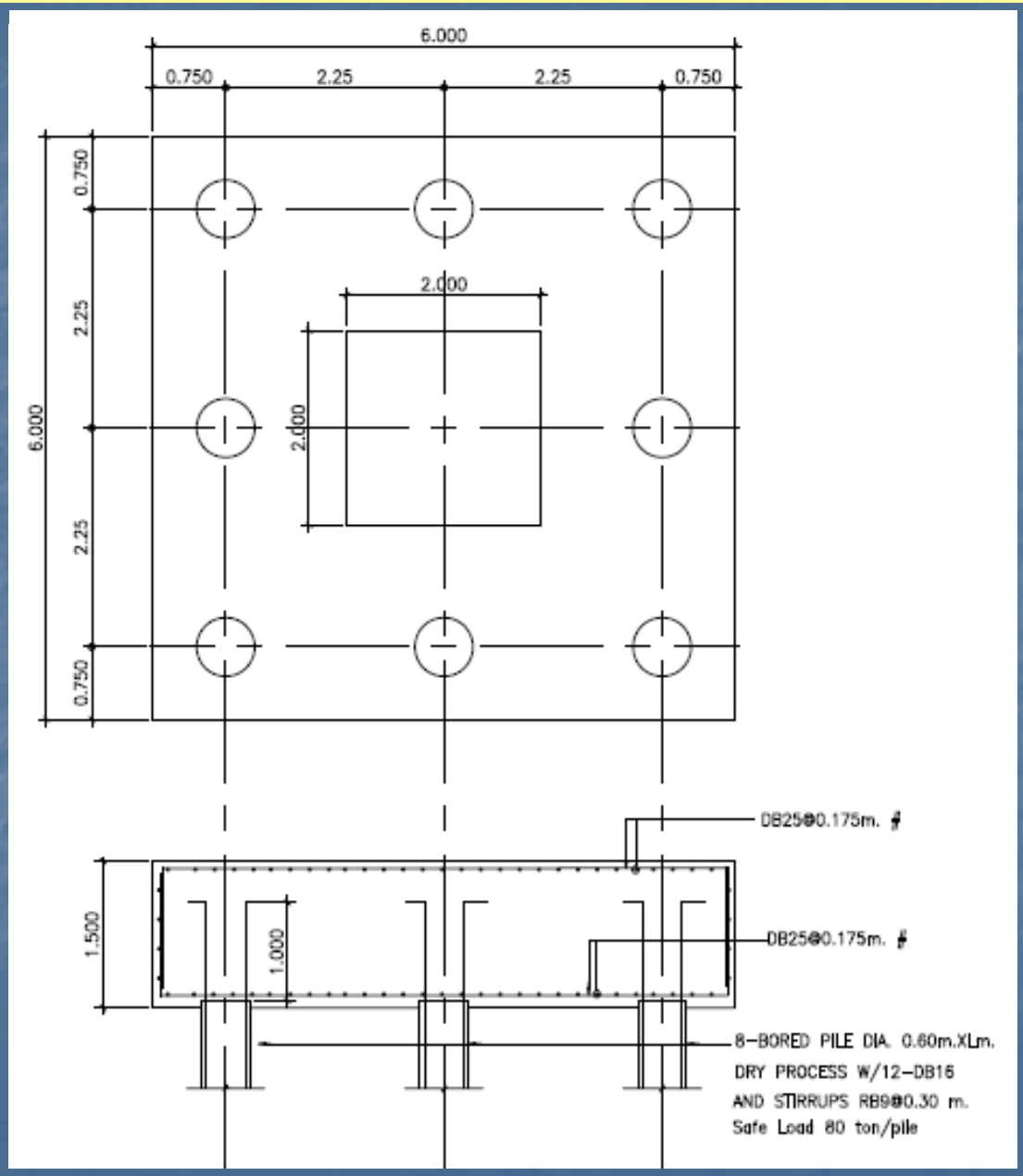
**Bending**

| About Axis | Moment (Ton-m) | Ru (ksc) | p | use p | Asx ($cm^2$) | Asy ($cm^2$) |
|---|---|---|---|---|---|---|
| Y | 288.17 | 2.93 | 0.0007 | 0.002 | 162.00 | |
| X | 288.17 | 2.93 | 0.0007 | 0.002 | | 162.00 |

**Beam Shear**

| Vu (Ton) | | ϕVc (Ton) | |
|---|---|---|---|
| 76.84 | < | 565.31 | OK |
| 76.84 | < | 565.31 | OK |

# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)



# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

## - Foundation for Static Tower Crane

- Steel Platform

## DESIGN LOADS FOR FREE STANDING TOWER CRANE

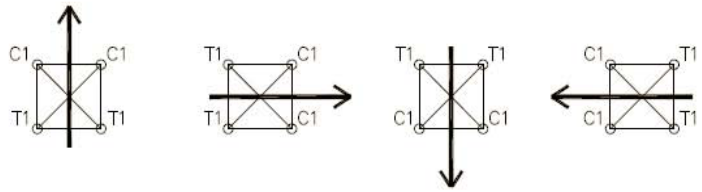
**MODEL : POTAIN MC205B-Out of Service**

Crane's specification

| | | |
|---|---|---|
| Leg spacing | = | 2.00 m. |
| Mast's weight | = | 0.5 ton./m. |
| Operating Height | = | 47.65 m. |
| Max. moment, M | = | 346.5 ton-m. |
| Max. vertical load, V | = | 67.3 ton. |
| Max. horizontal load, H | = | 12 ton. |
| Additional safety factor | = | 1.2 |
| Design moment | = | 415.8 ton-m. |
| Design vertical load | = | 80.76 ton. |
| Design horizontal load | = | 14.4 ton. |

**CASE 1 TO CASE 4**

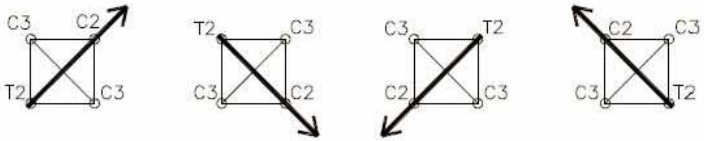
| | | |
|---|---|---|
| Max. compressive force, C1 | = | 124.14 ton. |
| Max. Tensile force, T1 | = | -83.76 ton. |




Case 1 Case 2 Case 3 Case 4

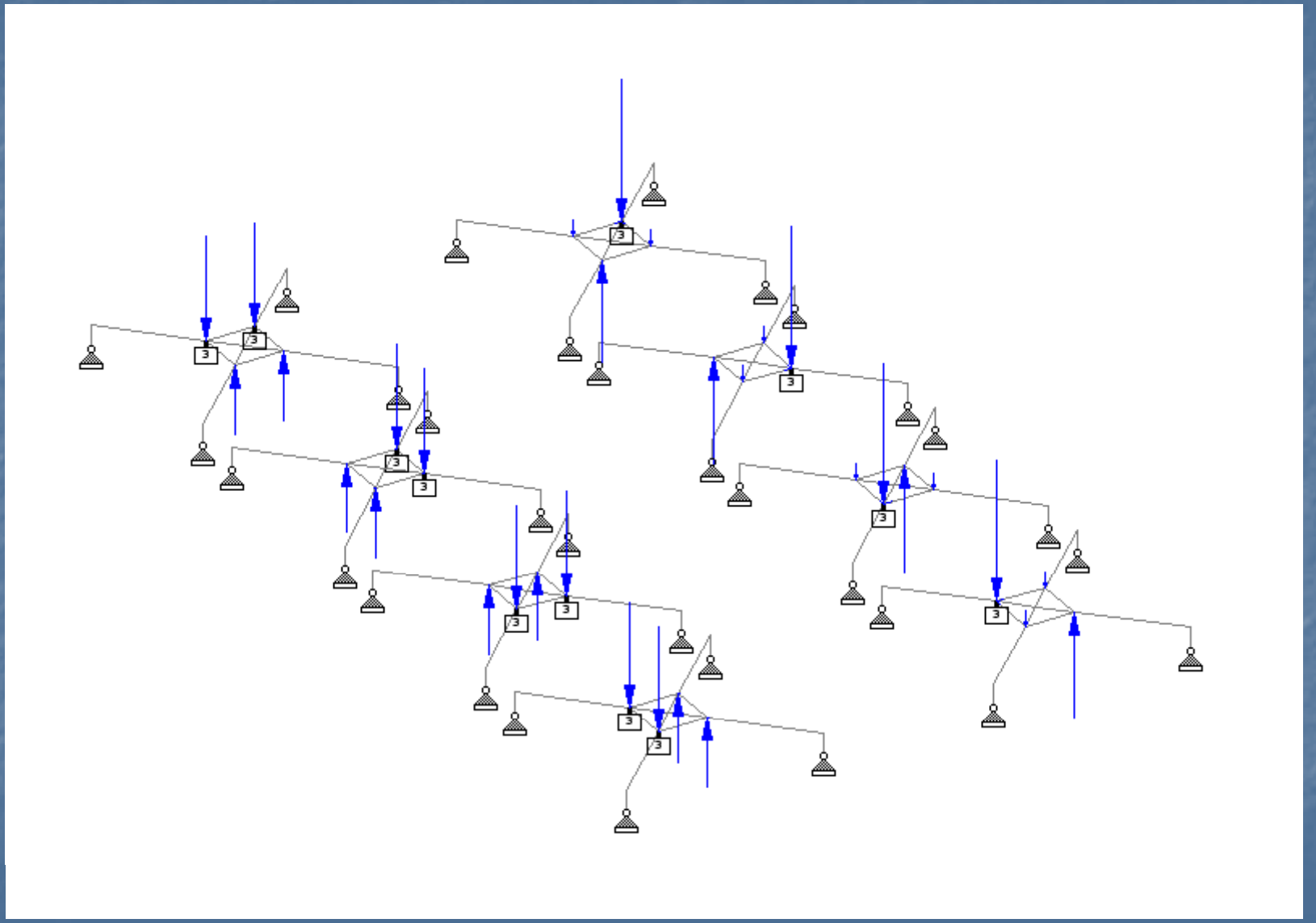
**CASE 5 TO CASE 8**

| | | |
|---|---|---|
| Max. compressive force, C2 | = | 167.20 ton. |
| Intermediate compressive force, C3 | = | 20.19 ton. |
| Max. Tensile force, T2 | = | -126.82 ton. |

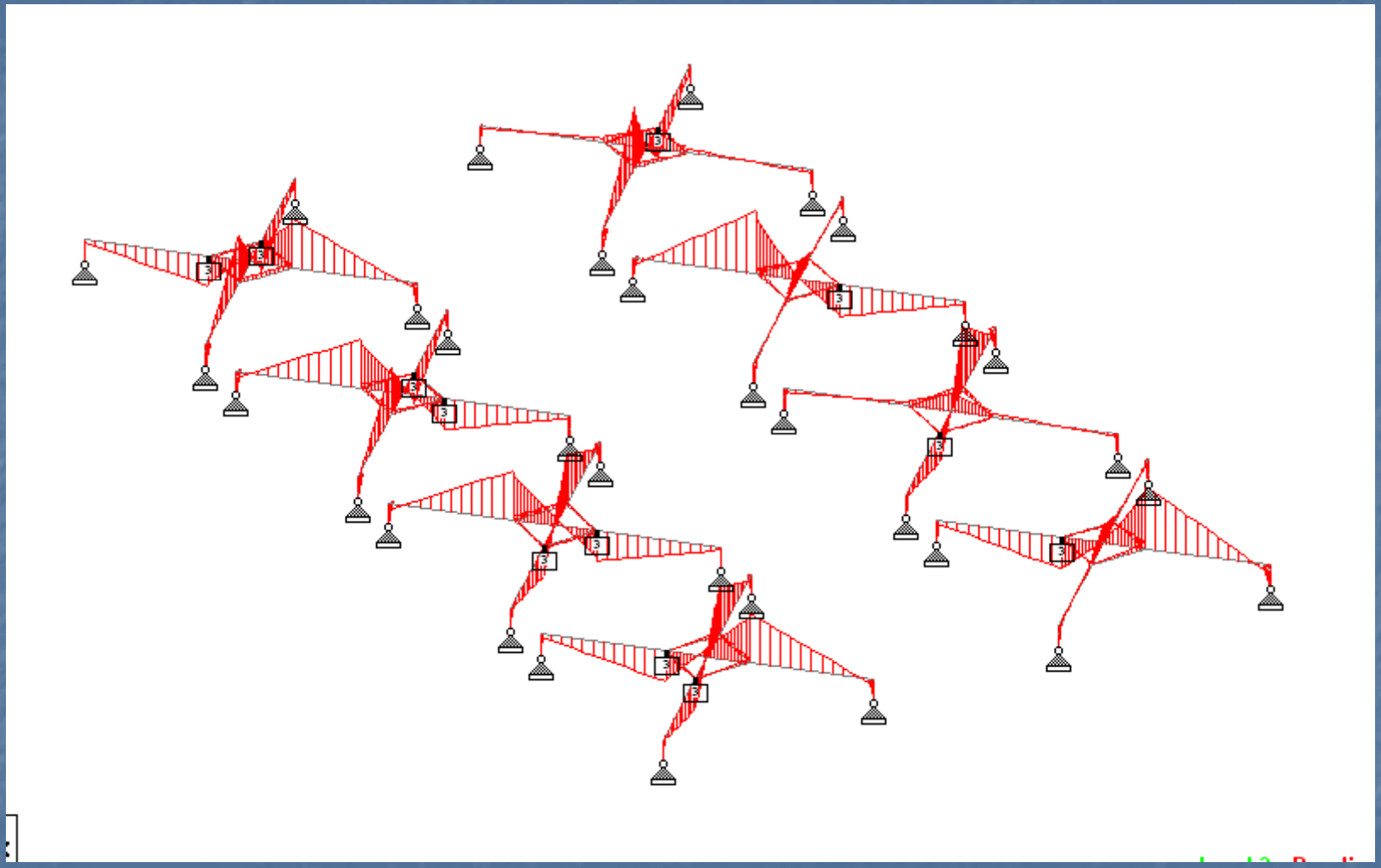



Case 5 Case 6 Case 7 Case 8

# Load Cases



# Moment Diagram



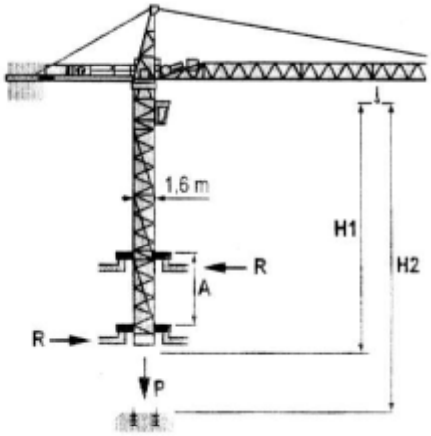
- ออกแบบ Chemical Bolts รับแรง Uplift

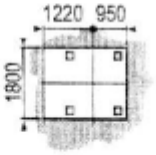
# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

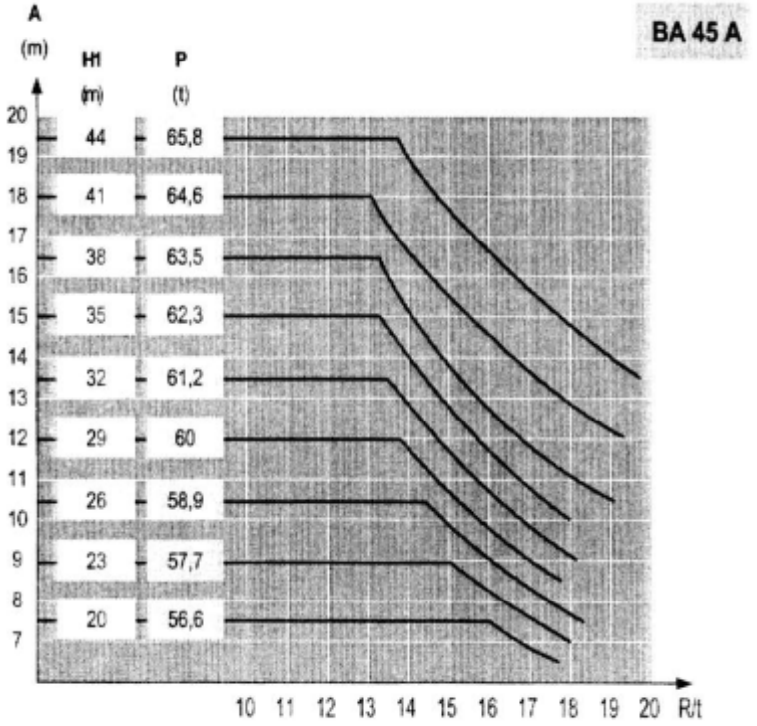
## - Support for Climbing Crane

- Steel Platform

Climbing crane



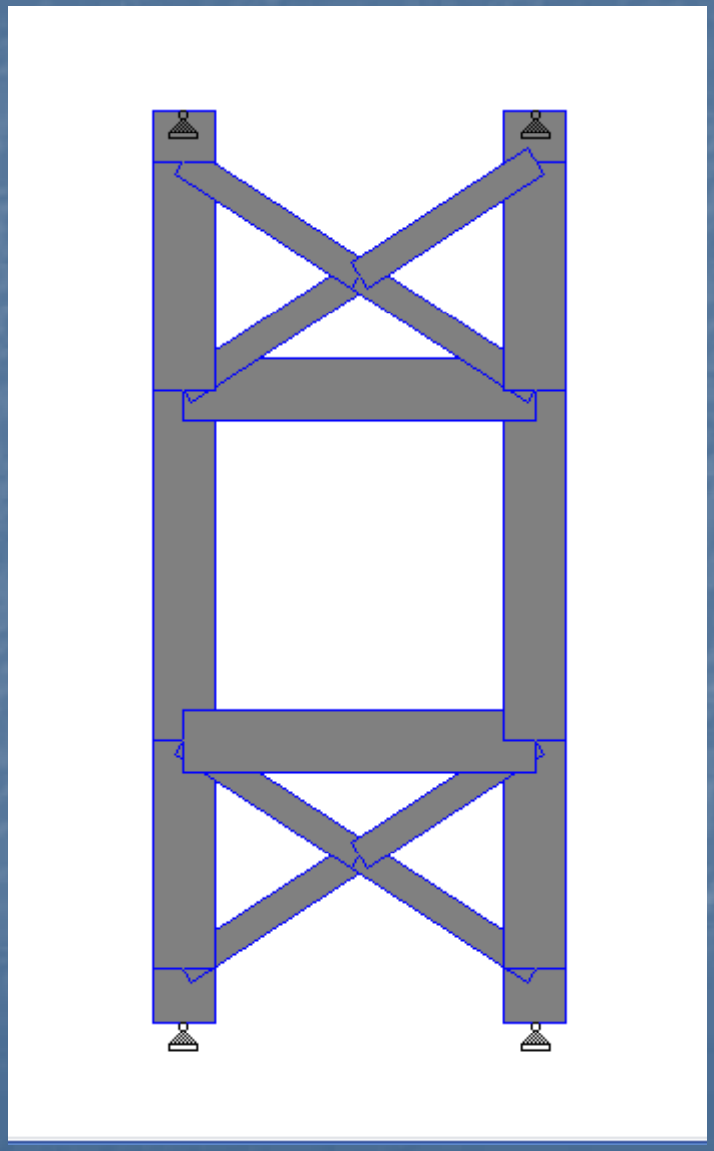



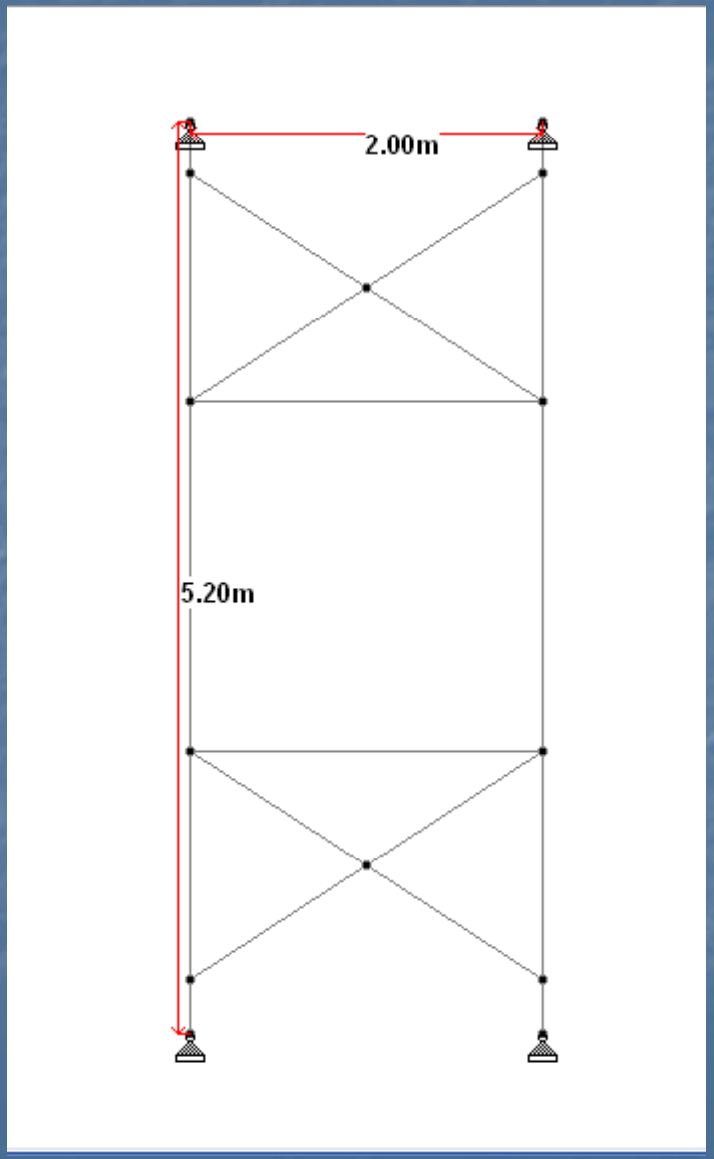




CITY CRANE
MC 175 B

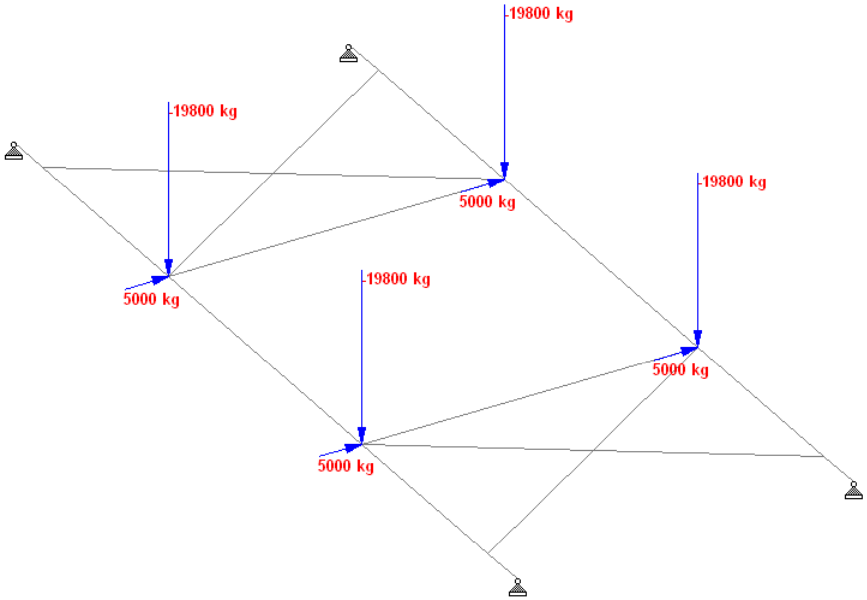
POTAIN

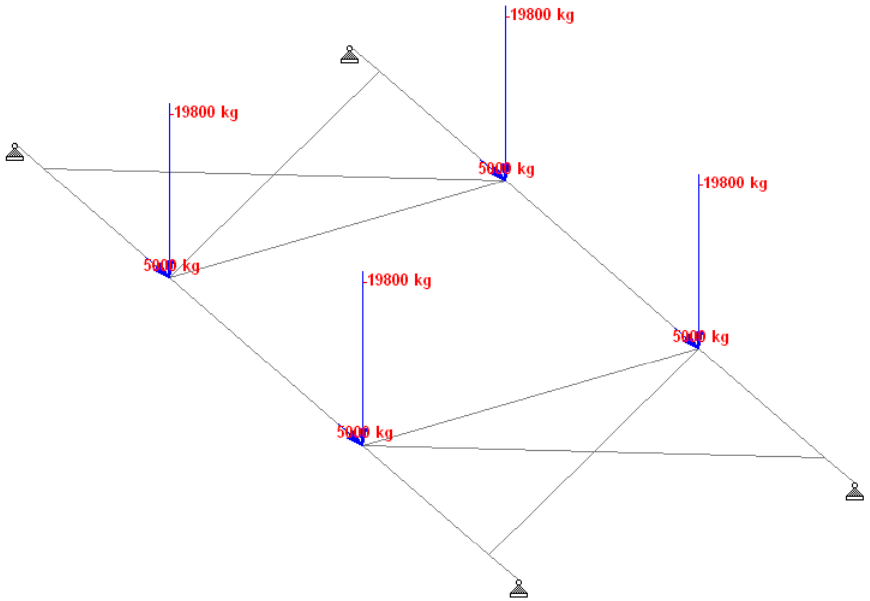
# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

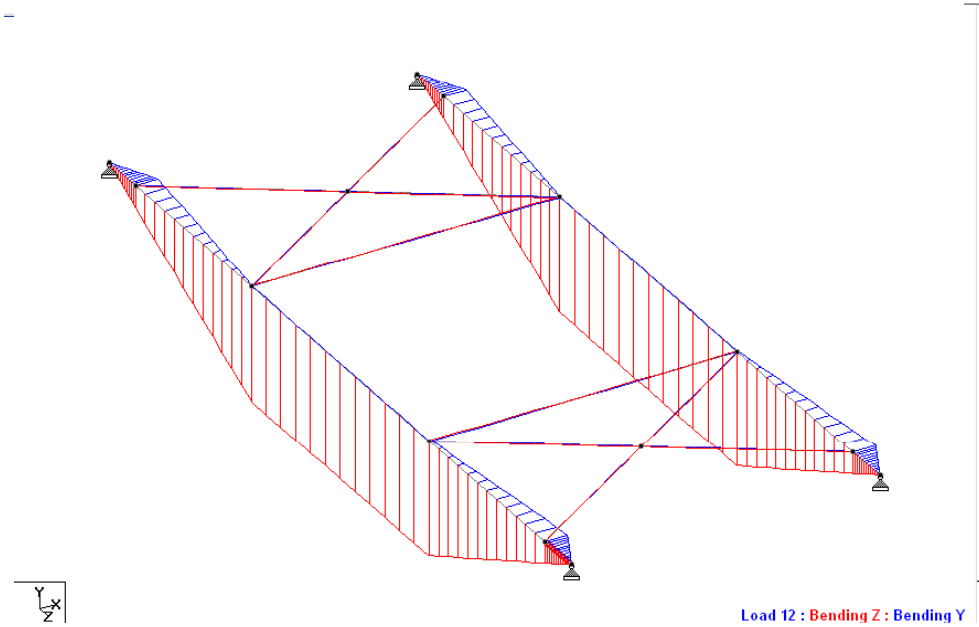


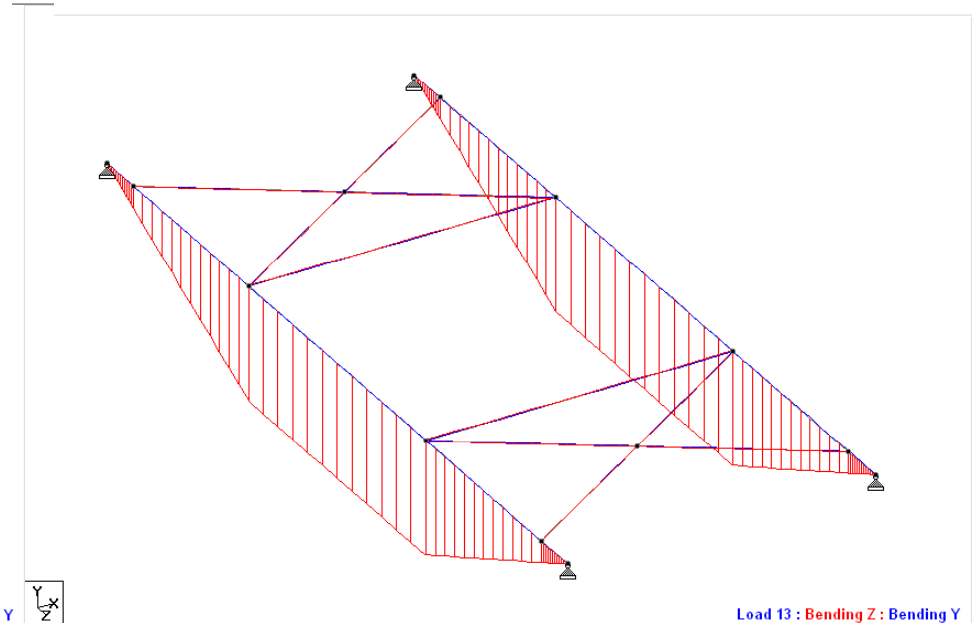


# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)

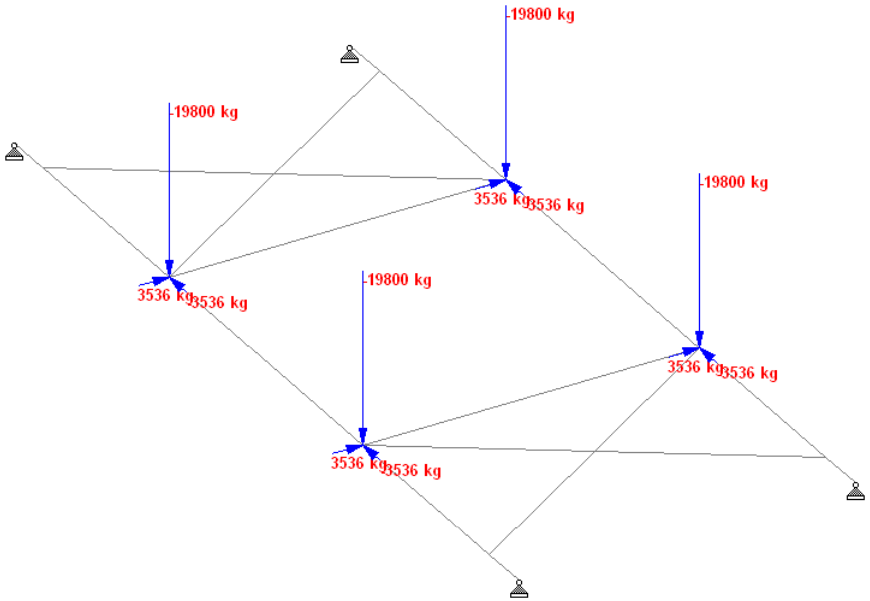


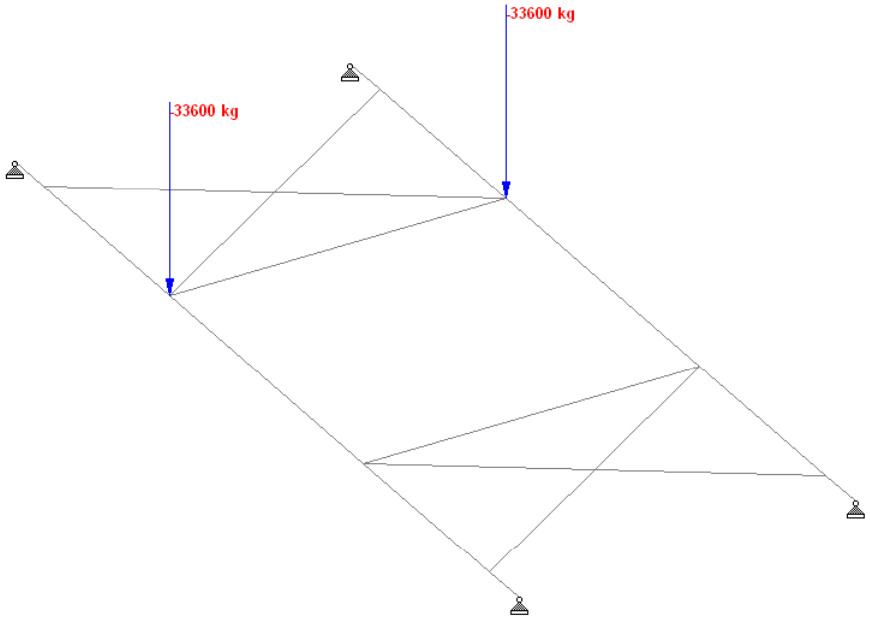



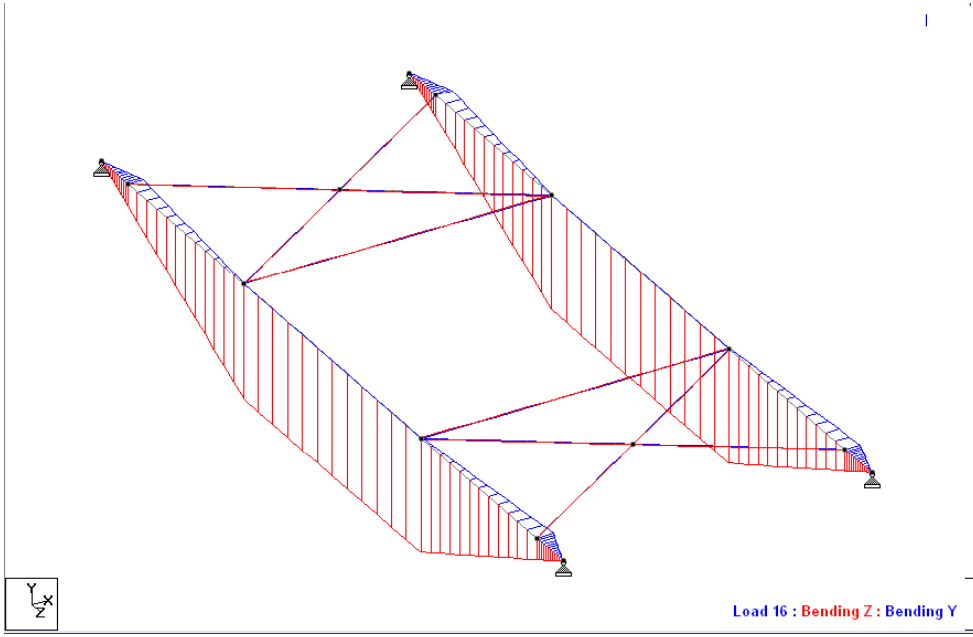



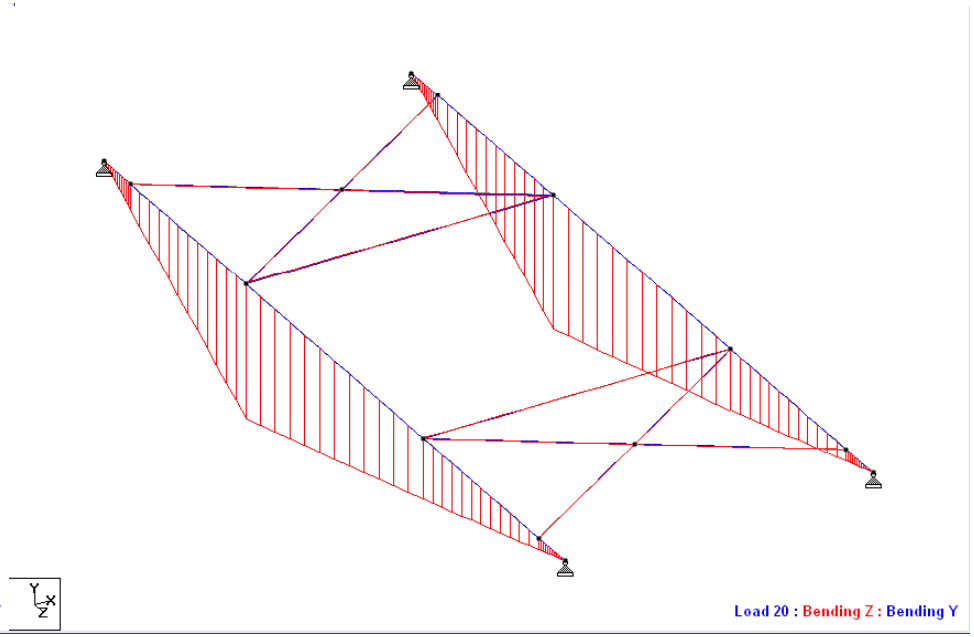



# 3.2 ออกแบบฐานรากตามประเภทของ Tower Crane (ต่อ)



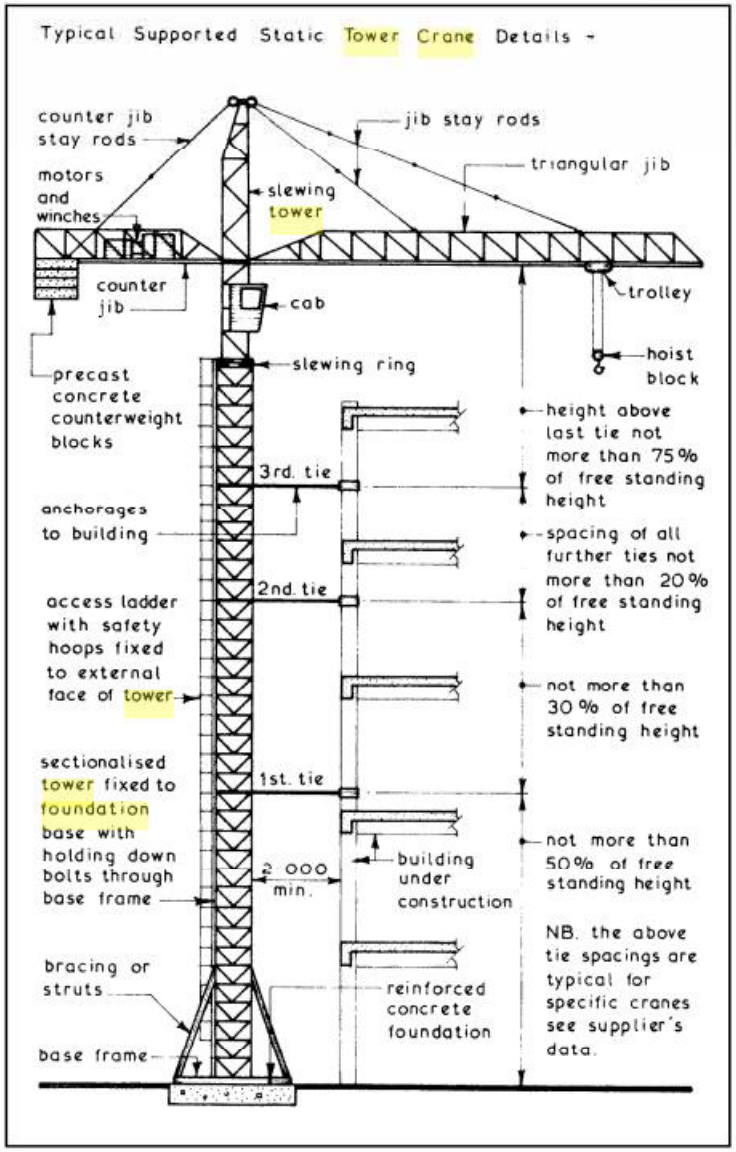



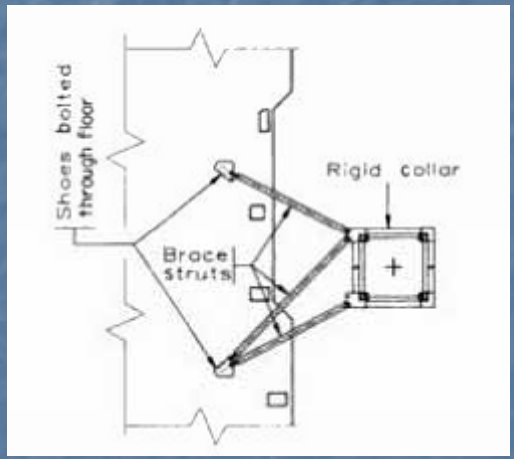
# 3.3 ออกแบบตัวค้ำยัน (Bracing) สำหรับ Static Tower Crane



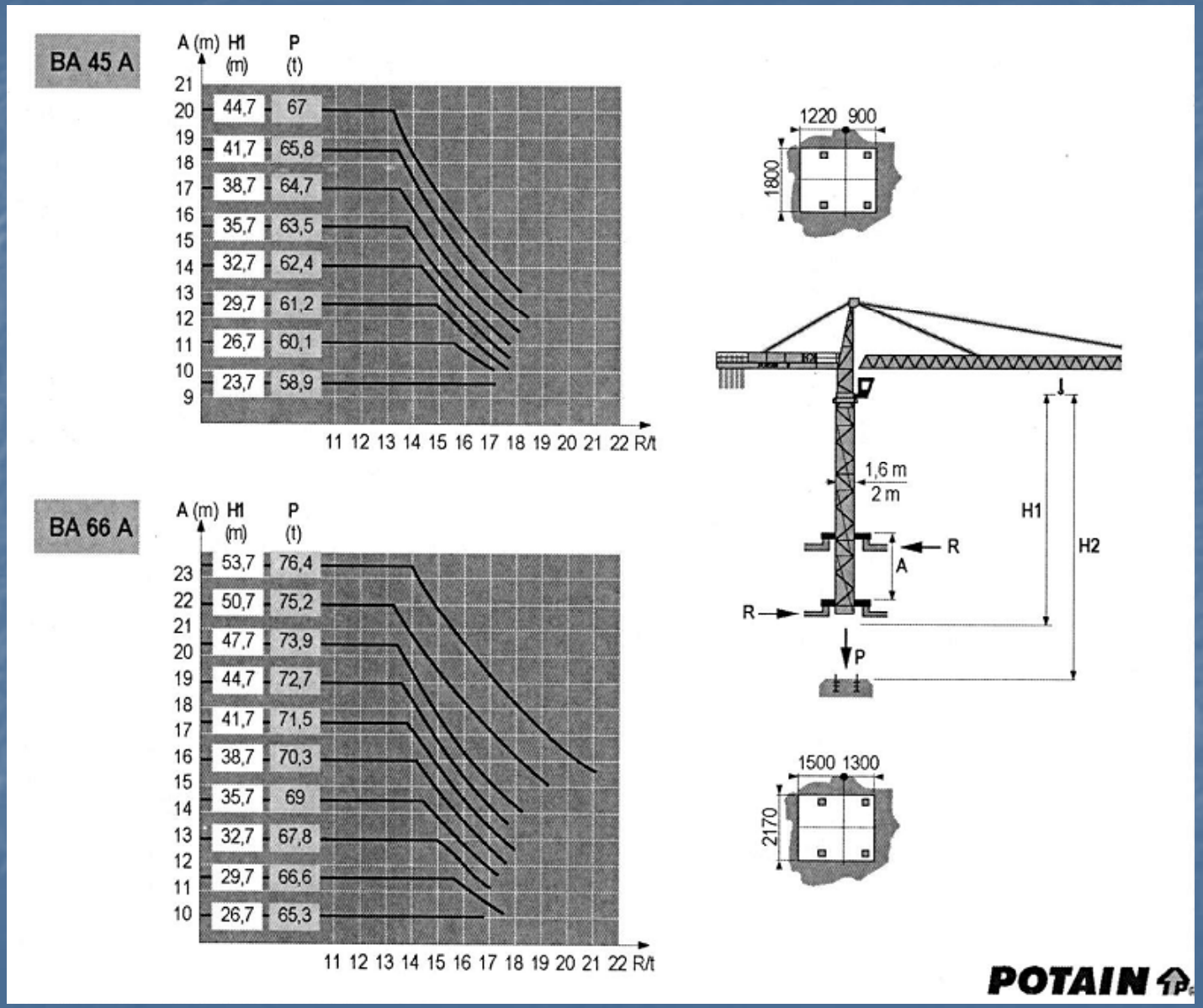




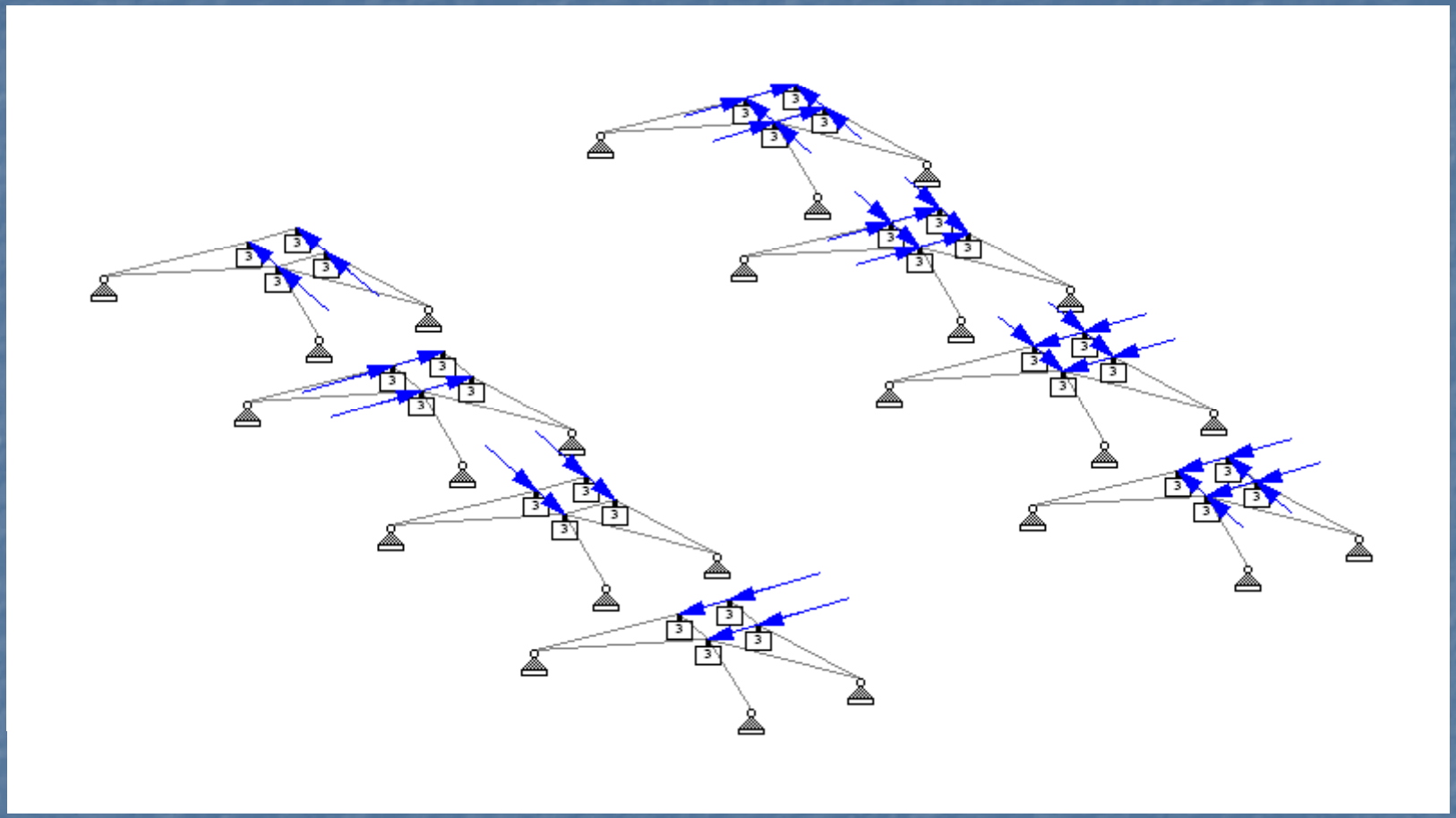


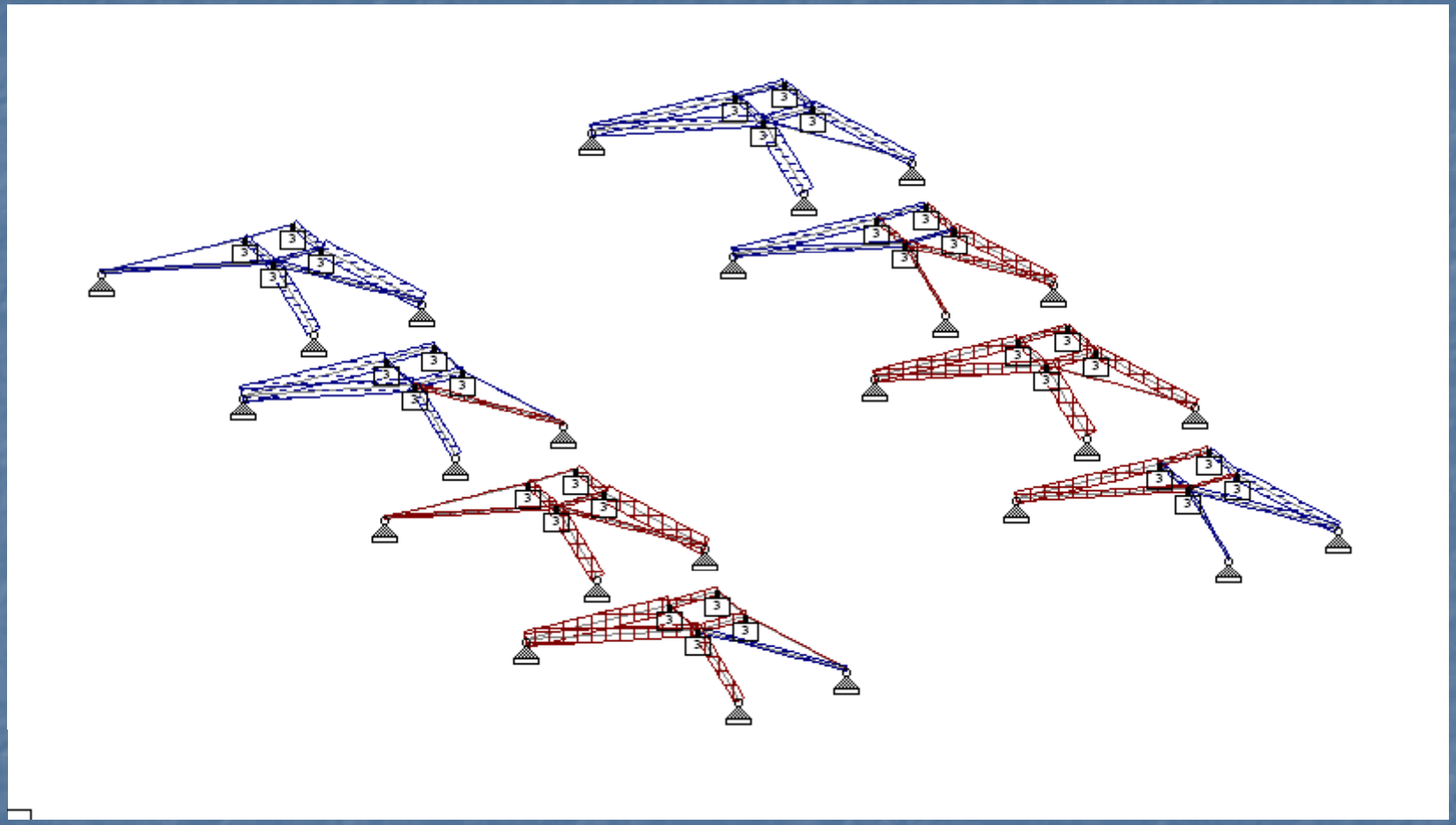
# Design Load


BA 45 A
A (m) H1 (m) P (t)
21 44,7 67
20 41,7 65,8
19 38,7 64,7
18 35,7 63,5
17 32,7 62,4
16 29,7 61,2
15 26,7 60,1
14 23,7 58,9
13
12
11
10
9
11 12 13 14 15 16 17 18 19 20 21 22 R/t
BA 66 A
A (m) H1 (m) P (t)
23 53,7 76,4
22 50,7 75,2
21 47,7 73,9
20 44,7 72,7
19 41,7 71,5
18 38,7 70,3
17 35,7 69
16 32,7 67,8
15 29,7 66,6
14 26,7 65,3
13
12
11
10
11 12 13 14 15 16 17 18 19 20 21 22 R/t
1220 900
1800
1,6 m
2 m
H1
H2
R
A
R
P
1500 1300
2170
POTAIN

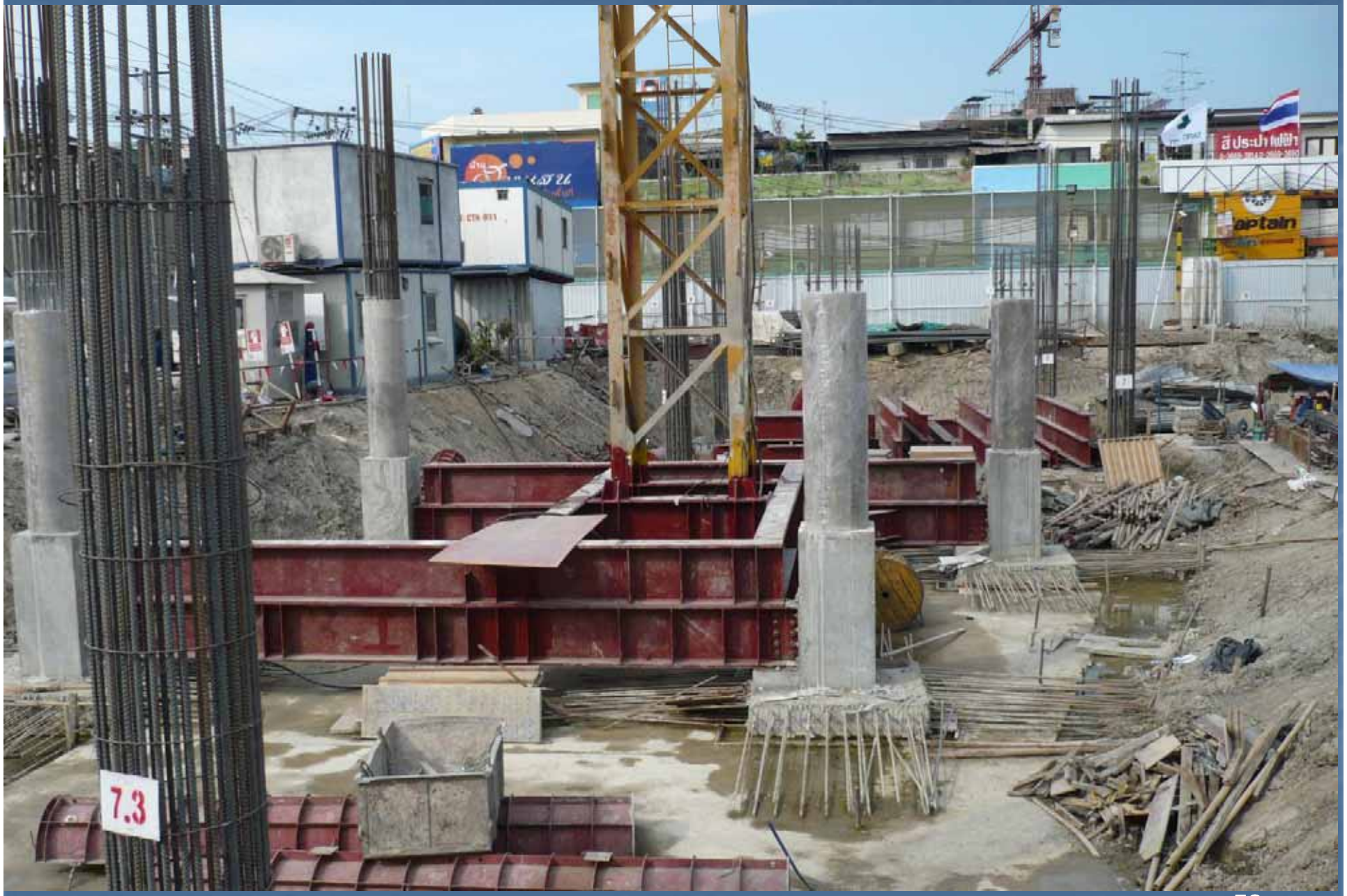
# Load Cases

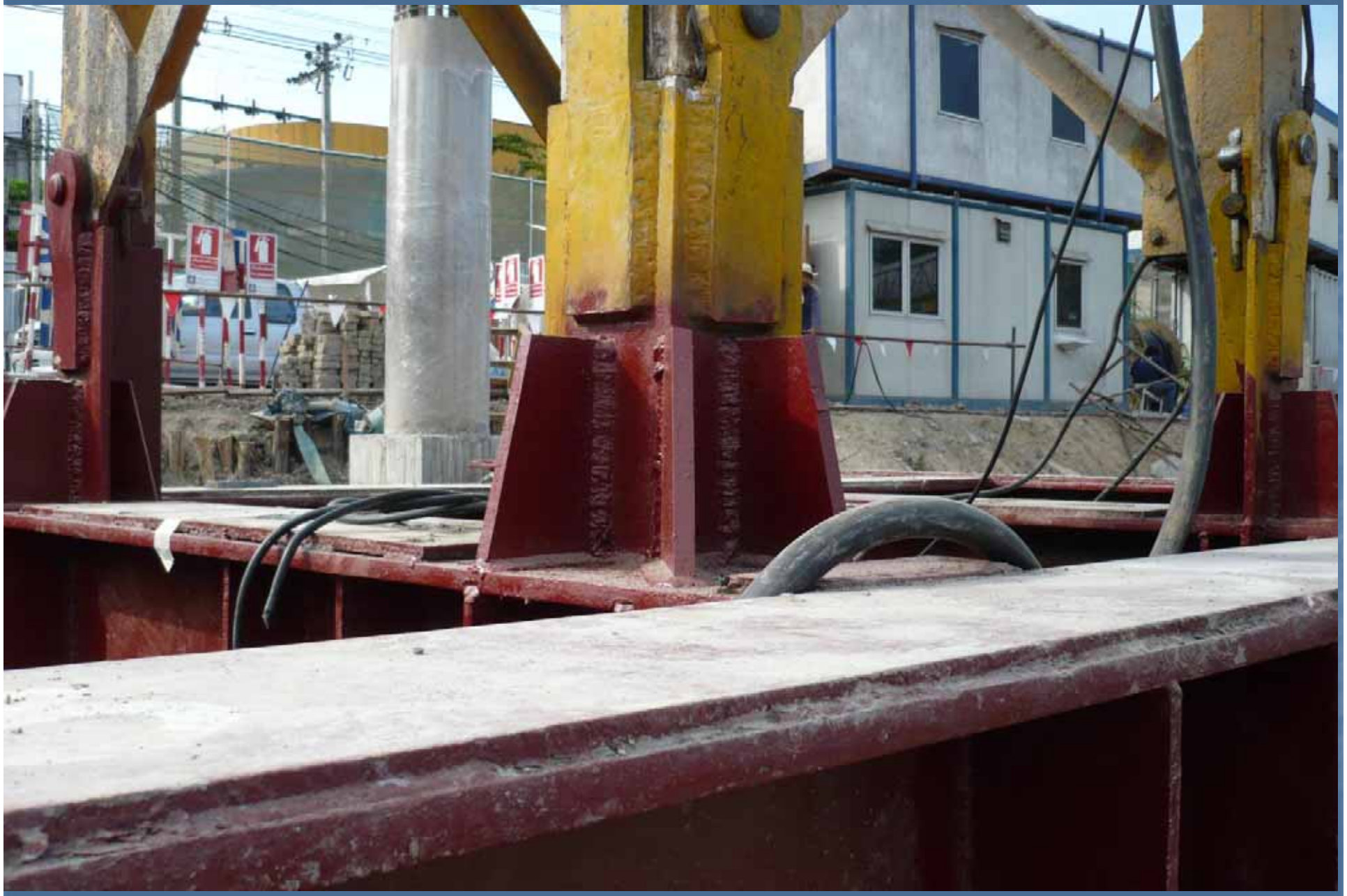


# Axial Forces



# ตัวอย่างฐานราก Tower Crane และ Bracing


7.3



# จบการบรรยาย

# ขอบคุณครับ