

# GATE 2024



**प्रचण्ड** Batch

## STEEL STRUCTURES

### DESIGN OF BOLTED CONNECTIONS

#### LECTURE :2

REHAN SIR



# BOLTED CONNECTIONS

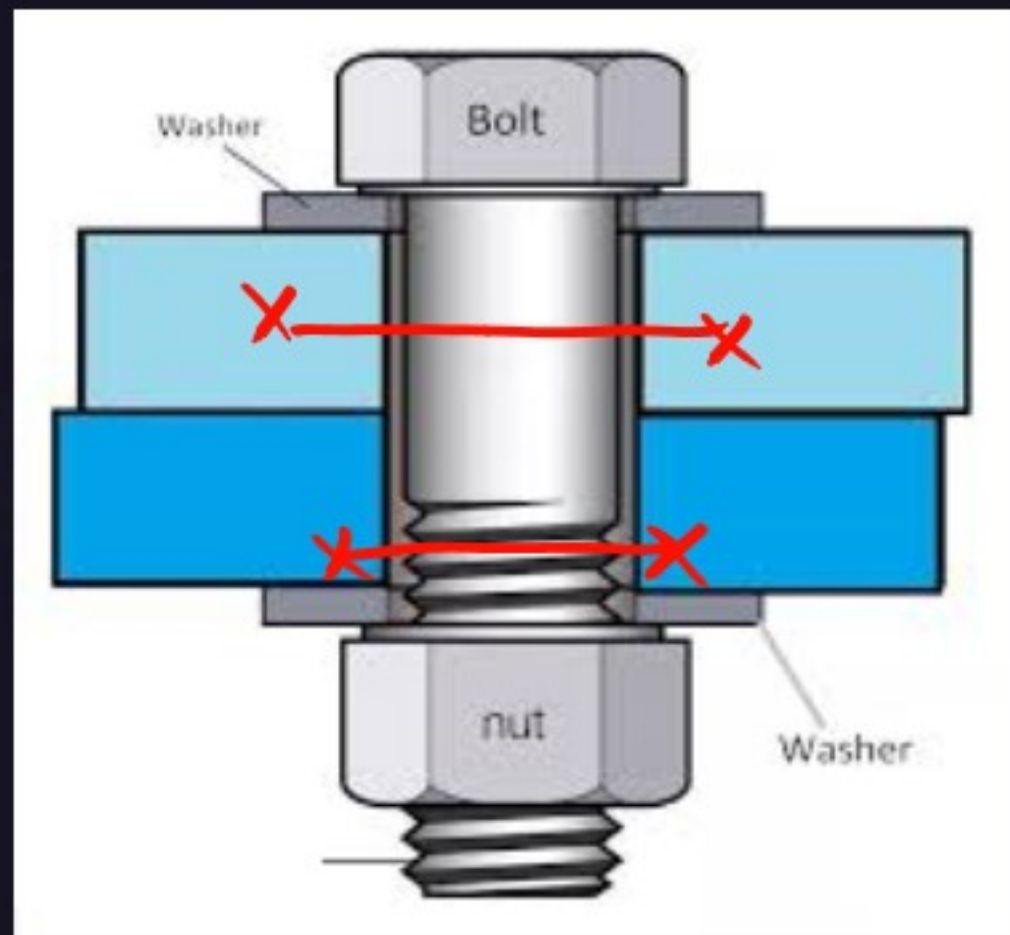
- ① Grade → size.  
② Class → strength

- Shank portion:

$$A_{sb} = \frac{\pi}{4} d^2 \quad (5-36)$$

- Threaded portion:

$$A_{nb} = 0.78 \times \frac{\pi}{4} d^2$$



Bolt Hole ( $d_o$ ):

M20  $\rightarrow$   $d = 20\text{ mm}$   
 $d_o = 22\text{ mm}$ .

According IS 800: 2007

d      clearance.

5m - 14 mm      1 mm

16 - 24 mm      2 mm

> 24 mm      3 mm.



# Types of bolts

Unfinished (5mm - 36mm)

class 4.6 →  $f_{ub} = 400 \text{ MPa}$   
 $f_{yb} = 0.6 \times 400$   
 $= 240 \text{ MPa}$



Bearing force

(16mm - 36mm)

HSGG bolts

M16 - M36

'S'

class 8.8,

← 8.8S,

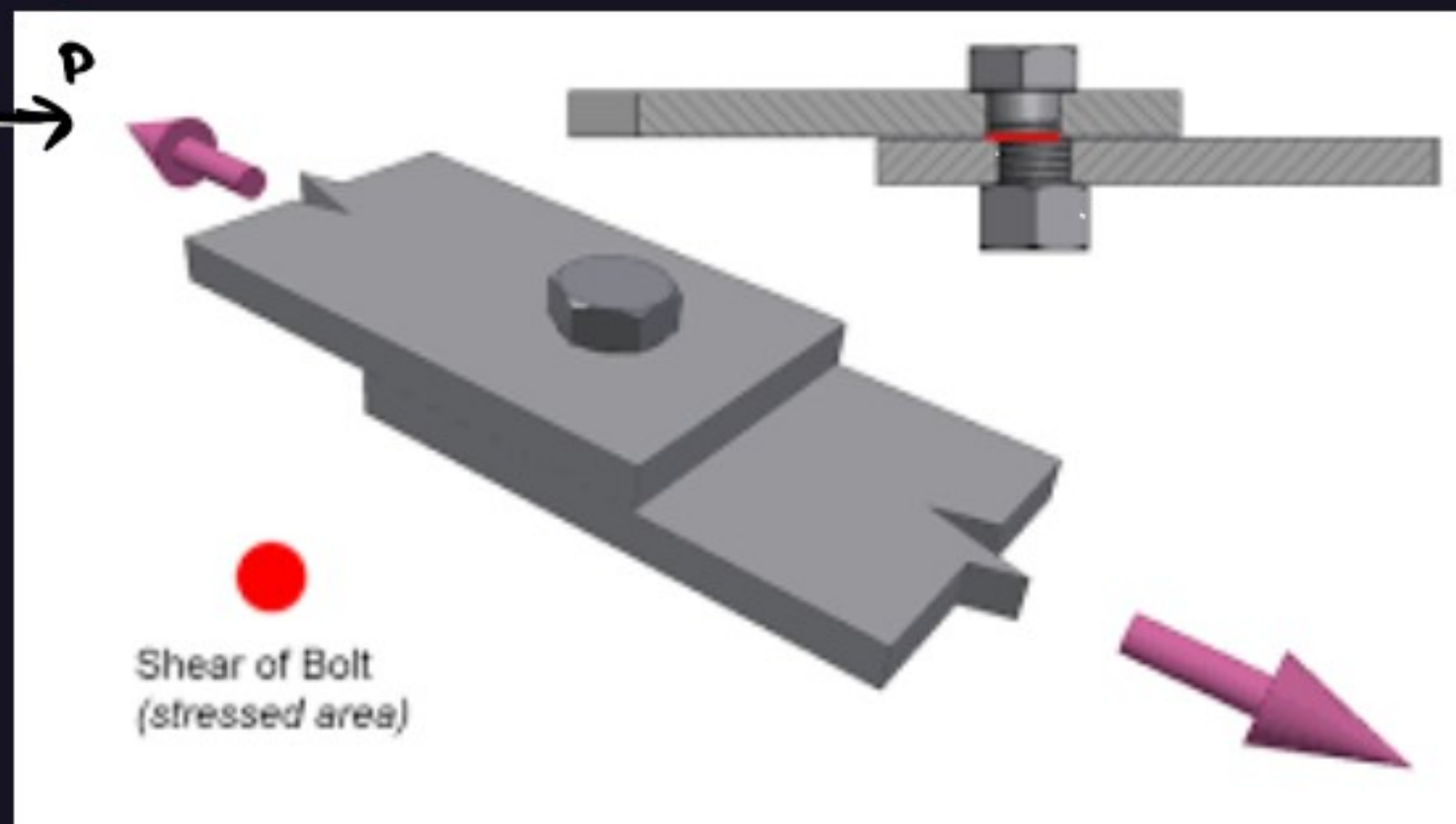
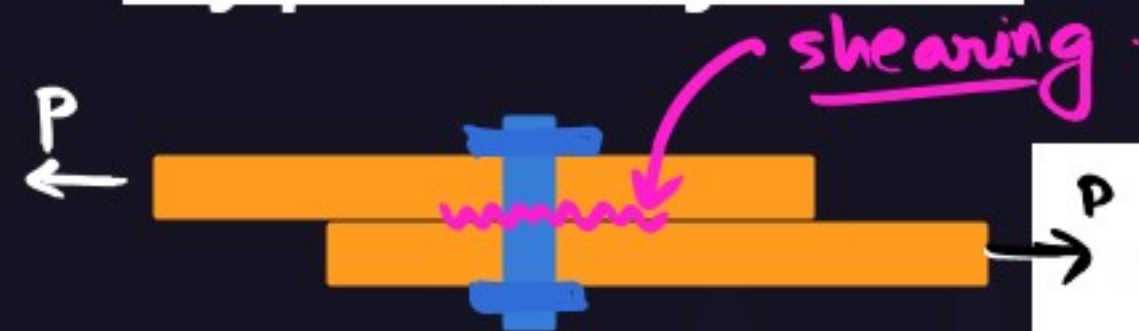
$f_{ub} = 800$  10S,  
 $f_{yb} = 0.8 \times 800$  10.9S

= 640 MPa



# Types of joints

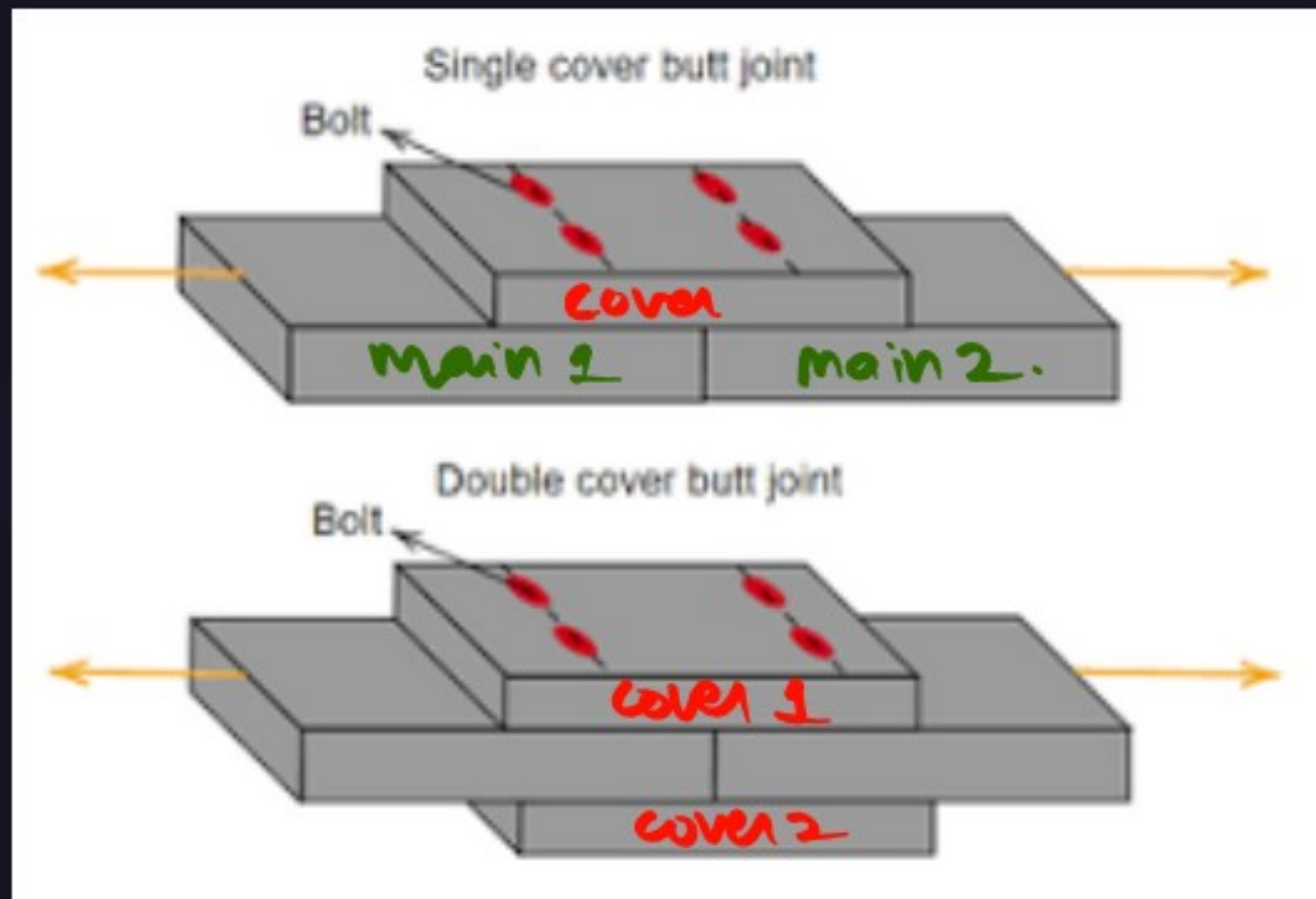
## 1. Lap Joint :



## 2. Butt Joint :

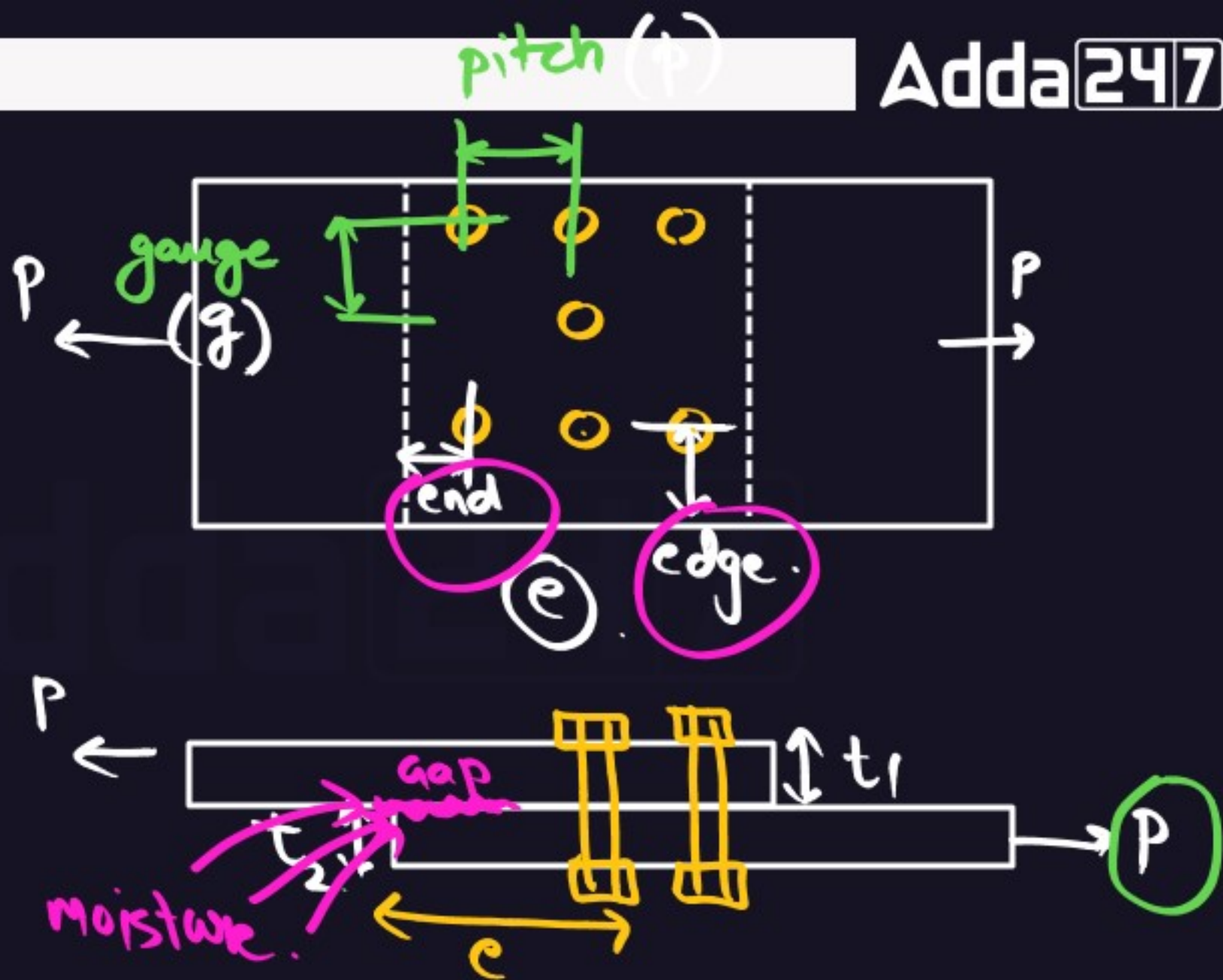
(i) Single cover B.J.

(ii) DCBJ.



# \* Terminology:

- ① Pitch 'p'
- ② gauge 'g'
- ③ end 'e' or edge



★ IS 800 codal provisions :

(i) Min end/edge distance :

$$e_{\min} = \begin{matrix} \checkmark \\ \checkmark \end{matrix} 1.5 d_0 \rightarrow \text{machine cut element.} \\ = 1.7 d_0 \rightarrow \text{Hand cut element.}$$

(ii) Maximum end/edge distance.

$$e_{\max} = 12 \cdot t \cdot e$$

$$e = \sqrt{\frac{250}{f_y}}$$

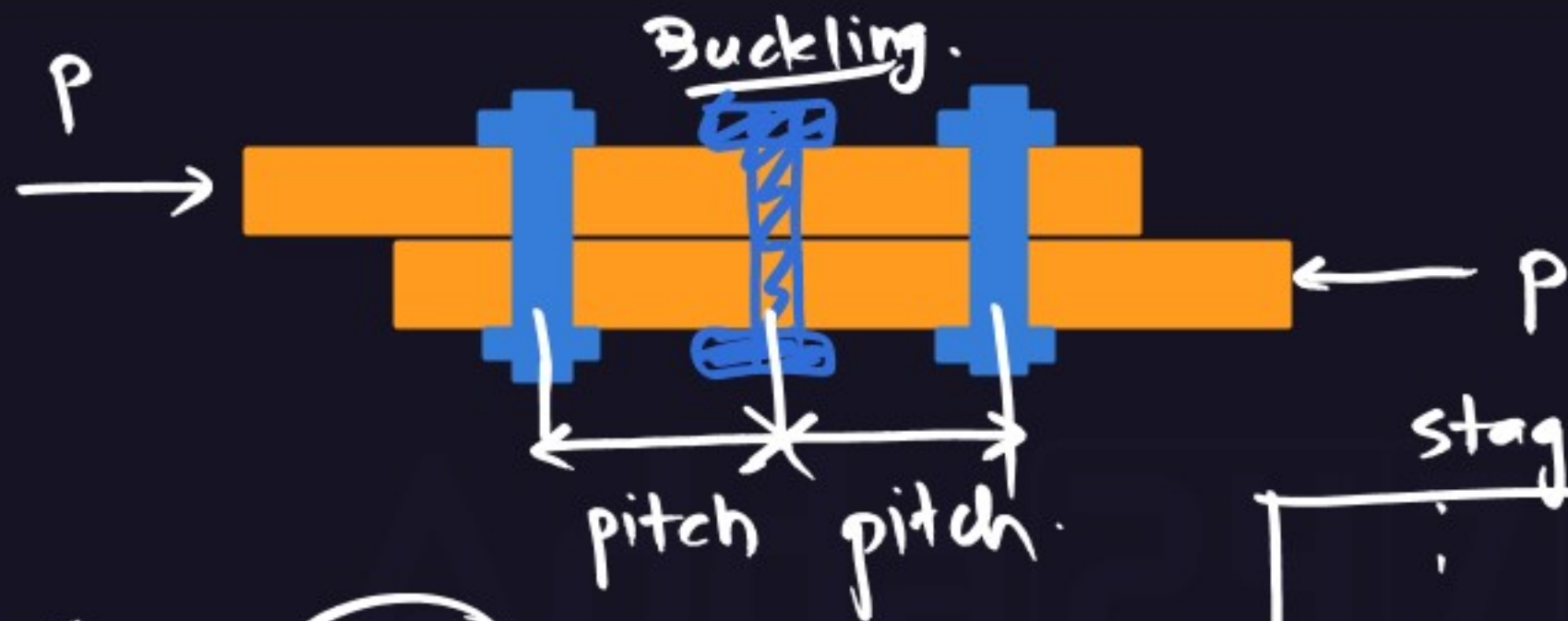


## 2. Pitch:

(i) min pitch :  $p_{\min} = 2.5d.$

(ii) max pitch :

$p_{\max} \rightarrow (12t \text{ or } 200 \text{ mm})_{\min} \rightarrow$  compression member  
 $\rightarrow (16t \text{ or } 200 \text{ mm})_{\min} \rightarrow$  Tension member.



$\checkmark p_{min} = 2.5d$   
 $\checkmark p_{max} = 12t \text{ or } 200 \text{ mm } \textcircled{C}$





























01

02

03



04

05

06