Design Calculation Sheet for AUTRA03

Designer: Steeler

Location: Cairo

City: Cairo

Country: Egypt

Date: 2020-06-23 02:44:57

Table of Contents

Secondary Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
44	(20,4,3)	(20,8,3)	4	0.04	0.04

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 0.04 t.m

Vd: 0.04 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 => Compact Web

c/tf= 3.06 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 59.39 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

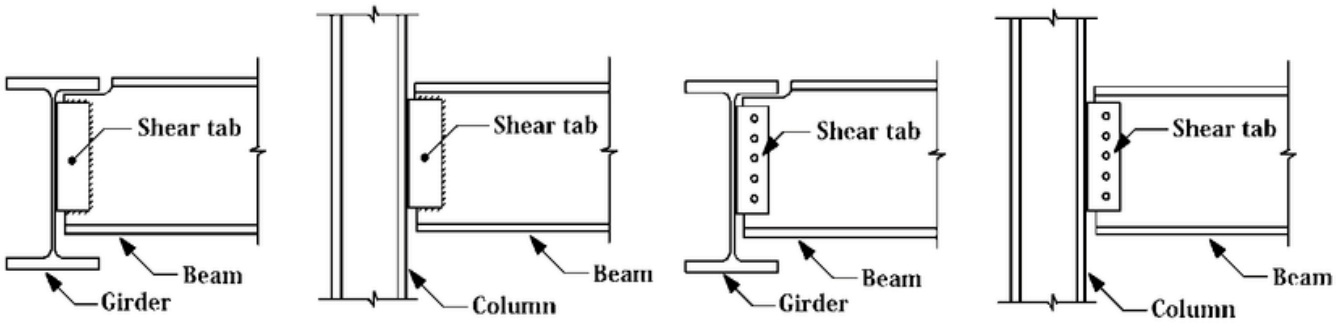
fact= 0.22 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.01 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0 cm < dall= 1.33 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 0.04 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 t/cm^2 & q = 0 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0 t/cm^2 & qmt = 0 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
14	(0,4,3)	(0,8,3)	4	1.04	1.04
40	(18,0,3)	(18,4,3)	4	1.04	1.04
17	(2,4,3)	(2,8,3)	4	1.04	1.04
20	(4,4,3)	(4,8,3)	4	1.04	1.04
34	(14,0,3)	(14,4,3)	4	1.04	1.04
36	(14,8,3)	(14,12,3)	4	1.04	1.04
37	(16,0,3)	(16,4,3)	4	1.04	1.04
39	(16,8,3)	(16,12,3)	4	1.04	1.04
42	(18,8,3)	(18,12,3)	4	1.04	1.04

43	(20,0,3)	(20,4,3)	4	1.04	1.04
45	(20,8,3)	(20,12,3)	4	1.04	1.04
62	(8,10,3)	(12,10,3)	4	1.04	1.04
63	(10,7,3)	(14,7,3)	4	1.04	1.04
64	(10,5,3)	(14,5,3)	4	1.04	1.04
65	(6,6,3)	(10,6,3)	4	1.18	1.18

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 1.18 t.m

Vd: 1.18 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -0.3 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 26.08 < 81.98 => Compact Web

c/tf= 4.21 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 105.86 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

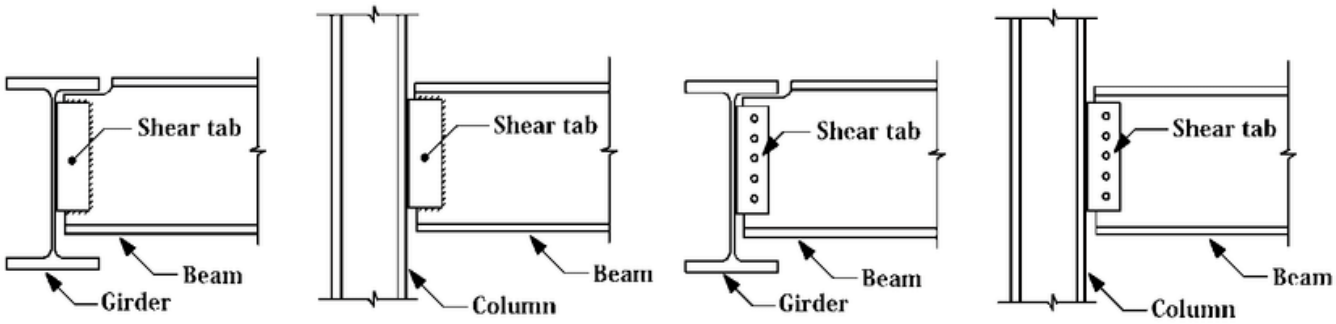
fact= 1.08 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.15 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.55 cm < dall= 1.33 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.18 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 = 0.08 t/cm^2 & q = 0.05 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.12 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.05 t/cm^2 & qmt = 0.08 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.1 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.1 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
66	(0,10,3)	(6,10,3)	6	2.41	1.61

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 2.41 t.m

Vd: 1.61 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.3 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 29.65 < 81.98 => Compact Web

c/tf= 4.56 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 129.1 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

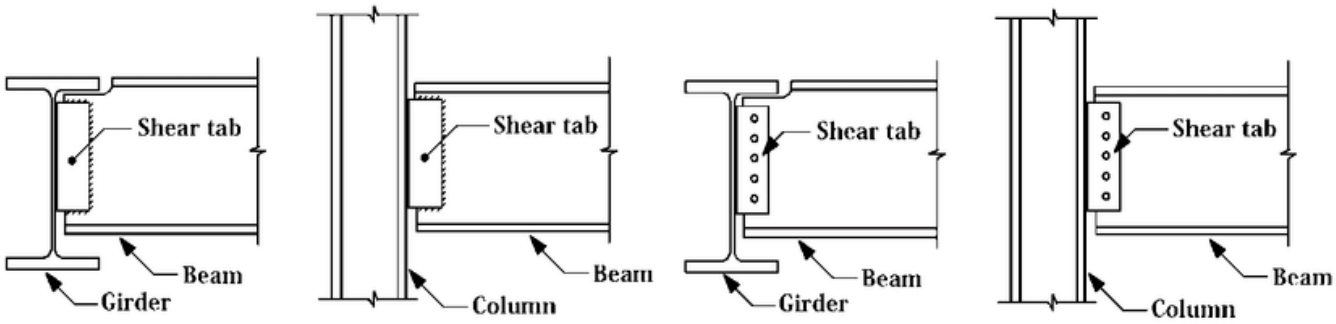
fact= 1.24 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.14 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 1.24 cm < dall= 2 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.61 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 = 0.11 t/cm^2 & q = 0.07 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.17 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.07 t/cm^2 & qmt = 0.11 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.13 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.14 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Main Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
35	(14,4,3)	(14,8,3)	4	1.09	1.09

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 1.09 t.m

Vd: 1.09 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -0.3 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 23.92 < 81.98 => Compact Web

c/tf= 3.95 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 94.24 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

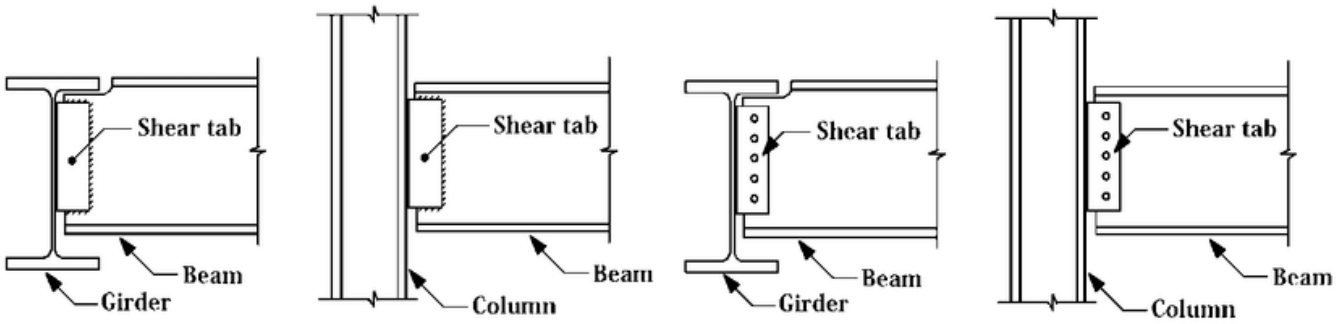
fact= 1.41 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.17 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.88 cm < dall= 1.33 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.09 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 = 0.08 t/cm^2 & q = 0.05 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.11 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.05 t/cm^2 & qmt = 0.08 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.09 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.09 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
24	(6,8,3)	(6,12,3)	4	1.65	0.85
15	(0,8,3)	(0,12,3)	4	1.65	0.85
33	(12,8,3)	(12,12,3)	4	2.09	1.57
27	(8,8,3)	(8,12,3)	4	2.09	1.57
23	(6,4,3)	(6,8,3)	4	2.23	1.64
3	(14,0,3)	(20,0,3)	6	2.25	1.15
12	(14,12,3)	(20,12,3)	6	2.25	1.15
6	(14,4,3)	(20,4,3)	6	2.25	1.15
9	(14,8,3)	(20,8,3)	6	2.25	1.15

4	(0,4,3)	(6,4,3)	6	2.25	1.15
29	(10,4,3)	(10,8,3)	4	2.27	1.68
10	(0,12,3)	(6,12,3)	6	2.41	1.61

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 2.41 t.m

Vd: 1.61 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.2 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 29.65 < 81.98 => Compact Web

c/tf= 4.56 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 129.1 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

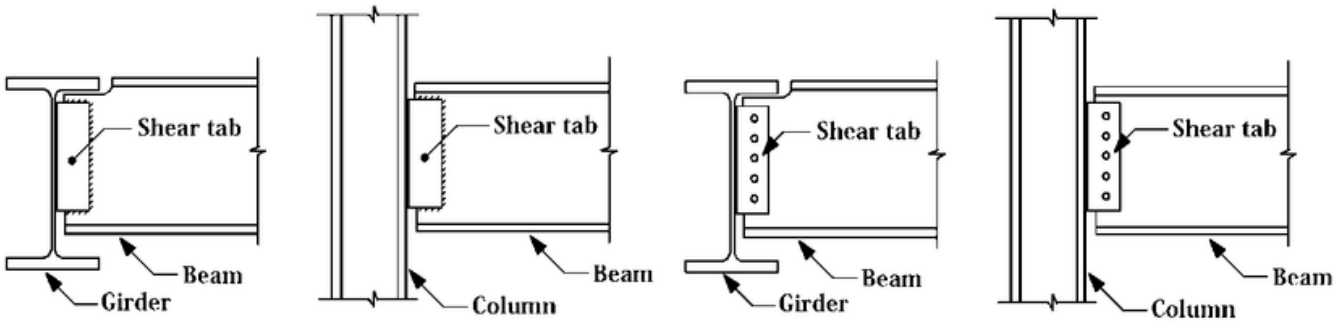
fact= 1.24 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.14 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.83 cm < dall= 2 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.61 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 = 0.11 t/cm^2 & q = 0.07 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.17 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.07 t/cm^2 & qmt = 0.11 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.13 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.14 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
7	(0,8,3)	(6,8,3)	6	4.5	2.65

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 4.5 t.m

Vd: 2.65 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.5 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 32.39 < 81.98 => Compact Web

c/tf= 4.81 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 154.92 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

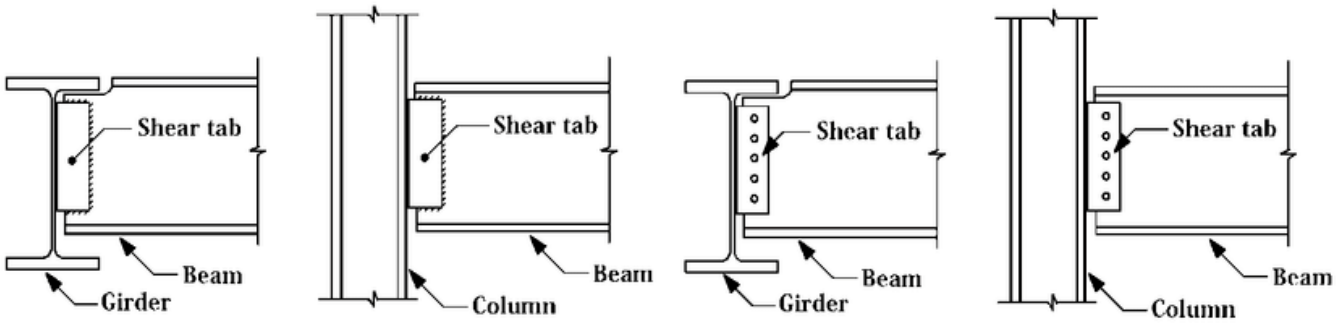
fact= 1.39 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.18 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 1.03 cm < dall= 2 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 2.65 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 = 0.19 t/cm^2 & q = 0.12 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.28 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.12 t/cm^2 & qmt = 0.19 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.22 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.22 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 189 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
11	(6,12,3)	(14,12,3)	8	7.42	3.71
5	(6,4,3)	(14,4,3)	8	7.65	2.98
8	(6,8,3)	(14,8,3)	8	10.78	4.55

Design Limit state:

Combo: 1*Dead + 1*Live

Md: 10.78 t.m

Vd: 4.55 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -0.52 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 37.87 < 81.98 => Compact Web

c/tf= 5.64 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 206.56 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE330

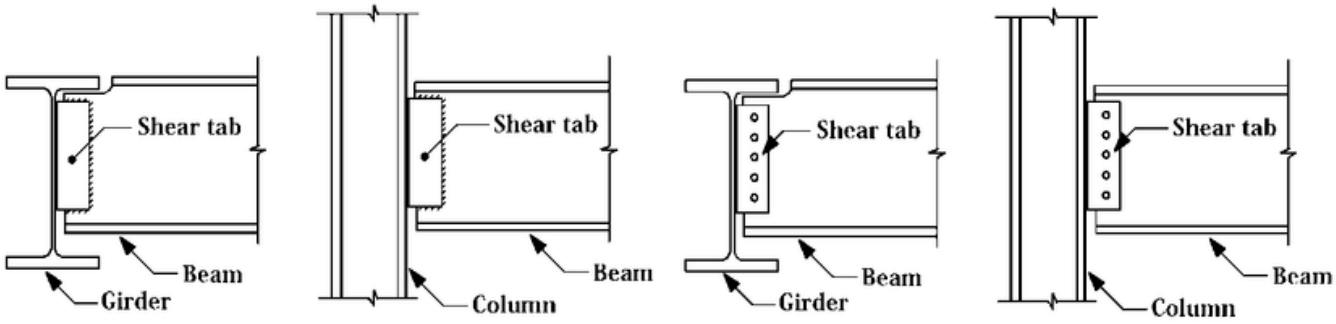
fact= 1.51 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.18 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 1.13 cm < dall= 2.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 4.55 ton

Rleast= 3.24 ton

N= 3 with Pitch= 77 mm & Full Layout: (38;77 77 38.5)

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

f = 0.21 t/cm^2 & q = 0.17 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.36 t/cm^2 < 1.1 * 0.2Fu = 0.79 t/cm^2 => OK

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

q = 0.17 t/cm^2 & qmt = 0.21 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.27 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.26 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 231 mm & tp = 10 mm & Sw = 6 mm

Columns

Column ID	Start Point	End Point	Height (m)	Nmax (ton)
55	(6,8,0)	(6,8,3)	3	-9.82
56	(14,8,0)	(14,8,3)	3	-7.97
52	(14,4,0)	(14,4,3)	3	-6.4
59	(6,12,0)	(6,12,3)	3	-6.3
60	(14,12,0)	(14,12,3)	3	-6.04
51	(6,4,0)	(6,4,3)	3	-5.9

54	(0,8,0)	(0,8,3)	3	-4.67
58	(0,12,0)	(0,12,3)	3	-2.58
53	(20,4,0)	(20,4,3)	3	-2.37
57	(20,8,0)	(20,8,3)	3	-2.37
48	(14,0,0)	(14,0,3)	3	-2.32
49	(20,0,0)	(20,0,3)	3	-2.32
50	(0,4,0)	(0,4,3)	3	-2.32
61	(20,12,0)	(20,12,3)	3	-2.32

Design Limit state:

Combo: 1*Dead + 1*Live

Nd: -9.82 ton

1-Check Local Buckling

dw/tw= 36.23 < 37.44 => Compact Web

c/tf= 5.68 < 10.91 => Compact Flange

2-Check Normal Stress

Section: IPE300

lambda = 89.55 < 100

fc= 0.18 t/cm^2 < Fc= 0.88 t/cm^2
