

Design Calculation Sheet for asae

Designer:

Location:

City:

Country:

Date: 2020-06-22 02:47:28

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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)
14	(12,4,3)	(12,8,3)	4	1.08	1.08
13	(12,0,3)	(12,4,3)	4	1.08	1.08
2	(0,4,3)	(0,8,3)	4	1.08	1.08
1	(0,0,3)	(0,4,3)	4	1.08	1.08

Design Limit state:

Combo: $1.4 \cdot D + 1 \cdot L$

Md: 1.08 t.m

Vd: 1.08 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -0.2 t/m'

Design Checks

1-Check Local Buckling

$d_w/t_w = 23.92 < 81.98 \Rightarrow$ Compact Web

$c/t_f = 3.95 < 10.91 \Rightarrow$ Compact Flange

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 94.24 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

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

4-Check Shear Stress

$q_{act} = 0.16 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$d_{act} = 0.59 \text{ cm} < d_{all} = 1.33 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$V_d = 1.08$ 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)

$f = 0.08$ t/cm² & $q = 0.05$ t/cm² $\Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.11$ t/cm² $< 1.1 \cdot 0.2F_u = 0.79$ t/cm² \Rightarrow OK

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

$q = 0.05$ t/cm² & $q_{mt} = 0.08$ t/cm² $\Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.09$ t/cm² $< 0.2F_u = 0.72$ t/cm² \Rightarrow OK

4-Check Thickness of Plate

$f = (6 \cdot V_d \cdot e) / (t_p \cdot L^2) = 0.09$ t/cm² $< 0.72 \cdot F_y = 1.73$ 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)
12	(10,4,3)	(10,8,3)	4	2.14	2.14
11	(10,0,3)	(10,4,3)	4	2.14	2.14
10	(8,4,3)	(8,8,3)	4	2.14	2.14
9	(8,0,3)	(8,4,3)	4	2.14	2.14
8	(6,4,3)	(6,8,3)	4	2.14	2.14
7	(6,0,3)	(6,4,3)	4	2.14	2.14
6	(4,4,3)	(4,8,3)	4	2.14	2.14
5	(4,0,3)	(4,4,3)	4	2.14	2.14
4	(2,4,3)	(2,8,3)	4	2.14	2.14

3	(2,0,3)	(2,4,3)	4	2.14	2.14
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Design Limit state:

Combo: $1.4 \cdot D + 1 \cdot L$

Md: 2.14 t.m

Vd: 2.14 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -0.4 t/m^1

Design Checks

1-Check Local Buckling

$d_w/t_w = 27.93 < 81.98 \Rightarrow$ Compact Web

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

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 117.48 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

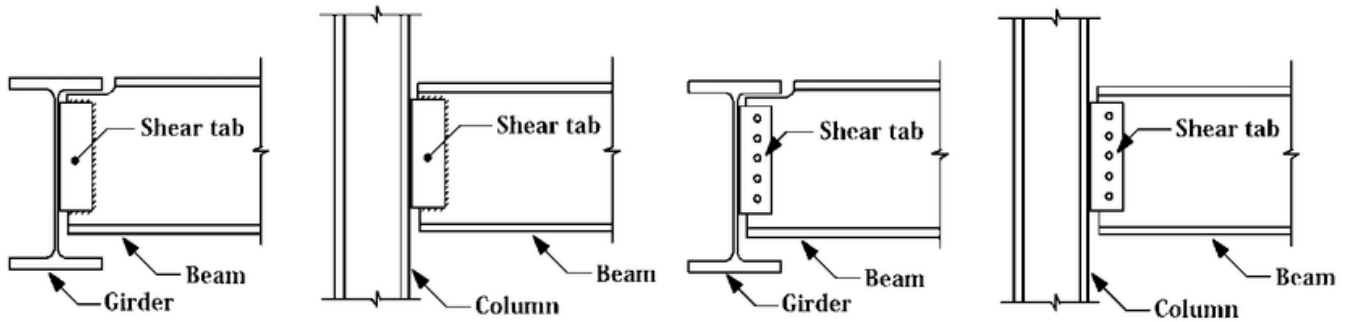
$f_{act} = 1.46 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0.22 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$d_{act} = 0.48 \text{ cm} < d_{all} = 1.33 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$V_d = 2.14$ 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)

$f = 0.15 \text{ t/cm}^2$ & $q = 0.1 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.23 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$

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

$q = 0.1 \text{ t/cm}^2$ & $q_{mt} = 0.15 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.18 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0.18 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$

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)
6	(6,8,3)	(12,8,3)	6	4.31	2.16
5	(0,8,3)	(6,8,3)	6	4.31	2.16
2	(6,0,3)	(12,0,3)	6	4.31	2.16
1	(0,0,3)	(6,0,3)	6	4.31	2.16

Design Limit state:

Combo: $1.4 * D + 1 * L$

$M_d = 4.31 \text{ t.m}$

Vd: 2.16 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.27 t/m'

Design Checks

1-Check Local Buckling

$dw/tw = 32.39 < 81.98 \Rightarrow$ Compact Web

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

2-Check Lateral Torsional Buckling

$Lu_{act} = 0 \text{ m} < Lu_{max} = 154.92 \text{ m} \Rightarrow$ Supported (No LTB)

3-Check Bending Stress

Section: IPE270

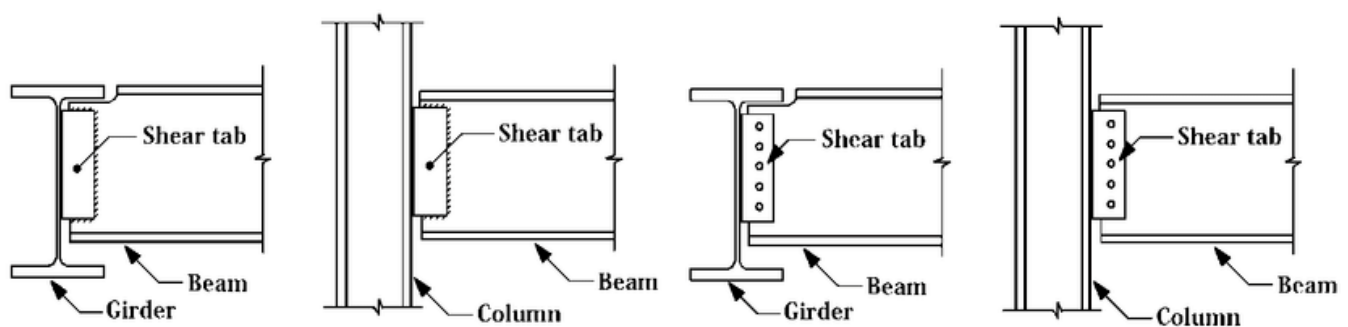
$f_{act} = 1.33 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$q_{act} = 0.15 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$

5-Check Deflection

$d_{act} = 0.55 \text{ cm} < d_{all} = 2 \text{ cm}$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 2.16 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)

$f = 0.15 \text{ t/cm}^2$ & $q = 0.1 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.23 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$

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

$q = 0.1 \text{ t/cm}^2$ & $q_{mt} = 0.15 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.18 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$

4-Check Thickness of Plate

$f = (6 * V_d * e) / (t_p * L^2) = 0.18 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$

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)
4	(6,4,3)	(12,4,3)	6	8.59	4.3
3	(0,4,3)	(6,4,3)	6	8.59	4.3

Design Limit state:

Combo: $1.4 * D + 1 * L$

Md: 8.59 t.m

Vd: 4.3 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.53 t/m'

Design Checks

1-Check Local Buckling

$d_w/t_w = 37.87 < 81.98 \Rightarrow \text{Compact Web}$

$c/t_f = 5.64 < 10.91 \Rightarrow \text{Compact Flange}$

2-Check Lateral Torsional Buckling

$L_{uact} = 0 \text{ m} < L_{umax} = 206.56 \text{ m} \Rightarrow \text{Supported (No LTB)}$

3-Check Bending Stress

Section: IPE330

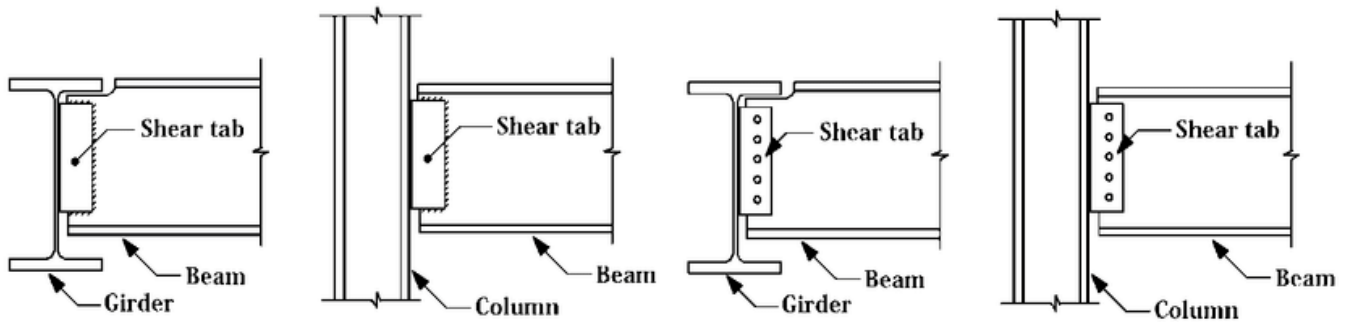
$f_{act} = 1.2 \text{ t/cm}^2 < F_b = 1.54 \text{ t/cm}^2$

4-Check Shear Stress

$$q_{act} = 0.17 \text{ t/cm}^2 < q_{all} = 0.84 \text{ t/cm}^2$$

5-Check Deflection

$$\delta_{act} = 0.36 \text{ cm} < \delta_{all} = 2 \text{ cm}$$



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

$$V_d = 4.3 \text{ ton}$$

$$R_{least} = 3.24 \text{ ton}$$

$$N = 3 \text{ with Pitch} = 77 \text{ mm} \text{ \& Full Layout: (38;77 77 38.5)}$$

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

$$f = 0.2 \text{ t/cm}^2 \text{ \& } q = 0.16 \text{ t/cm}^2 \Rightarrow f_{eq} = (f^2 + 3q^2)^{0.5} = 0.34 \text{ t/cm}^2 < 1.1 * 0.2F_u = 0.79 \text{ t/cm}^2 \Rightarrow \text{OK}$$

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

$$q = 0.16 \text{ t/cm}^2 \text{ \& } q_{mt} = 0.2 \text{ t/cm}^2 \Rightarrow q_{res} = (q^2 + q_{mt}^2)^{0.5} = 0.26 \text{ t/cm}^2 < 0.2F_u = 0.72 \text{ t/cm}^2 \Rightarrow \text{OK}$$

4-Check Thickness of Plate

$$f = (6 * V_d * e) / (t_p * L^2) = 0.24 \text{ t/cm}^2 < 0.72 * F_y = 1.73 \text{ t/cm}^2 \Rightarrow \text{OK}$$

$$\text{Plate Layout} \Rightarrow L = 231 \text{ mm} \text{ \& } t_p = 10 \text{ mm} \text{ \& } S_w = 6 \text{ mm}$$

Columns

Column ID	Start Point	End Point	Height (m)	Nmax (ton)
5	(6,4,0)	(6,4,3)	3	-12.9
2	(6,0,0)	(6,0,3)	3	-6.49
8	(6,8,0)	(6,8,3)	3	-6.49
6	(12,4,0)	(12,4,3)	3	-6.48

4	(0,4,0)	(0,4,3)	3	-6.48
3	(12,0,0)	(12,0,3)	3	-3.26
9	(12,8,0)	(12,8,3)	3	-3.26
1	(0,0,0)	(0,0,3)	3	-3.26
7	(0,8,0)	(0,8,3)	3	-3.26

Design Limit state:

Combo: $1.4 \cdot D + 1 \cdot L$

Nd: -12.9 ton

1-Check Local Buckling

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

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

2-Check Normal Stress

Section: IPE80

$\lambda = 285.71 > 100$

$f_c = 1.69 \text{ t/cm}^2 < F_c = 0.09 \text{ t/cm}^2$
