Company Name		Project Title	
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Designer		Job Number	
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1 Input Parameters

Module	Flexural Members - Cantilever
Shear Force (kN)*	2.5
Bending Moment (kNm)*	3.0
Effective Span (m)*	24.0
Section Profile*	Beams and Columns
Section Size*	Ref List of Input Section
Material	E 250 (Fe 410 W)A
Support Type	Major Laterally Supported
End Conditions	Cantilever
Ultimate Strength, F_u (MPa)	410
Yield Strength, F_y (MPa)	250
End Conditions - Cantilever	
Support restraint	Continous, with lateral restraint to top flange
Top restraint	Free
Design Preference	
Effective Area Parameter	1.0
Semi-compact sections	Yes
Loading Condition	Normal
Effective Length Parameter	NA
Bearing Length (mm)	NA

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1.1 List of Input Section

Section Size*	'NPB 350 X 170 X 57.1','WPB 100 X 100 X 41.79','UC 305 x 305 x 97','UB 305 x 165 x 54','WPB 180 X 180 X 35.52','NPB 200 X 165 X 48.0','LB 150','NPB 250 X 175 X 43.94','LB 500','UC 356 x 406 x 551','NPB 350 X 250 X 79.18','NPB 300 X 200 X 75.37','UB 406 x 178 x 67','PBP 300 X 150.01','NPB 270 X 135 X 30.73','WPB 220 X 220 X 115.61','WPB 400 X 300 X 255.74','WPB 250 X 250 X 85.04','WPB 150 X 150 X 30.11','UB 406 x 178 x 74','NPB 180 X 90 X 18.8','WPB 280 X 280 X 188.54','UB 914 x 305 x 253','MB 400','NPB 750 X 270 X 145.29','NPB 300 X 150 X 42.24','WPB 850 X 300 X 214.25','SC 100','NPB 330 X 160 X 49.15','UC 305 x 305 x 137','PBP 300 X 184.12','UC 356 x 368 x 202','NPB 250 X 150 X 39.78','WPB 550 X 300 X 166.24','UB 305 x 127 x 48','UB 305 x 165 x 40','WPB 260 X 260 X 92.99','WPB 180 X 180 X 51.22','NPB 220 X 110 X 29.35','UB 203 x 133 x 25','UC 305 x 305 x 283','NPB 270 X 135 X 36.07','NPB 300 X 200 X 59.57','WPB 200 X 200 X 74.01','UB 254 x 146 x 43','WPB 240 X 240 X 47.4','NPB 550 X 210 X 122.52','WPB 120 X 120 X 52.13','UB 914 x 419 x 388','NPB 200 X 100 X 25.09','WPB 140 X 140 X 24.66','PBP 300 X 222.58','WPB 260 X 260 X 172.43','WPB 250 X 250 X 133.92','UB 1016 x 305 x 272','UB 178 x 102 x 19','NPB 330 X 160 X 57.01','WPB 240 X 240 X 60.32','WPB 400 X 300 X 92.4','WPB 100 X 100 X 12.24','WPB 250 X 250 X 103.97','UB 610 x 305 x 179','WPB 650 X 300 X 293.39','UC 152 x 152 x 30','WPB 450 X 300 X 139.76','UB 254 x 102 x 28','UB 305 x 102 x 33','HB 225','PBP 320 X 184.1','WPB 400 X 300 X 155.26','UB 610 x 229 x 125','NPB 600 X 220 X 107.57','UB 610 x 229 x 101','NPB 400 X 200 X 67.28','WPB 360 X 300 X 91.04','PBP 200 X 53.49','WPB 600 X 300 X 177.78','WPB 500 X 300 X 155.08','WPB 800 X 300 X 171.52','UC 356 x 368 x 153','UB 356 x 171 x 57','UB 406 x 140 x 46','UB 305 x 127 x 42','PBP 300 X 88.46','NPB 250 X 150 X 34.08','NPB 330 X 160 X 42.97','UC 203 x 203 x 60','PBP 260 X 75.01','WPB 120 X 120 X 26.7','WPB 400 X 400 X 239.62','NPB 220 X 110 X 26.2','UB 406 x 178 x 54','NPB 200 X 100 X 18.43','UB 457 x 152 x 52','UB 457 x 152 x 74','WPB 700 X 300 X 204.48','PBP 400 X 194.3','NPB 240 X 120 X 26.15','NPB 450 X190 X 67.16','UB 610 x 229 x 113','HB 350*','WPB 300 X 300 X 88.34','JB 150','UC 254 x 254 x 73','UC 356 x 406 x 340','UB 1016 x 305 x 487','UB 914 x 419 x 343','UC 356 x 406 x 235','WPB 900 X 300 X 251.62','UB 406 x 140 x 39','SC 150*','WPB 250 X 250 X 97.04','UC 203 x 203 x 46','MB 350','WPB 160 X 160 X 76.19','WPB 250 X 250 X 67.22','PBP 200 X 43.85','WPB 340 X 300 X 78.9','LB 300','WPB 220 X 220 X 40.4','WPB 250 X 250 X 148.38','HB 250*','UC 305 x 305 x 198','WPB 160 X 160 X 22.75','PBP 400 X 212.5','UB 762 x 267 x 173','UC 254 x 254 x 132','LB(P) 100','WPB 400 X 400 X 219.67','LB 125','WPB 600 X300 X 128.79','NPB 300 X 165 X 53.46','NPB 700 X 250 X 153.87','UB 127 x 76 x 13','WPB 120 X 120 X 14.56','NPB 550 X 210 X 105.52','SC 220','WB 550','UB 305 x 127 x 37','WPB 320 X 300 X 74.25','UB 533 x 210 x 122','MB 550','WPB 220 X 220 X 50.51','NPB 200 X 165 X 42.48','NPB 400 X 180 X 57.38','LB 225','WPB 360 X 370 X 136.21','SC 180','LB 175','PBP 300 X 76.92','NPB 700 X 250 X 128.41','PBP 400 X 176.1','WB 400','UB 305 x 102 x 25','HB 200*','WPB 800 X 300 X 262.34','WPB 700 X 300 X 149.89','WPB 140 X 140 X 33.72','NPB 200 X 165 X 35.69','NPB 160 X 80 X 15.77','WPB 140 X 140 X 18.08','NPB 700 X 250 X 171.48','LB 450','MB 450','UB 254 x 146 x 31','LB 275','WPB 500 X 300 X 129.78','NPB 240 X 120 X 30.71','UB 457 x 152 x 67','WPB 300 X 300 X 117.03','MB 500','PBP 260 X 87.3','UB 457 x 152 x 60','NPB 400 X 180 X 66.31','WB 200','PBP 300 X 95','PBP 320 X 88.48','WPB 850 X 300 X 253.69','NPB 300 X 200 X 66.75','PBP 360 X 152.2','NPB 700 X 250 X 143.42','NPB 240 X 120 X 34.32','LB 325','WPB 400 X 400 X 191.11','UB 1016 x 305 x 222','LB 250','JB 200','WPB 280 X 280 X 76.36','UB 610 x 305 x 238','WB 350','UB 254 x 146 x 37','WPB 200 X 200 X 50.92','UC 203 x 203 x 86','WPB 160 X 160 X 42.59','WPB 260 X 260 X 68.16','NPB 600 X 220 X 154.47','PBP 220 X 57.28','WPB 650 X 300 X 224.78','UC 356 x 368 x 129','WPB 500 X 300 X 270.28','WB 300','UB 152 x 89 x 16','UB 914 x 305 x 201','UC 203 x 203 x 52','HB 200','NPB 450 X 190 X 77.58','WPB 260 X 260 X 114.4','HB 450','WPB 850 X 300 X 230.56','WPB 800 X 300 X 179.9','WPB 800 X 300 X 317.36','NPB 300 X 150 X 36.53','WPB 400 X 300 X 124.81','WPB 600 X 300 X 285.48','NPB 300 X 165 X 45.76','UC 356 x 368 x 177','UB 457 x 191 x 98','UC 152 x 152 x 23','SC 160','UB 356 x 127 x 33'

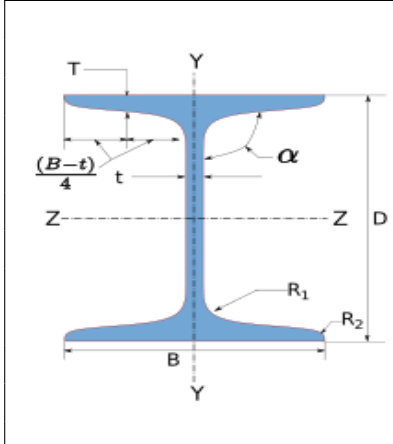| Company Name		Project Title	
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Section Size*	'UB 457 x 191 x 89','MB 225','WPB 700 X 300 X 240.51','WPB 450 X 300 X 99.75','UB 533 x 210 x 92','NPB 250 X 150 X 46.48','WPB 200 X 200 X 42.26','WPB 200 X 200 X 103.06','NPB 550 X 210 X 92.08','HB 300*','NPB 750 X 270 X 202.49','WPB 180 X180 X 88.9','WPB 500 X 300 X 187.34','UB 1016 x 305 x 249','WPB 600 X 300 X 211.92','UB 356 x 127 x 39','WPB 360 X 300 X 163.0','WPB 260 X 260 X 54.15','WPB 280 X 280 X 284.13','UB 686 x 254 x 125','NPB 120 X 60 X 10.37','WPB 300 X 300 X 100.85','PBP 300 X 124.2','SC 120','LB 200','WPB 240 X 240 X 156.68','LB(P) 175','WB 500','PBP 360 X 178.4','UB 914 x 305 x 289','UC 254 x 254 x 107','WPB 120 X 120 X 19.89','JB 225','HB 250','WPB 800 X 300 X 224.38','WPB 250 X 250 X 73.15','MB 600','WPB 200 X 200 X 83.52','WPB 360 X 300 X 250.27','MB 100','SC 250','UB 457 x 152 x 82','UB 533 x 210 x 82','UC 356 x 406 x 287','MB 125','NPB 180 X 90 X 21.27','PBP 320 X 117.33','UB 686 x 254 x 170','PBP 320 X 102.84','HB 300','NPB 220 X 110 X 22.18','WB 225','WPB 100 X 100 X 16.67','NPB 350 X 170 X 50.22','WPB 300 X 300 X 237.92','UC 305 x 305 x 240','WPB 340 X 300 X 290.64','WPB 450 X 300 X 263.33','UB 610 x 305 x 149','WPB 200 X 200 X 61.3','WPB 550 X 300 X 278.19','WPB 220 X 220 X 71.47','NPB 200 X 100 X 22.36','WPB 360 X 370 X 182.02','NPB 400 X 180 X 75.67','WPB 280 X 280 X 61.26','UC 356 x 406 x 634','MB 200','UC 356 x 406 x 393','WB 175','WPB 200 X 200 X 37.34','UB 254 x 102 x 22','WPB 360 X 370 X 150.87','NPB 100 X 55 X 8.1','NPB 750 X 270 X 174.54','LB 400','UB 914 x 305 x 224','UC 305 x 305 x 158','WPB 150 X 150 X 23.5','UB 356 x 171 x 67','UC 152 x 152 x 37','WPB 320 X 300 X 97.64','WPB 340 X 300 X 134.16','WB 450','UC 203 x 203 x 71','HB 150*','UC 305 x 305 x 118','WPB 150 X 150 X 36.97','HB 400*','NPB 500 X 200 X 107.32','NPB 140 X 70 X 12.89','NPB 300 X 150 X 49.32','UB 686 x 254 x 140','UB 254 x 102 x 25','LB(P) 200','NPB 500 X 200 X 79.36','UB 533 x 210 x 101','WPB 180 X 180 X 28.68','UB 762 x 267 x 134','HB 450*','LB(P) 300','WPB 320 X 300 X 126.66','UB 305 x 102 x 28','UB 1016 x 305 x 314','PBP 400 X 122.4','LB 100','WPB 140 X 140 X 63.24','HB 400','NPB 250 X 125 X 30.11','HB 150','UB 203 x 102 x 23','PBP 400 X 230.9','WB 600','NPB 180 X 90 X 15.37','WPB 360 X 370 X 165.35','WPB 240 X 240 X 83.2','WPB 700 X 300 X 300.68','UB 762 x 267 x 197','PBP 300 X 180.12','WPB 340 X 300 X 104.78','WPB 900 X 300 X 291.46','PBP 320 X 146.69','UB 1016 x 305 x 393','UB 610 x 229 x 140','WPB 900 X 300 X 198.01','WPB 200 X 200 X 34.65','WPB 650 X 300 X 189.69','UC 254 x 254 x 89','WPB 100 X 100 X 20.44','UB 533 x 210 x 109','MB 300','SC 200','NPB 450 X 190 X 92.37','PBP 400 X 158.1','UC 356 x 406 x 467','MB 250','WPB 260 X 260 X 141.52','MB 150','PBP 400 X 140.2','WPB 450 X 300 X 171.12','NPB 270 X 135 X 42.26','UB 406 x 178 x 60','UC 254 x 254 x 167','LB 600','HB 350','LB 75','UB 1016 x 305 x 437','WPB 850 X 300 X 195.74','UB 305 x 165 x 46','UB 457 x 191 x 67','PBP 360 X 174.2','WB 150','UB 457 x 191 x 82','WPB 360 X 300 X 125.81','UB 457 x 191 x 74','UB 203 x 133 x 30','NPB 700 X 250 X 113.46','NPB 350 X 170 X 66.05','UB 356 x 171 x 51','WPB 550 X 300 X 199.44','HB 225*','UB 686 x 254 x 152','LB 550','NPB 600 X 220 X 122.45','WPB 360 X 370 X 197.66','UB 762 x 267 x 147','WPB 300 X 300 X 69.8','WPB 320 X 300 X 244.97','MB 175','WPB 500 X 300 X 107.46','NPB 300 X 165 X 39.88','SC 140','NPB 200 X 130 X 31.56','NPB 500 X 200 X 90.69','WPB 160 X 160 X 30.44','WPB 250 X 250 X 117.58','LB 350','NPB 200 X 150 X 30.46','UB 1016 x 305 x 349','NPB 200 X 130 X 27.37','UB 356 x 171 x 45','JB 175','PBP 300 X 109.54','WPB 650 X 300 X 137.98','WB 250','WPB 550 X 300 X 119.99'

2 Design Checks

Design Status	Pass

2.1 Selected Member Data

Section Size*		('LB 75', 'Beams and Columns')	
Column Section		LB 75	
Material		E 250 (Fe 410 W)A	
Mass, m (kg/m)		6.05	
Area, A (cm^2)	7.71	I_z (cm^4)	72.7
D (mm)	75.0	I_y (cm^4)	10.0
B (mm)	50.0	r_z (cm)	3.07
t (mm)	3.7	r_y (cm)	1.13
T (mm)	5.0	Z_z (cm^3)	19.3
Flange Slope	91.5	Z_y (cm^3)	4.0
R_1 (mm)	6.5	Z_{pz} (cm^3)	22.3
R_2 (mm)	2.0	Z_{py} (cm^3)	6.39

2.2 Effective Area

Check	Required	Provided	Remarks
Effective Area (mm^2)		= Effective Area Parameter × Area of Section = 1.0×771.0 = 771.0	

2.3 Section Classification

Check	Required	Provided	Remarks
Web Class	Neutral Axis at Mid-Depth	$d = D - 2(T + R1) = 52.0$ $\dfrac{d}{t_w} = \dfrac{52.0}{3.7} \le 84\varepsilon$ $= 14.05 \le 84.0$ **Plastic**	

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Check	Required	Provided	Remarks
Flange Class	Rolled	$\frac{b}{t_f} = \frac{25.0}{5.0} \le 9.4\varepsilon$ $= 5.0 \le 9.4$ **Plastic**	
Section Class		**Plastic** [Ref: Table 2, Cl.3.7.2 and 3.7.4, IS 800:2007]	

2.4 Web Slenderness Check

Check	Required	Provided	Remarks
Web Buckling	$= 67 \times \epsilon$ $= 67 \times 1.0$ $= 67.0$	$= \frac{d_{web}}{t_{web}} = \frac{(D - 2(T + R1))}{t_{web}}$ $= \frac{52.0}{3.7}$ $= 14.05$ [Ref. IS 800:2007, Cl.8.2.1.1]	**Pass**

2.5 Shear Strength Results

Check	Required	Provided	Remarks
Shear Strength (kN)	2.5	$V_d = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{75.0 \times 3.7 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 36.41$ [Ref. IS 800:2007, Cl.10.4.3]	**Pass**
Allowable Shear Capacity (kN)		$= 0.6\ V_d$ $= 0.6 \times 36.41$ $= 21.85 > 2.5$ [Limited to low shear]	**Low Shear**

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2.6   Moment Strength Results
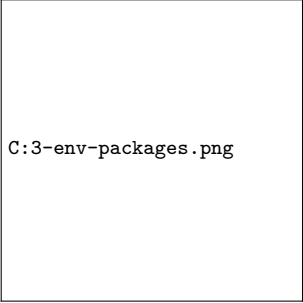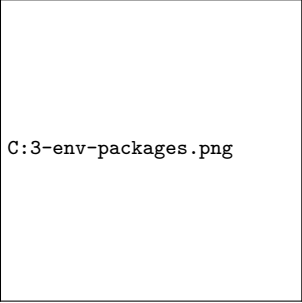
Check	Required	Provided	Remarks
Moment Strength (kNm)	3.0	$\beta_b = 1.0 \qquad \textit{Section is Plastic}$ $M_d = \dfrac{\beta_b Z_p f_y}{\gamma_{m0}} \leq \dfrac{1.5 Z_e f_y}{\gamma_{mo}}$ $\quad = \dfrac{1 \times 22300.0 \times 250}{1.1 \times 10^6} \leq \dfrac{1.5 \times 19300.0 \times 250}{1.1 \times 10^6}$ $\quad = 5.07 \leq 6.58$ [Ref. IS 800:2007, Cl.8.2.1.2]	**Pass**

2.7   Utilization

Check	Required	Provided	Remarks
Utilization Ratio	1.0	$UR = \text{MAX}\left(\dfrac{\text{Shear Force}}{\text{Shear Strength}}, \dfrac{\text{Bending Moment}}{\text{Bending Strength}}\right)$ $\quad = \text{MAX}\left(\dfrac{2.5}{36.41}, \dfrac{3.0}{5.07}\right)$ $\quad = \text{MAX}\,(0.069, 0.592)$ $\quad = 0.592$	**Pass**

3   3D Views

(a) 3D View

(b) Top View

(c) Side View

(d) Front View

4   Design Log

2024-12-28 16:11:12 - Osdag - INFO - Provided appropriate design preference, now checking input.

2024-12-28 16:11:14 - Osdag - INFO - The effective sectional area is taken as 100% of the cross-sectional area [Reference: Cl. 7.3.2, IS 800:2007].

2024-12-28 16:11:23 - Osdag - INFO - The section is Plastic. The LB 75 section has Plastic flange(5.0) and Plastic web(14.05). [Reference: Cl 3.7, IS 800:2007].