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Company Name		Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	15 /12 /2023	Client	

1 Input Parameters

Module	Flexural Members - Simply Supported
Shear Force (kN)	50.0
Bending Moment (kNm)(M_{z-z})	50.0
Effective Span (m)	1000.0
Section Profile*	Beams
Section Size*	Ref List of Input Section
Material	E 250 (Fe 410 W)A
Support Type	Major Laterally Supported
End Conditions	Simply Supported
Ultimate Strength, F_u (MPa)	410
Yield Strength, F_y (MPa)	250
End Conditions - Simply Supported	
Torsional restraint	Fully Restrained
Warping restraint	Both flanges fully restrained
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*	<p>JB 150JB 175JB 200JB 225LB 75LB 100LB(P) 100LB 125LB 150LB 175LB(P) 175LB 200LB(P) 200LB 225LB 250LB 275LB 300LB(P) 300LB 325LB 350LB 400LB 450LB 500LB 550LB 600MB 100MB 125MB 150MB 175MB 200MB 225MB 250MB 300MB 350MB 400MB 450MB 500MB 550MB 600NPB 100 X 55 X 8.1NPB 120 X 60 X 10.37NPB 140 X 70 X 12.89NPB 160 X 80 X 15.77NPB 180 X 90 X 15.37NPB 180 X 90 X 18.8NPB 180 X 90 X 21.27NPB 200 X 100 X 18.43NPB 200 X 100 X 22.36NPB 200 X 100 X 25.09NPB 200 X 130 X 27.37NPB 200 X 130 X 31.56NPB 200 X 150 X 30.46NPB 200 X 165 X 35.69NPB 200 X 165 X 42.48NPB 200 X 165 X 48.0NPB 220 X 110 X 22.18NPB 220 X 110 X 26.2NPB 220 X 110 X 29.35NPB 240 X 120 X 26.15NPB 240 X 120 X 30.71NPB 240 X 120 X 34.32NPB 250 X 125 X 30.11NPB 250 X 150 X 34.08NPB 250 X 150 X 39.78NPB 250 X 150 X 46.48NPB 250 X 175 X 43.94NPB 270 X 135 X 30.73NPB 270 X 135 X 36.07NPB 270 X 135 X 42.26NPB 300 X 150 X 36.53NPB 300 X 150 X 42.24NPB 300 X 150 X 49.32NPB 300 X 165 X 39.88NPB 300 X 165 X 45.76NPB 300 X 165 X 53.46NPB 300 X 200 X 59.57NPB 300 X 200 X 66.75NPB 300 X 200 X 75.37NPB 330 X 160 X 42.97NPB 330 X 160 X 49.15NPB 330 X 160 X 57.01NPB 350 X 170 X 50.22NPB 350 X 170 X 57.1NPB 350 X 170 X 66.05NPB 350 X 250 X 79.18NPB 400 X 180 X 57.38NPB 400 X 180 X 66.31NPB 400 X 180 X 75.67NPB 400 X 200 X 67.28NPB 450 X190 X 67.16NPB 450 X 190 X 77.58NPB 450 X 190 X 92.37NPB 500 X 200 X 79.36NPB 500 X 200 X 90.69NPB 500 X 200 X 107.32NPB 550 X 210 X 92.08NPB 550 X 210 X 105.52NPB 550 X 210 X 122.52NPB 600 X 220 X 107.57NPB 600 X 220 X 122.45NPB 600 X 220 X 154.47NPB 700 X 250 X 113.46NPB 700 X 250 X 128.41NPB 700 X 250 X 143.42NPB 700 X 250 X 153.87NPB 700 X 250 X 171.48NPB 750 X 270 X 145.29NPB 750 X 270 X 174.54NPB 750 X 270 X 202.49WB 150WB 175WB 200WB 200WB 225WB 250WB 300WB 350WB 400WB 450WB 500WB 550WB 600WB 600WPB 100 X 100 X 12.24WPB 100 X 100 X 16.67WPB 100 X 100 X 20.44WPB 100 X 100 X 41.79WPB 120 X 120 X 14.56WPB 120 X 120 X 19.89WPB 120 X 120 X 26.7WPB 120 X 120 X 52.13WPB 140 X 140 X 18.08WPB 140 X 140 X 24.66WPB 140 X 140 X 33.72WPB 140 X 140 X 63.24WPB 150 X 150 X 23.5WPB 150 X 150 X 30.11WPB 150 X 150 X 36.97WPB 160 X 160 X 22.75WPB 160 X 160 X 30.44WPB 160 X 160 X 42.59WPB 160 X 160 X 76.19WPB 180 X 180 X 28.68WPB 180 X 180 X 35.52WPB 180 X 180 X 51.22WPB 180 X180 X 88.9WPB 200 X 200 X 34.65WPB 200 X 200 X 37.34WPB 200 X 200 X 42.26WPB 200 X 200 X 50.92WPB 200 X 200 X 61.3WPB 200 X 200 X 74.01WPB 200 X 200 X 83.52WPB 200 X 200 X 103.06WPB 220 X 220 X 40.4WPB 220 X 220 X 50.51WPB 220 X 220 X 71.47WPB 220 X 220 X 115.61WPB 240 X 240 X 47.4WPB 240 X 240 X 60.32WPB 240 X 240 X 83.2WPB 240 X 240 X 156.68WPB 250 X 250 X 67.22WPB 250 X 250 X 73.15WPB 250 X 250 X 85.04WPB 250 X 250 X 97.04WPB 250 X 250 X 103.97WPB 250 X 250 X 117.58WPB 250 X 250 X 133.92WPB 250 X 250 X 148.38WPB 260 X 260 X 54.15WPB 260 X 260 X 68.16WPB 260 X 260 X 92.99WPB 260 X 260 X 114.4WPB 260 X 260 X 141.52WPB 260 X 260 X 172.43WPB 280 X 280 X 61.26WPB 280 X 280 X 76.36WPB 280 X 280 X 188.54WPB 280 X 280 X 284.13WPB 300 X 300 X 69.8WPB 300 X 300 X 88.34WPB 300 X 300 X 100.85WPB 300 X 300 X 117.03WPB 300 X 300 X 237.92WPB 320 X 300 X 74.25WPB 320 X 300 X 97.64WPB 320 X 300 X 126.66WPB 320 X 300 X 244.97WPB 340 X 300 X 78.9WPB 340 X 300 X 104.78WPB 340 X 300 X 134.16WPB 340 X 300 X 290.64WPB 360 X 300 X 91.04WPB 360 X 300 X 125.81WPB 360 X 300 X 163.0WPB 360 X 300 X 250.27WPB 360 X 370 X 136.21WPB 360 X 370 X 150.87WPB 360 X 370 X 165.35WPB 360 X 370 X 182.02WPB 360 X 370 X 197.66WPB 400 X 300 X 92.4WPB 400 X 300 X 124.81WPB 400 X 300 X 155.26WPB 400 X 300 X 255.74WPB 400 X 400 X 191.11WPB 400 X 400 X 219.67WPB 400 X 400 X 239.62WPB 450 X 300 X 99.75WPB 450 X 300 X 139.76WPB 450 X 300 X 171.12WPB 450 X 300 X 263.33WPB 500 X 300 X 107.46WPB 500 X 300 X 129.78WPB 500 X 300 X 155.08WPB 500 X 300 X 187.34WPB 500 X 300 X 270.28WPB 550 X 300 X 119.99WPB 550 X 300 X 166.24</p>
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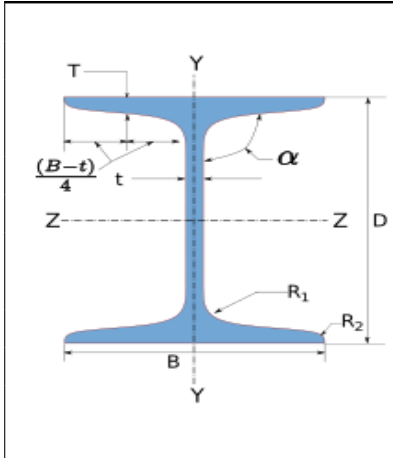
Section Size*	<p>WPB 550 X 300 X 199.44WPB 550 X 300 X 278.19WPB 600 X300 X 128.79WPB 600 X 300 X 177.78WPB 600 X 300 X 211.92WPB 600 X 300 X 285.48WPB 650 X 300 X 137.98WPB 650 X 300 X 189.69WPB 650 X 300 X 224.78WPB 650 X 300 X 293.39WPB 700 X 300 X 149.89WPB 700 X 300 X 204.48WPB 700 X 300 X 240.51WPB 700 X 300 X 300.68WPB 800 X 300 X 171.52WPB 800 X 300 X 224.38WPB 800 X 300 X 262.34WPB 800 X 300 X 317.36WPB 800 X 300 X 179.9WPB 850 X 300 X 195.74WPB 850 X 300 X 214.25WPB 850 X 300 X 230.56WPB 850 X 300 X 253.69WPB 900 X 300 X 198.01WPB 900 X 300 X 251.62WPB 900 X 300 X 291.46UB 1016 x 305 x 222UB 1016 x 305 x 249UB 1016 x 305 x 272UB 1016 x 305 x 314UB 1016 x 305 x 349UB 1016 x 305 x 393UB 1016 x 305 x 437UB 1016 x 305 x 487UB 127 x 76 x 13UB 152 x 89 x 16UB 178 x 102 x 19UB 203 x 102 x 23UB 203 x 133 x 25UB 203 x 133 x 30UB 254 x 102 x 22UB 254 x 102 x 25UB 254 x 102 x 28UB 254 x 146 x 31UB 254 x 146 x 37UB 254 x 146 x 43UB 305 x 102 x 25UB 305 x 102 x 28UB 305 x 102 x 33UB 305 x 127 x 37UB 305 x 127 x 42UB 305 x 127 x 48UB 305 x 165 x 40UB 305 x 165 x 46UB 305 x 165 x 54UB 356 x 127 x 33UB 356 x 127 x 39UB 356 x 171 x 45UB 356 x 171 x 51UB 356 x 171 x 57UB 356 x 171 x 67UB 406 x 140 x 39UB 406 x 140 x 46UB 406 x 178 x 54UB 406 x 178 x 60UB 406 x 178 x 67UB 406 x 178 x 74UB 457 x 152 x 52UB 457 x 152 x 60UB 457 x 152 x 67UB 457 x 152 x 74UB 457 x 152 x 82UB 457 x 191 x 67UB 457 x 191 x 74UB 457 x 191 x 82UB 457 x 191 x 89UB 457 x 191 x 98UB 533 x 210 x 101UB 533 x 210 x 109UB 533 x 210 x 122UB 533 x 210 x 82UB 533 x 210 x 92UB 610 x 229 x 101UB 610 x 229 x 113UB 610 x 229 x 125UB 610 x 229 x 140UB 610 x 305 x 149UB 610 x 305 x 179UB 610 x 305 x 238UB 686 x 254 x 125UB 686 x 254 x 140UB 686 x 254 x 152UB 686 x 254 x 170UB 762 x 267 x 134UB 762 x 267 x 147UB 762 x 267 x 173UB 762 x 267 x 197UB 914 x 305 x 201UB 914 x 305 x 224UB 914 x 305 x 253UB 914 x 305 x 289UB 914 x 419 x 343UB 914 x 419 x 388</p>
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2 Design Checks

Design Status	Pass
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2.1 Selected Member Data

	Section Size*		('UB 203 x 102 x 23', 'Beams')	
	Column Section		UB 203 x 102 x 23	
	Material		E 250 (Fe 410 W)A	
	Mass, m (kg/m)		23.1	
	Area, A (cm ²)	29.4	I_z (cm ⁴)	2105.0
	D (mm)	203.0	I_y (cm ⁴)	164.0
	B (mm)	101.8	r_z (cm)	8.5
	t (mm)	5.4	r_y (cm)	2.4
	T (mm)	9.3	Z_z (cm ³)	207.0
	Flange Slope	90	Z_y (cm ³)	32.0
	R_1 (mm)	7.6	Z_{pz} (cm ³)	234.0
	R_2 (mm)	0.0	Z_{py} (cm ³)	49.8

2.2 Effective Area

Check	Required	Provided	Remarks
Effective Area (mm ²)		= Effective Area Parameter × Area of Section = 1.0 × 2940.0 = 2940.0	

2.3 Section Classification

Check	Required	Provided	Remarks
Web Class	Neutral Axis at Mid-Depth	$\frac{d}{t_w} = \frac{799.6}{5.4} \leq 84\epsilon$ $= 31.33 \leq 84.0$ Plastic	
Flange Class	Rolled	$\frac{d}{t_w} = \frac{50.9}{9.3} \leq 9.4\epsilon$ $= 5.47 \leq 9.4$ Plastic	

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Check	Required	Provided	Remarks
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	$= 67 \times \epsilon$ $= 67 \times 1.0$ $= 67.0$	$= \frac{d_{web}}{t_{web}} = \frac{(D - 2(T + R1))}{t_{web}}$ $= \frac{169.2}{5.4}$ $= 31.33$ [Ref. IS 800:2007, Cl.8.2.1.1]	Pass

2.5 Shear Strength Results

Check	Required	Provided	Remarks
Design Shear Strength (kN)	50.0	$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{203.0 \times 5.4 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 143.84$ [Ref. IS 800:2007, Cl.10.4.3]	Pass
Allowable Shear Capacity (kN)		$V_d = 0.6 V_{dy}$ $= 0.6 \times 143.84$ $= 86.3 > 50.0$ [Limited to low shear]	Low Shear

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2.6 Moment Strength Results





Check	Required	Provided	Remarks
Design Moment Strength (kNm)	50.0	$\beta_b = 1.0$ <i>Section is Plastic or Compact</i> $M_d = \frac{\beta_b Z_p f_y}{\gamma_{m0}} \leq \frac{1.2 Z_e f_y}{\gamma_{m0}}$ $= \frac{1 \times 234000.0 \times 250}{1.1 \times 10^6} \leq \frac{1.2 \times 207000.0 \times 250}{1.1 \times 10^6}$ $= 53.18 \leq 56.45$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass

2.7 Utilization

Check	Required	Provided	Remarks
Utilization Ratio	1.0	$UR = \text{MAX} \left(\frac{\text{Shear Force}}{\text{Shear Strength}}, \frac{\text{Bending Moment}}{\text{Bending Strength}} \right)$ $= \text{MAX} \left(\frac{50.0}{143.84}, \frac{50.0}{53.18} \right)$ $= \text{MAX} (0.348, 0.94)$ $= 0.94$	Pass

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3 3D Views

 <p>(a) 3D View</p>	 <p>(b) Top View</p>
 <p>(c) Side View</p>	 <p>(d) Front View</p>

4 Design Log

2023-12-15 19:08:58 - Osdag - INFO - Provided appropriate design preference, now checking input.

2023-12-15 19:08:59 - Osdag - INFO - The effective sectional area is taken as 100% of the cross-sectional area [Reference: Cl. 7.3.2, IS 800:2007].

2023-12-15 19:08:59 - Osdag - INFO - Section = NPB 700 X 250 X 113.46, $V_{cr} = 776.26$

2023-12-15 19:08:59 - Osdag - INFO - Considering Simple Post Critical

2023-12-15 19:09:00 - Osdag - INFO - The section is Plastic. The UB 203 x 102 x 23 section has Plastic flange(5.47) and Plastic web(31.33). [Reference: Cl 3.7, IS 800:2007].