

Design Calculation Sheet for dsfdsf

Designer: dsfdsf

Location: dsfdsf

City: dfsdf

Country: sdfds

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- Design For Flexural and shear
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Secondary Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
22	(20,4,6)	(20,8,6)	4	0.01	0.01
21	(20,0,6)	(20,4,6)	4	0.01	0.01
2	(0,4,6)	(0,8,6)	4	0.01	0.01
1	(0,0,6)	(0,4,6)	4	0.01	0.01

Design Limit state:

Combo: D+L

Md: 0.01 t.m

Vd: 0.01 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: 0 t/m'

Design Checks

1-Check Local Buckling

$dw/tw = 15.58 < 81.98 \Rightarrow$ Compact Web

$c/tf = 3.06 < 10.91 \Rightarrow$ Compact Flange

2-Check Lateral Torsional Buckling

$Lu_{act} = 0 \text{ m} < Lu_{max} = 59.39 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

$f_{act} = 0.06 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$d_{act} = 0 \text{ cm} < d_{all} = 1.33 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$V_d = 0.01$ ton

$R_{least} = 2.85$ ton

$N = 3$ with Pitch = 63 mm & Full Layout: (31;63 63 31.5)

2-Stresses Induced in Fillet Weld Lines at Plane(1-1)

$f = 0$ t/cm² & $q = 0$ t/cm² $\Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0$ t/cm² $< 1.1 * 0.2F_u = 0.79$ t/cm² \Rightarrow OK

3-Stresses Induced in Fillet Weld Lines at Plane(2-2)

$q = 0$ t/cm² & $q_{mt} = 0$ t/cm² $\Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0$ t/cm² $< 0.2F_u = 0.72$ t/cm² \Rightarrow OK

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0$ t/cm² $< 0.72 * F_y = 1.73$ t/cm² \Rightarrow OK

Plate Layout $\Rightarrow L = 189$ mm & $t_p = 10$ mm & $S_w = 6$ mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
18	(16,4,6)	(16,8,6)	4	2.01	2.01
17	(16,0,6)	(16,4,6)	4	2.01	2.01
20	(18,4,6)	(18,8,6)	4	2.01	2.01
3	(2,0,6)	(2,4,6)	4	2.01	2.01
4	(2,4,6)	(2,8,6)	4	2.01	2.01
5	(4,0,6)	(4,4,6)	4	2.01	2.01
6	(4,4,6)	(4,8,6)	4	2.01	2.01
7	(6,0,6)	(6,4,6)	4	2.01	2.01
8	(6,4,6)	(6,8,6)	4	2.01	2.01

9	(8,0,6)	(8,4,6)	4	2.01	2.01
10	(8,4,6)	(8,8,6)	4	2.01	2.01
19	(18,0,6)	(18,4,6)	4	2.01	2.01
12	(10,4,6)	(10,8,6)	4	2.01	2.01
13	(12,0,6)	(12,4,6)	4	2.01	2.01
14	(12,4,6)	(12,8,6)	4	2.01	2.01
15	(14,0,6)	(14,4,6)	4	2.01	2.01
16	(14,4,6)	(14,8,6)	4	2.01	2.01
11	(10,0,6)	(10,4,6)	4	2.01	2.01

Design Limit state:

Combo: D+L

Md: 2.01 t.m

Vd: 2.01 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -1 t/m'

Design Checks

1-Check Local Buckling

$dw/tw = 27.93 < 81.98 \Rightarrow$ Compact Web

$c/tf = 4.36 < 10.91 \Rightarrow$ Compact Flange

2-Check Lateral Torsional Buckling

$Lu_{act} = 0 \text{ m} < Lu_{max} = 117.48 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

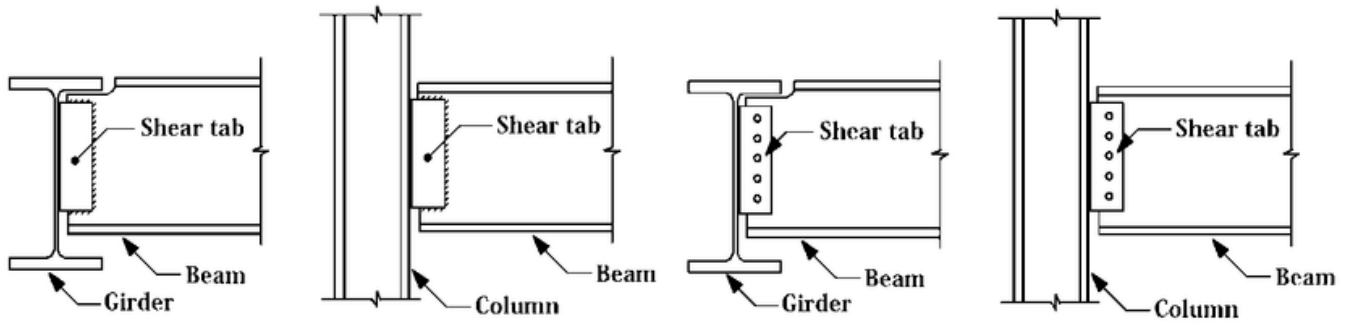
$f_{act} = 1.38 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0.21 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$d_{act} = 1.2 \text{ cm} < d_{all} = 1.33 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$V_d = 2.01$ ton

$R_{least} = 2.85$ ton

$N = 3$ with Pitch = 63 mm & Full Layout: (31;63 63 31.5)

2-Stresses Induced in Fillet Weld Lines at Plane(1-1)

$f = 0.14 \text{ t/cm}^2$ & $q = 0.09 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.21 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$

3-Stresses Induced in Fillet Weld Lines at Plane(2-2)

$q = 0.09 \text{ t/cm}^2$ & $q_{mt} = 0.14 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.17 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0.17 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$

Plate Layout $\Rightarrow L = 189 \text{ mm}$ & $t_p = 10 \text{ mm}$ & $S_w = 6 \text{ mm}$

Main Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
9	(14,8,6)	(20,8,6)	6	4.05	2.03
7	(0,8,6)	(6,8,6)	6	4.05	2.03
3	(14,0,6)	(20,0,6)	6	4.05	2.03
1	(0,0,6)	(6,0,6)	6	4.05	2.03

Design Limit state:

Combo: D+L

Md: 4.05 t.m

Vd: 2.03 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.67 t/m'

Design Checks

1-Check Local Buckling

$d_w/t_w = 32.39 < 81.98 \Rightarrow$ Compact Web

$c/t_f = 4.81 < 10.91 \Rightarrow$ Compact Flange

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 154.92 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

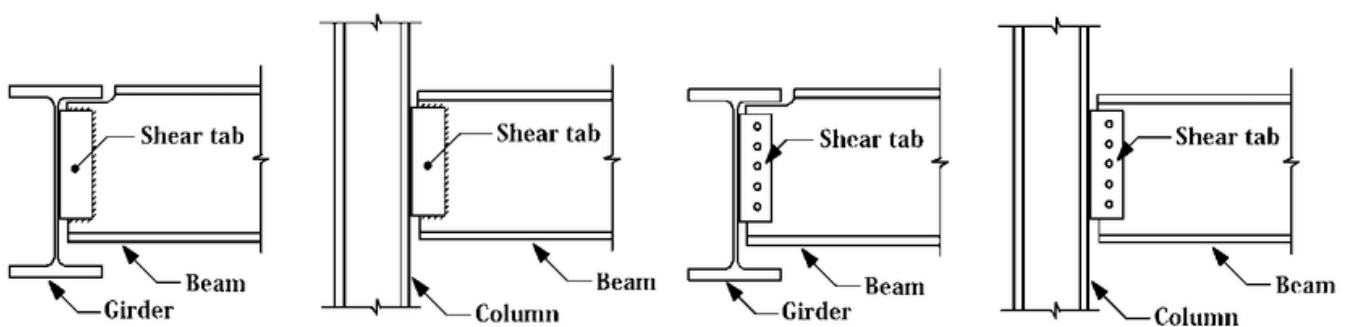
$f_{act} = 1.25 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0.14 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$\delta_{act} = 1.38 \text{ cm} < \delta_{all} = 2 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 2.03 ton

Rleast= 2.85 ton

N= 3 with Pitch= 63 mm & Full Layout: (31;63 63 31.5)

2-Stresses Induced in Fillet Weld Lines at Plane(1-1)

$f = 0.14 \text{ t/cm}^2$ & $q = 0.09 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.21 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$

3-Stresses Induced in Fillet Weld Lines at Plane(2-2)

$q = 0.09 \text{ t/cm}^2$ & $q_{mt} = 0.14 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.17 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0.17 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$

Plate Layout $\Rightarrow L = 189 \text{ mm}$ & $t_p = 10 \text{ mm}$ & $S_w = 6 \text{ mm}$

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
6	(14,4,6)	(20,4,6)	6	8.07	4.04
4	(0,4,6)	(6,4,6)	6	8.07	4.04
8	(6,8,6)	(14,8,6)	8	8.1	3.04
2	(6,0,6)	(14,0,6)	8	8.1	3.04

Design Limit state:

Combo: D+L

Md: 8.1 t.m

Vd: 3.04 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -0.75 t/m'

Design Checks

1-Check Local Buckling

$d_w/t_w = 36.23 < 81.98 \Rightarrow \text{Compact Web}$

$c/t_f = 5.68 < 10.91 \Rightarrow \text{Compact Flange}$

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 193.65 \text{ m} \Rightarrow \text{Supported (No LTB)}$

3-Check Bending Stress

Section: IPE300

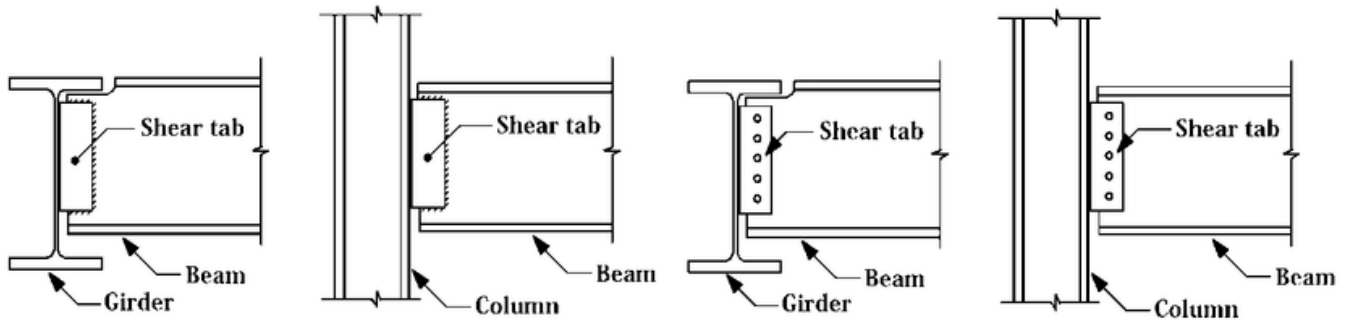
$$fact = 1.45 \text{ t/cm}^2 < Fb = 1.54 \text{ t/cm}^2$$

4-Check Shear Stress

$$qact = 0.14 \text{ t/cm}^2 < qall = 0.84 \text{ t/cm}^2$$

5-Check Deflection

$$dact = 2.28 \text{ cm} < dall = 2.67 \text{ cm}$$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$$Vd = 3.04 \text{ ton}$$

$$Rleast = 3.07 \text{ ton}$$

N = 3 with Pitch = 70 mm & Full Layout: (35;70 70 35)

2-Stresses Induced in Fillet Weld Lines at Plane(1-1)

$$f = 0.17 \text{ t/cm}^2 \text{ \& } q = 0.12 \text{ t/cm}^2 \Rightarrow feq = (f^2 + 3q^2)^{0.5} = 0.27 \text{ t/cm}^2 < 1.1 * 0.2Fu = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$$

3-Stresses Induced in Fillet Weld Lines at Plane(2-2)

$$q = 0.12 \text{ t/cm}^2 \text{ \& } qmt = 0.17 \text{ t/cm}^2 \Rightarrow qres = (q^2 + qmt^2)^{0.5} = 0.21 \text{ t/cm}^2 < 0.2Fu = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$$

4-Check Thickness of Plate

$$f = (6 * Vd * e) / (tp * L^2) = 0.21 \text{ t/cm}^2 < 0.72 * Fy = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$$

Plate Layout \Rightarrow L = 210 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
5	(6,4,6)	(14,4,6)	8	16.14	6.06

Design Limit state:

Combo: D+L

Md: 16.14 t.m

Vd: 6.06 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -1.5 t/m'

Design Checks

1-Check Local Buckling

$d_w/t_w = 40.24 < 81.98 \Rightarrow$ Compact Web

$c/t_f = 5.35 < 10.91 \Rightarrow$ Compact Flange

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 232.38 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE400

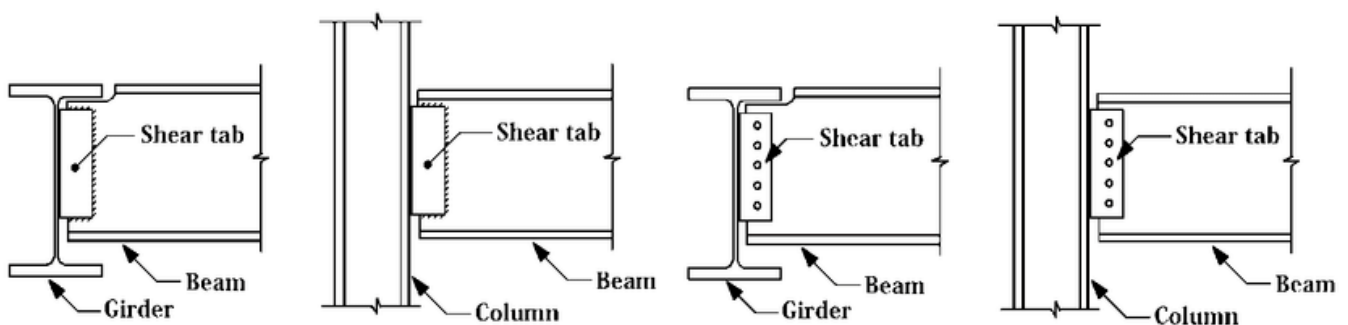
$f_{act} = 1.39 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0.18 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$\delta_{act} = 1.65 \text{ cm} < \delta_{all} = 2.67 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 6.06 ton

Rleast= 3.72 ton

N= 3 with Pitch= 93 mm & Full Layout: (46;93 93 47.5)

2-Stresses Induced in Fillet Weld Lines at Plane(1-1)

$f = 0.19 \text{ t/cm}^2$ & $q = 0.18 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.37 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$

3-Stresses Induced in Fillet Weld Lines at Plane(2-2)

$q = 0.18 \text{ t/cm}^2$ & $q_{mt} = 0.19 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.27 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0.23 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$

Plate Layout $\Rightarrow L = 280 \text{ mm}$ & $t_p = 10 \text{ mm}$ & $S_w = 6 \text{ mm}$

Columns

Column ID	Start Point	End Point	Height (m)	Nmax (ton)
6	(6,4,0)	(6,4,6)	6	-14.16
7	(14,4,0)	(14,4,6)	6	-14.16
2	(6,0,0)	(6,0,6)	6	-7.12
3	(14,0,0)	(14,0,6)	6	-7.12
10	(6,8,0)	(6,8,6)	6	-7.12
11	(14,8,0)	(14,8,6)	6	-7.12
5	(0,4,0)	(0,4,6)	6	-4.1
8	(20,4,0)	(20,4,6)	6	-4.1
1	(0,0,0)	(0,0,6)	6	-2.08
4	(20,0,0)	(20,0,6)	6	-2.08
9	(0,8,0)	(0,8,6)	6	-2.08
12	(20,8,0)	(20,8,6)	6	-2.08

Design Limit state:

Combo: D+L

Nd: -14.16 ton

1-Check Local Buckling

$d_w/t_w = 15.58 < 37.44 \Rightarrow \text{Compact Web}$

$c/t_f = 3.06 < 10.91 \Rightarrow \text{Compact Flange}$

2-Check Normal Stress

Section: IPE80

$\lambda = 571.43 > 100$

$f_c = 1.85 \text{ t/cm}^2 < F_c = 0.02 \text{ t/cm}^2$
