

# DESIGN REPORT

Steel compression member - ISHB 300 (58.8)

Designed in accordance with IS 800:2007 (limit state method)

|             |                      |
|-------------|----------------------|
| Project     | -                    |
| Client      | -                    |
| Location    | -                    |
| Member      | C1 - Column C1       |
| Designed by | -                    |
| Checked by  | -                    |
| Result      | All checks satisfied |
| Date        | 31 Oct 2026          |

## Contents

- 1. Design summary
- 2. Design basis and material
- 3. Section properties
- 4. Design loads
- 5. Section classification
- 6. Effective length and slenderness
- 7. Design compressive strength
- 8. Column base
- 9. Detailing notes
- 10. Member drawing (A3)

1. Design summary

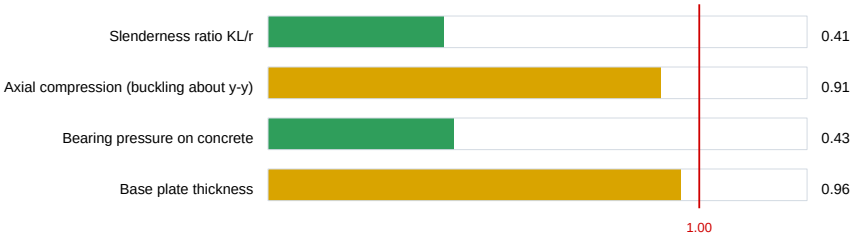
All design checks are satisfied. Maximum utilisation 0.96.

|                             |                                               |
|-----------------------------|-----------------------------------------------|
| Project                     | -                                             |
| Client / location           | -                                             |
| Member                      | C1 - Column C1                                |
| Member type                 | Rolled I / H section (ISMB, ISWB, ISHB, ISLB) |
| Section                     | ISHB 300 (58.8)                               |
| Steel                       | E250: fy = 250 N/mm², fu = 410 N/mm²          |
| Length                      | 4.000 m                                       |
| Design axial force          | 1,003.5 kN (Factored design load (input))     |
| Design compressive strength | Pd = 1,101.5 kN (buckling about y-y)          |
| Self weight of member       | 58.9 kg/m - 236 kg                            |
| Report date                 | 31 Oct 2026                                   |

Summary of design checks

| Check                                  | Clause  | Demand      | Capacity    | Ratio | Status |
|----------------------------------------|---------|-------------|-------------|-------|--------|
| Slenderness ratio KL/r                 | Table 3 | 73.44       | 180.00      | 0.408 | OK     |
| Axial compression (buckling about y-y) | 7.1.2   | 1,003.47 kN | 1,101.52 kN | 0.911 | OK     |
| Bearing pressure on concrete           | 7.4.1   | 6.46 N/mm²  | 15.00 N/mm² | 0.430 | OK     |
| Base plate thickness                   | 7.4.3.1 | 13.38 mm    | 14.00 mm    | 0.956 | OK     |

UTILISATION OF DESIGN CHECKS



Utilisation of each check (1.00 = capacity)

2. Design basis and material

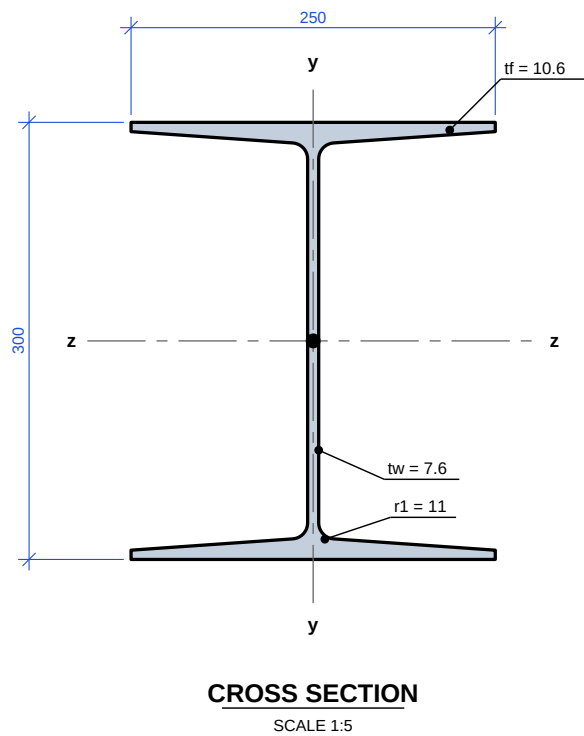
- IS 800:2007 General construction in steel - Code of practice (limit state method).
- IS 808:1989 Dimensions for hot rolled steel beam, column, channel and angle sections.
- IS 2062:2011 Hot rolled structural steel; IS 4923:2017 Hollow steel sections.
- IS 875 (Parts 1-3) and IS 1893 for loads; IS 456:2000 for the concrete pedestal.
- Section properties are computed from the IS 808 outline (tapered flanges and root fillets of rolled shapes included); they agree with the tabulated values within about 1-3 %.

|                                              |                         |
|----------------------------------------------|-------------------------|
| γm0 - resistance governed by yielding        | 1.10 (Table 5)          |
| γm1 - resistance governed by ultimate stress | 1.25 (Table 5)          |
| γmb - bolts (bearing type)                   | 1.25 (Table 5)          |
| γmw - shop welds                             | 1.25 (Table 5)          |
| Modulus of elasticity E                      | 200,000 N/mm² (2.2.4.1) |
| Shear modulus G                              | 76,900 N/mm² (2.2.4.1)  |

| Material strength (IS 800 Table 1 / IS 2062) |                     |                                                   |           | OK |
|----------------------------------------------|---------------------|---------------------------------------------------|-----------|----|
| Reference                                    | Description         | Calculation                                       | Result    |    |
| Table 1                                      | Steel grade         | E250                                              |           |    |
|                                              | Governing thickness | maximum element thickness t = 10.6 mm (t < 20 mm) |           |    |
| Table 1                                      | Yield stress fy     | fy for t < 20 mm                                  | 250 N/mm² |    |

| Reference | Description           | Calculation                               | Result                  |  |
|-----------|-----------------------|-------------------------------------------|-------------------------|--|
| Table 1   | Ultimate stress $f_u$ |                                           | 410 N/mm <sup>2</sup>   |  |
| Table 2   | $\epsilon$            | $\sqrt{(250 / f_y)} = \sqrt{(250 / 250)}$ | 1.000                   |  |
| 5.4.1     | Design yield stress   | $f_y / \gamma_{m0} = 250 / 1.1$           | 227.3 N/mm <sup>2</sup> |  |

3. Section properties



Cross section - ISHB 300 (58.8)

|                                             |                                      |
|---------------------------------------------|--------------------------------------|
| Area A                                      | 7,508 mm <sup>2</sup>                |
| Mass                                        | 58.94 kg/m (IS 808 table: 58.8 kg/m) |
| I <sub>z</sub> (major axis)                 | 12,592.3 cm <sup>4</sup>             |
| I <sub>y</sub> (minor axis)                 | 2,227.3 cm <sup>4</sup>              |
| r <sub>z</sub>                              | 129.5 mm                             |
| r <sub>y</sub>                              | 54.5 mm                              |
| Z <sub>ez</sub> / Z <sub>ey</sub> (elastic) | 839.5 / 178.2 cm <sup>3</sup>        |
| Z <sub>pz</sub> / Z <sub>py</sub> (plastic) | 925.0 / 294.2 cm <sup>3</sup>        |
| Torsion constant I <sub>t</sub>             | 23.93 cm <sup>4</sup>                |
| Warping constant I <sub>w</sub>             | 466,347.5 cm <sup>6</sup>            |

4. Design loads

| Design forces |                      |                                                                          |            | OK |
|---------------|----------------------|--------------------------------------------------------------------------|------------|----|
| Reference     | Description          | Calculation                                                              | Result     |    |
|               | Factored axial force | Factored design load (input)                                             | 1,000.0 kN |    |
| Table 4       | Factored self weight | 1.5 × 58.94 kg/m × 9.81 × 4.000 m                                        | 3.47 kN    |    |
|               | Design axial force P | applied + self weight (at the base, conservatively over the full length) | 1,003.5 kN |    |

## 5. Section classification

Compression elements are classified to IS 800 Table 2. Limits are shown as plastic / compact / semi-compact (multiples of  $\varepsilon$ , or  $\varepsilon^2$  for tubes, already applied). An element beyond the semi-compact limit is slender and only its effective width is counted (Cl. 7.3.2).

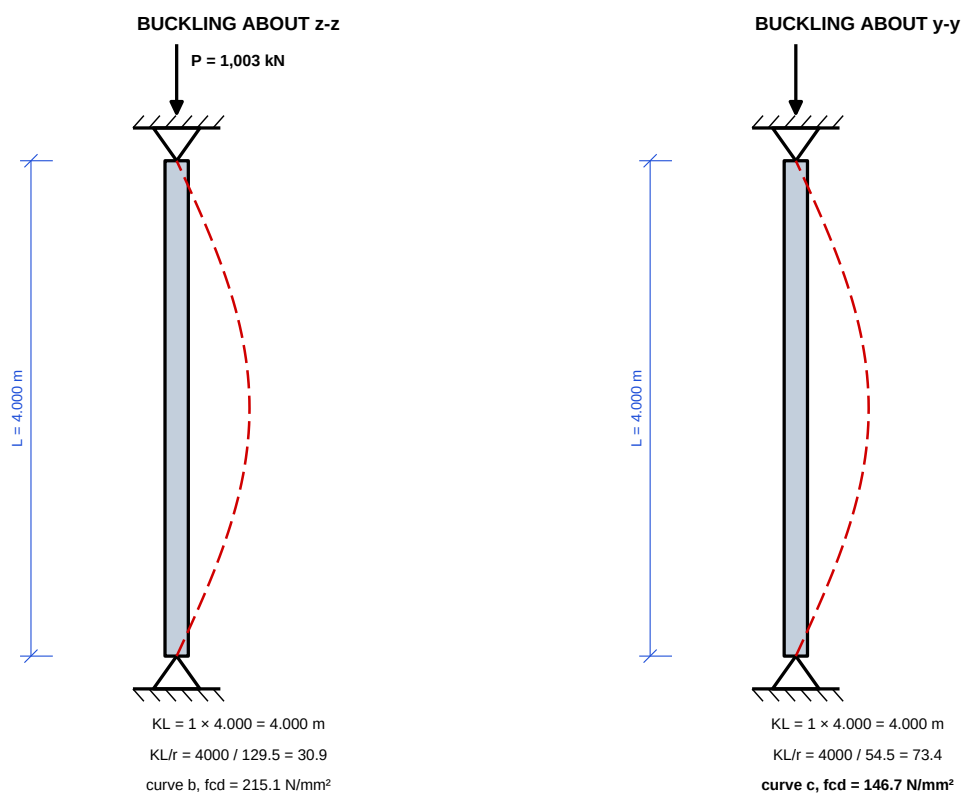
Section classification (Table 2)

| Element         | Table 2 row                                        | b / t (mm)   | Ratio | Limits            | Class        |
|-----------------|----------------------------------------------------|--------------|-------|-------------------|--------------|
| Flange outstand | Outstanding element of compression flange - rolled | 125.0 / 10.6 | 11.79 | 9.4 / 10.5 / 15.7 | Semi-compact |
| Web             | Web of an I, H or channel section                  | 256.8 / 7.6  | 33.79 | - / - / 42.0      | Semi-compact |

| Classification result |                |                                      |                            |  | OK |
|-----------------------|----------------|--------------------------------------|----------------------------|--|----|
| Reference             | Description    | Calculation                          | Result                     |  |    |
| 3.7.2                 | Section class  | governed by the most slender element | Semi-compact               |  |    |
| 7.3.2                 | Effective area | no slender element: $A_e = A$        | $A_e = 7,508 \text{ mm}^2$ |  |    |

## 6. Effective length and slenderness



End restraints, buckled shapes and effective lengths

| Effective length and slenderness about z-z |                          |                                                                                 |          |  | OK |
|--------------------------------------------|--------------------------|---------------------------------------------------------------------------------|----------|--|----|
| Reference                                  | Description              | Calculation                                                                     | Result   |  |    |
| Table 11                                   | End restraint            | Both ends pinned - translation restrained, rotation free                        | $K = 1$  |  |    |
| 7.2.2                                      | Unbraced length          | $L$                                                                             | 4,000 mm |  |    |
| 7.2.2                                      | Effective length $KL$    | $1 \times 4,000$                                                                | 4,000 mm |  |    |
|                                            | Radius of gyration $r_z$ |                                                                                 | 129.5 mm |  |    |
| 7.1.2                                      | Slenderness $KL/r$       | $4,000 / 129.5$                                                                 | 30.9     |  |    |
| Table 3                                    | Slenderness limit        | $30.9 \leq 180$ - Member carrying compressive loads from dead and imposed loads | OK       |  | OK |

| Effective length and slenderness about y-y |               |                                                          |         |  | OK |
|--------------------------------------------|---------------|----------------------------------------------------------|---------|--|----|
| Reference                                  | Description   | Calculation                                              | Result  |  |    |
| Table 11                                   | End restraint | Both ends pinned - translation restrained, rotation free | $K = 1$ |  |    |

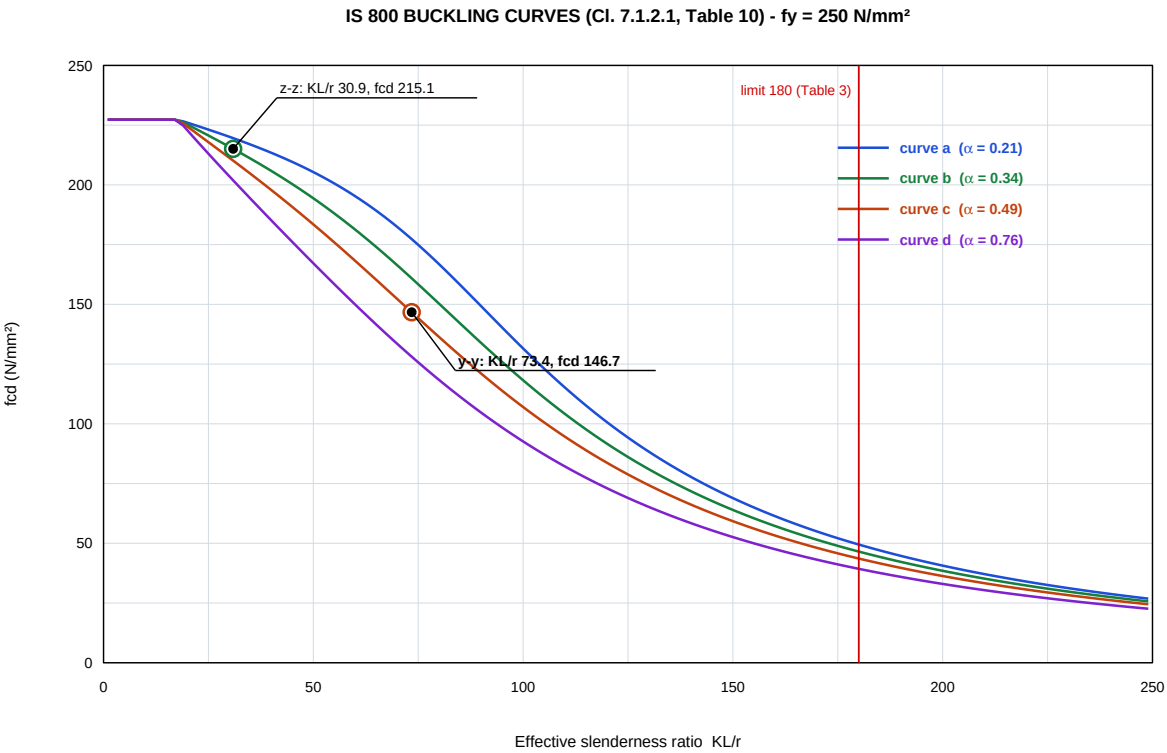
| Reference | Description              | Calculation                                                                     | Result   |    |
|-----------|--------------------------|---------------------------------------------------------------------------------|----------|----|
| 7.2.2     | Unbraced length          | L                                                                               | 4,000 mm |    |
| 7.2.2     | Effective length KL      | $1 \times 4,000$                                                                | 4,000 mm |    |
|           | Radius of gyration $r_y$ |                                                                                 | 54.5 mm  |    |
| 7.1.2     | Slenderness $KL/r$       | $4,000 / 54.5$                                                                  | 73.4     |    |
| Table 3   | Slenderness limit        | $73.4 \leq 180$ - Member carrying compressive loads from dead and imposed loads | OK       | OK |

## 7. Design compressive strength

| Buckling about z-z |                                       |                                                                                         |                           | OK |
|--------------------|---------------------------------------|-----------------------------------------------------------------------------------------|---------------------------|----|
| Reference          | Description                           | Calculation                                                                             | Result                    |    |
| Table 10           | Buckling class                        | rolled I, $h/b = 1.20 \leq 1.2$ , $t_f = 10.6$ mm, axis z-z                             | b                         |    |
| Table 7            | Imperfection factor $\alpha$          |                                                                                         | 0.34                      |    |
| 7.1.2.1            | Euler buckling stress $f_{cc}$        | $\pi^2 E / (KL/r)^2 = \pi^2 \times 200,000 / 30.9^2$                                    | 2,069.1 N/mm <sup>2</sup> |    |
| 7.1.2.1            | Non-dimensional slenderness $\lambda$ | $\sqrt{f_y / f_{cc}} = \sqrt{(250 / 2,069.1)}$                                          | 0.348                     |    |
| 7.1.2.1            | $\phi$                                | $0.5 [1 + \alpha (\lambda - 0.2) + \lambda^2] = 0.5 [1 + 0.34 (0.348 - 0.2) + 0.348^2]$ | 0.586                     |    |
| 7.1.2.1            | Stress reduction factor $\chi$        | $1 / [\phi + \sqrt{(\phi^2 - \lambda^2)}]$                                              | 0.946                     |    |
| 7.1.2.1            | Design compressive stress $f_{cd}$    | $\chi f_y / \gamma_{m0} = 0.946 \times 250 / 1.1 (\leq f_y / \gamma_{m0})$              | 215.1 N/mm <sup>2</sup>   |    |
| 7.1.2              | Design compressive strength $P_d$     | $A_e f_{cd} = 7,508 \times 215.1 / 1000$                                                | 1,614.9 kN                |    |

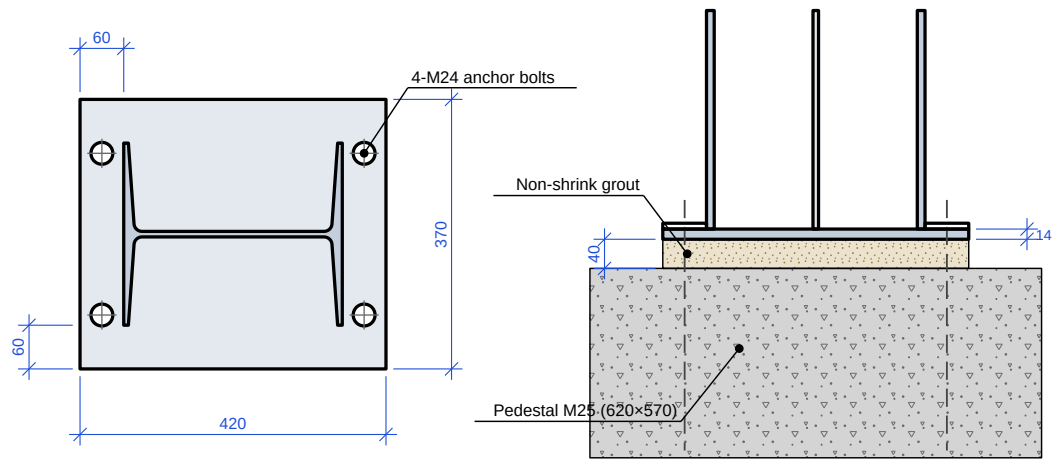
| Buckling about y-y |                                       |                                                                                         |                         | OK |
|--------------------|---------------------------------------|-----------------------------------------------------------------------------------------|-------------------------|----|
| Reference          | Description                           | Calculation                                                                             | Result                  |    |
| Table 10           | Buckling class                        | rolled I, $h/b = 1.20 \leq 1.2$ , $t_f = 10.6$ mm, axis y-y                             | c                       |    |
| Table 7            | Imperfection factor $\alpha$          |                                                                                         | 0.49                    |    |
| 7.1.2.1            | Euler buckling stress $f_{cc}$        | $\pi^2 E / (KL/r)^2 = \pi^2 \times 200,000 / 73.4^2$                                    | 366.0 N/mm <sup>2</sup> |    |
| 7.1.2.1            | Non-dimensional slenderness $\lambda$ | $\sqrt{f_y / f_{cc}} = \sqrt{(250 / 366.0)}$                                            | 0.827                   |    |
| 7.1.2.1            | $\phi$                                | $0.5 [1 + \alpha (\lambda - 0.2) + \lambda^2] = 0.5 [1 + 0.49 (0.827 - 0.2) + 0.827^2]$ | 0.995                   |    |
| 7.1.2.1            | Stress reduction factor $\chi$        | $1 / [\phi + \sqrt{(\phi^2 - \lambda^2)}]$                                              | 0.646                   |    |
| 7.1.2.1            | Design compressive stress $f_{cd}$    | $\chi f_y / \gamma_{m0} = 0.646 \times 250 / 1.1 (\leq f_y / \gamma_{m0})$              | 146.7 N/mm <sup>2</sup> |    |
| 7.1.2              | Design compressive strength $P_d$     | $A_e f_{cd} = 7,508 \times 146.7 / 1000$                                                | 1,101.5 kN              |    |

| Axial compression check |                    |                                          |                    | OK |
|-------------------------|--------------------|------------------------------------------|--------------------|----|
| Reference               | Description        | Calculation                              | Result             |    |
| 7.1.2                   | Governing strength | minimum of the axes - buckling about y-y | $P_d = 1,101.5$ kN |    |
| 7.1.2                   | Design axial force |                                          | $P = 1,003.5$ kN   |    |
| 7.1.2                   | $P \leq P_d$       | $1,003.5 \leq 1,101.5$ (ratio 0.911)     | OK                 | OK |



Design compressive stress against slenderness for the four buckling curves, with the design points of this member

8. Column base



BASE PLATE - PLAN  
SCALE 1:10

SECTION  
SCALE 1:10

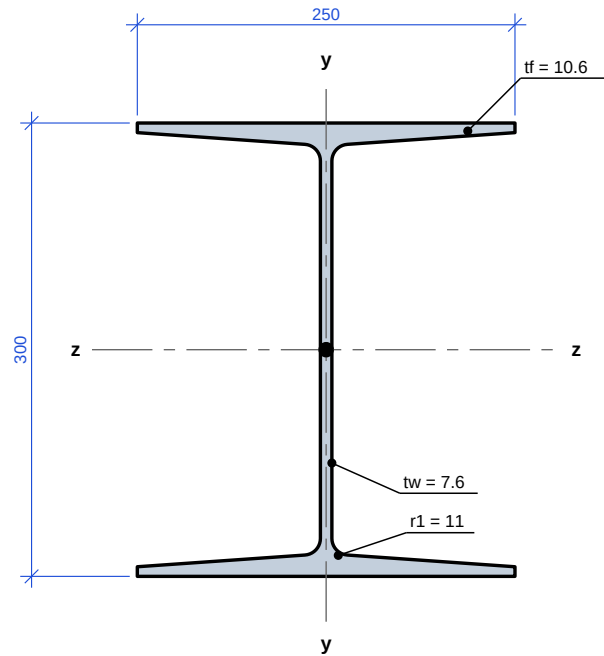
Slab base - plan and section

| Slab base design (Cl. 7.4) |                              |                                           |                        | OK |
|----------------------------|------------------------------|-------------------------------------------|------------------------|----|
| Reference                  | Description                  | Calculation                               | Result                 |    |
| 7.4.1                      | Bearing strength of concrete | $0.6 f_{ck} = 0.6 \times 25$              | 15.0 N/mm <sup>2</sup> |    |
| 7.4.1                      | Area required                | $P / (0.6 f_{ck}) = 1,003,469 / 15.0$     | 66,898 mm <sup>2</sup> |    |
|                            | Projection beyond the column | required 0; min. for anchors $2.5 d = 60$ | 60 mm                  |    |

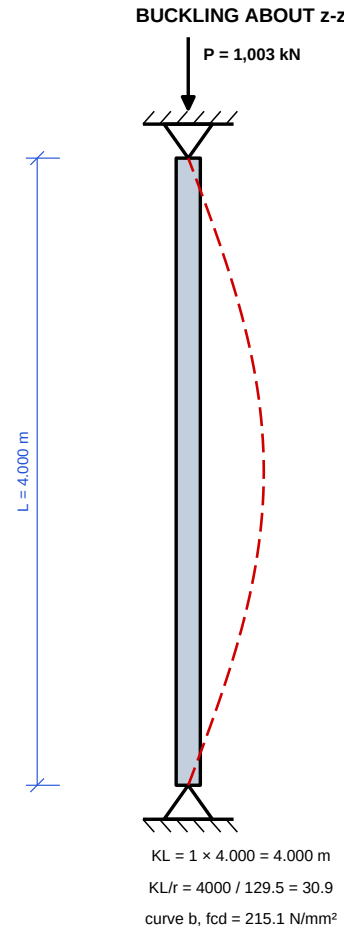
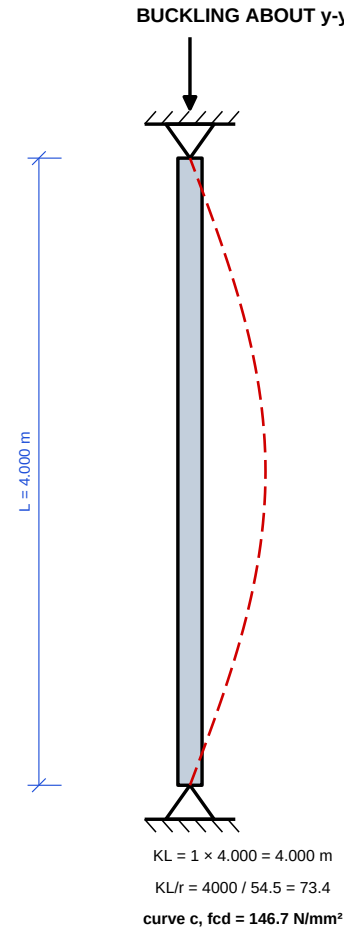
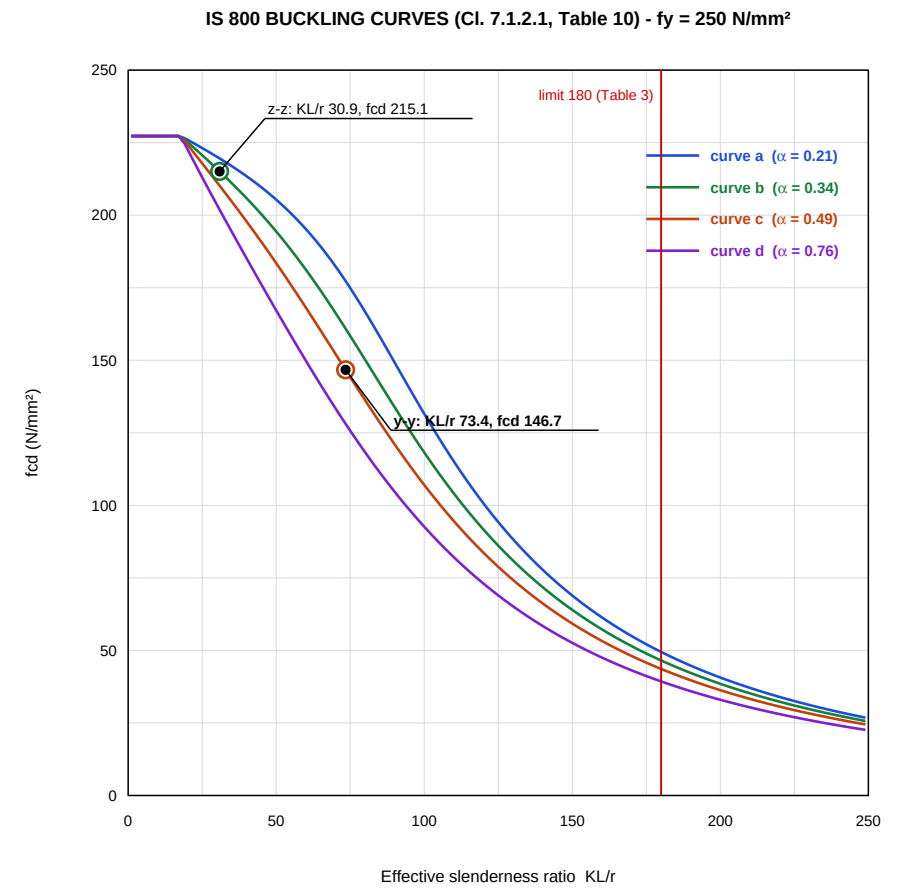
| Reference | Description                               | Calculation                                                        | Result                       |           |
|-----------|-------------------------------------------|--------------------------------------------------------------------|------------------------------|-----------|
|           | <b>Plate size L × B</b>                   | column 300 × 250 + projections                                     | <b>420 × 370 mm</b>          |           |
| 7.4.1     | <b>Bearing pressure w</b>                 | $P / (L B) = 1,003,469 / (420 \times 370)$                         | <b>6.46 N/mm<sup>2</sup></b> | <b>OK</b> |
| 7.4.3.1   | <b>Projections a, b</b>                   | larger / smaller projection beyond the column                      | <b>60 / 60 mm</b>            |           |
| 7.4.3.1   | <b>Thickness required ts</b>              | $\sqrt{[2.5 w (a^2 - 0.3 b^2) \gamma m_0 / f_y]}$ with $f_y = 250$ | <b>13.4 mm</b>               |           |
| 7.4.3.1   | <b>ts ≥ flange thickness</b>              | $t_f = 10.6$ mm                                                    |                              |           |
|           | <b>Plate provided</b>                     | E250 plate                                                         | <b>14 mm</b>                 | <b>OK</b> |
|           | <b>Anchor bolts (nominal, axial load)</b> | 4-M24 grade 4.6, 500 mm embedment                                  |                              |           |
| 7.4.3     | <b>Column to base connection</b>          | column end machined for full bearing; 6 mm fillet weld all round   |                              |           |
|           | <b>Pedestal</b>                           | M25, 620 × 570 mm, 40 mm non-shrink grout                          |                              |           |

## 9. Detailing notes

- Fabrication, erection and tolerances to IS 800 Sections 15 and 17; out-of-plumb not to exceed H/1000.
- Bolts to IS 1364 / IS 1367 with washers; holes drilled or sub-punched and reamed.
- Welding to IS 816 with E41 electrodes; minimum fillet size per IS 800 Table 21.
- Surface preparation and painting per the project specification (IS 800 Section 15).



**CROSS SECTION**  
SCALE 1:5



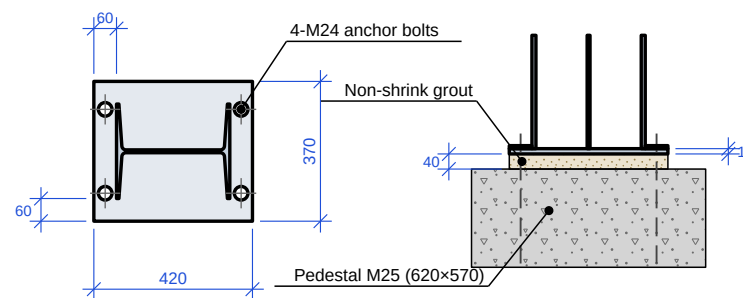
#### DESIGN SUMMARY (IS 800:2007)

|                |                                     |
|----------------|-------------------------------------|
| Section        | ISHB 300 (58.8)                     |
| Mass           | 58.9 kg/m                           |
| Steel          | E250 (fy = 250, fu = 410 N/mm²)     |
| Section class  | Semi-compact                        |
| Design load P  | 1,003.5 kN                          |
| Governing axis | y-y (KL/r = 73.4, buckling class c) |
| fcd            | 146.7 N/mm²                         |
| Pd             | 1,101.5 kN                          |
| Base plate     | 420 × 370 × 14 mm                   |

Result: **ALL CHECKS SATISFIED**

#### NOTES

- All dimensions are in mm unless noted otherwise.
- Structural steel E250 to IS 2062 / IS 4923; bolts to IS 1367, grade 4.6.
- Welding to IS 816 with E41 electrodes; fillet welds 6 mm min.
- Holes drilled, d0 = d + 2 mm (d + 3 mm above M24).
- Erect plumb within H/1000; grout base plates before loading.



**BASE PLATE - PLAN**  
SCALE 1:20

**SECTION**  
SCALE 1:20

#### Column C1

Member C1 · ISHB 300 (58.8)

Designed: - Checked: -

Date: 31 Oct 2026 Scale: as shown Sheet 1 of 1