Design Calculation Sheet for lklml

Designer:

Location:

City:

Country: lk

Date: 2020-06-21 08:43:41

Table of Contents

Secondary Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
45	(10,23.7,3)	(15,23.7,3)	5	1.64	1.31
44	(5,23.7,3)	(10,23.7,3)	5	1.64	1.31
43	(0,23.7,3)	(5,23.7,3)	5	1.64	1.31
2	(5,0,3)	(10,0,3)	5	1.87	1.5
3	(10,0,3)	(15,0,3)	5	1.87	1.5
1	(0,0,3)	(5,0,3)	5	1.87	1.5

Design Limit state:

Combo: D+L

Md: 1.87 t.m

Vd: 1.5 ton

Service Limit State

Combo: LIVE

Span: 5 m

Load: -0.32 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 27.93 < 81.98 => Compact Web

c/tf= 4.36 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 117.48 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

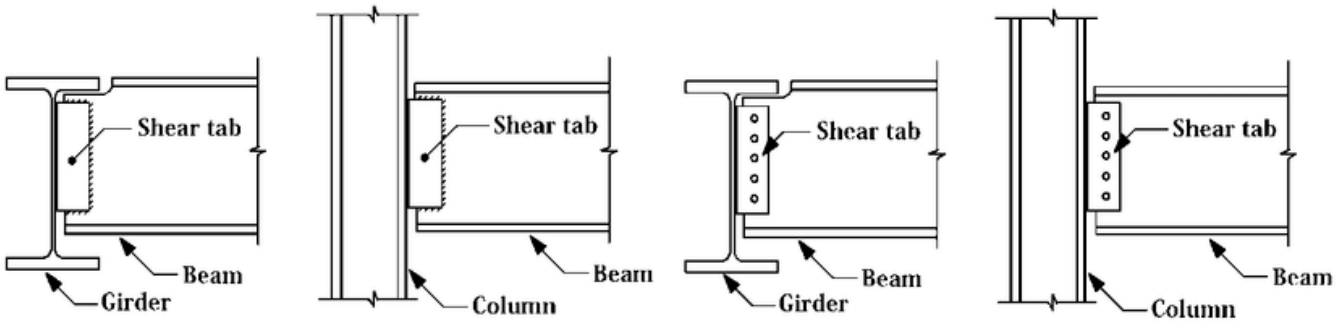
fact= 1.28 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.16 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.95 cm < dall= 1.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.5 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 = 0.1 t/cm^2 & q = 0.07 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.16 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 = 0.1 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) = 0.13 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)
39	(10,21.1,3)	(15,21.1,3)	5	3.16	2.53
37	(0,21.1,3)	(5,21.1,3)	5	3.16	2.53
36	(10,19.8,3)	(15,19.8,3)	5	3.16	2.53
35	(5,19.8,3)	(10,19.8,3)	5	3.16	2.53
34	(0,19.8,3)	(5,19.8,3)	5	3.16	2.53
38	(5,21.1,3)	(10,21.1,3)	5	3.16	2.53
40	(0,22.4,3)	(5,22.4,3)	5	3.16	2.53
42	(10,22.4,3)	(15,22.4,3)	5	3.16	2.53
41	(5,22.4,3)	(10,22.4,3)	5	3.16	2.53

6	(10,1.5,3)	(15,1.5,3)	5	3.63	2.9
9	(10,3,3)	(15,3,3)	5	3.63	2.9
8	(5,3,3)	(10,3,3)	5	3.63	2.9
7	(0,3,3)	(5,3,3)	5	3.63	2.9
5	(5,1.5,3)	(10,1.5,3)	5	3.63	2.9
4	(0,1.5,3)	(5,1.5,3)	5	3.63	2.9
31	(0,18.5,3)	(5,18.5,3)	5	3.98	3.18
32	(5,18.5,3)	(10,18.5,3)	5	3.98	3.18
33	(10,18.5,3)	(15,18.5,3)	5	3.98	3.18
10	(0,4.5,3)	(5,4.5,3)	5	4.21	3.37
11	(5,4.5,3)	(10,4.5,3)	5	4.21	3.37
12	(10,4.5,3)	(15,4.5,3)	5	4.21	3.37

Design Limit state:

Combo: D+L

Md: 4.21 t.m

Vd: 3.37 ton

Service Limit State

Combo: LIVE

Span: 5 m

Load: -0.65 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

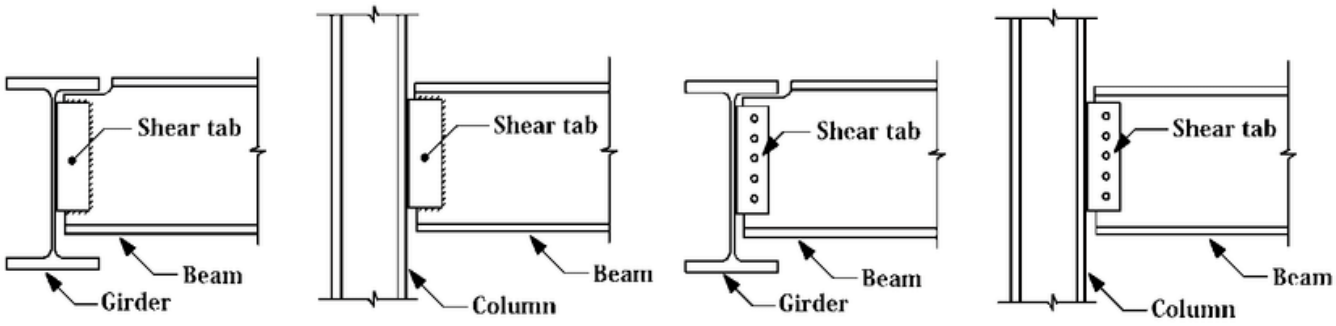
fact= 1.3 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.23 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.65 cm < dall= 1.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 3.37 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 = 0.24 t/cm^2 & q = 0.15 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 = 0.15 t/cm^2 & qmt = 0.24 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.28 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.28 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)
15	(10,6.5,3)	(15,6.5,3)	5	4.8	3.84
13	(0,6.5,3)	(5,6.5,3)	5	4.8	3.84
14	(5,6.5,3)	(10,6.5,3)	5	4.8	3.84
20	(5,10.5,3)	(10,10.5,3)	5	4.8	3.84
16	(0,8.5,3)	(5,8.5,3)	5	4.8	3.84
17	(5,8.5,3)	(10,8.5,3)	5	4.8	3.84

18	(10,8.5,3)	(15,8.5,3)	5	4.8	3.84
19	(0,10.5,3)	(5,10.5,3)	5	4.8	3.84
21	(10,10.5,3)	(15,10.5,3)	5	4.8	3.84
22	(0,12.5,3)	(5,12.5,3)	5	4.8	3.84
24	(10,12.5,3)	(15,12.5,3)	5	4.8	3.84
25	(0,14.5,3)	(5,14.5,3)	5	4.8	3.84
26	(5,14.5,3)	(10,14.5,3)	5	4.8	3.84
27	(10,14.5,3)	(15,14.5,3)	5	4.8	3.84
28	(0,16.5,3)	(5,16.5,3)	5	4.8	3.84
29	(5,16.5,3)	(10,16.5,3)	5	4.8	3.84
30	(10,16.5,3)	(15,16.5,3)	5	4.8	3.84
23	(5,12.5,3)	(10,12.5,3)	5	4.8	3.84

Design Limit state:

Combo: D+L

Md: 4.8 t.m

Vd: 3.84 ton

Service Limit State

Combo: LIVE

Span: 5 m

Load: -1 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 34.73 < 81.98 => Compact Web

c/tf= 5.3 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 174.28 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

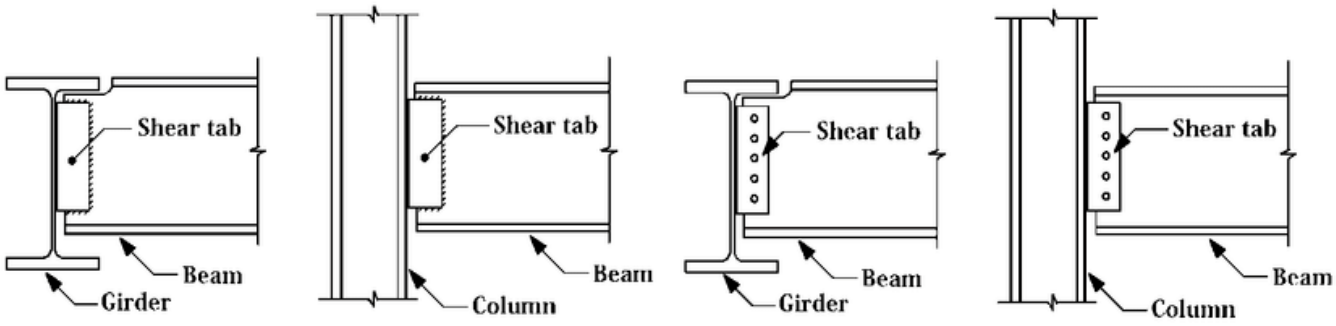
fact= 1.12 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.22 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.67 cm < dall= 1.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 3.84 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 = 0.27 t/cm^2 & q = 0.17 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.4 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 = 0.27 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.32 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.32 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)
13	(15,0,3)	(15,4.5,3)	4.5	4.45	2.98
1	(0,0,3)	(0,4.5,3)	4.5	4.45	2.98

Design Limit state:

Combo: D+L

Md: 4.45 t.m

Vd: 2.98 ton

Service Limit State

Combo: LIVE

Span: 4.5 m

Load: -0.83 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

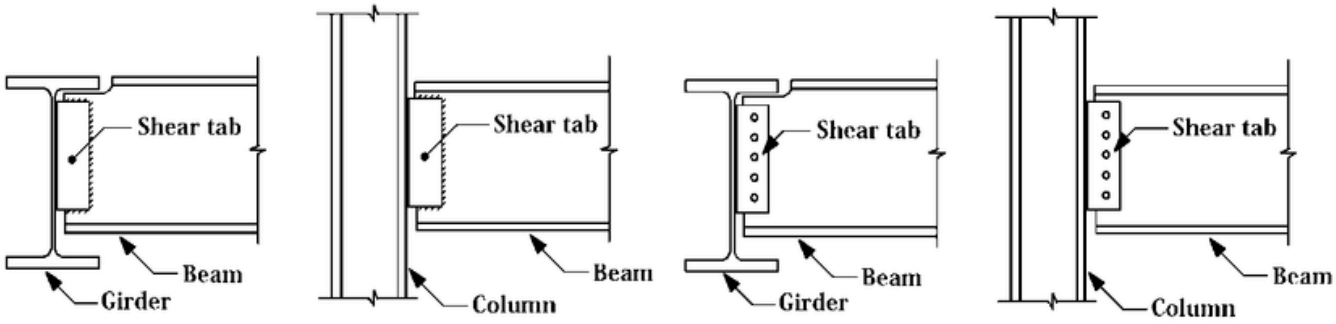
fact= 1.37 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.2 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.54 cm < dall= 1.5 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 2.98 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 = 0.21 t/cm^2 & q = 0.14 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.31 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 = 0.14 t/cm^2 & qmt = 0.21 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.25 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.25 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)
16	(15,18.5,3)	(15,23.7,3)	5.2	6.69	3.89
4	(0,18.5,3)	(0,23.7,3)	5.2	6.69	3.89
14	(15,4.5,3)	(15,10.5,3)	6	7.84	3.95
2	(0,4.5,3)	(0,10.5,3)	6	7.84	3.95
9	(10,0,3)	(10,4.5,3)	4.5	8.8	5.89
5	(5,0,3)	(5,4.5,3)	4.5	8.8	5.89

Design Limit state:

Combo: D+L

Md: 8.8 t.m

Vd: 5.89 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.83 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

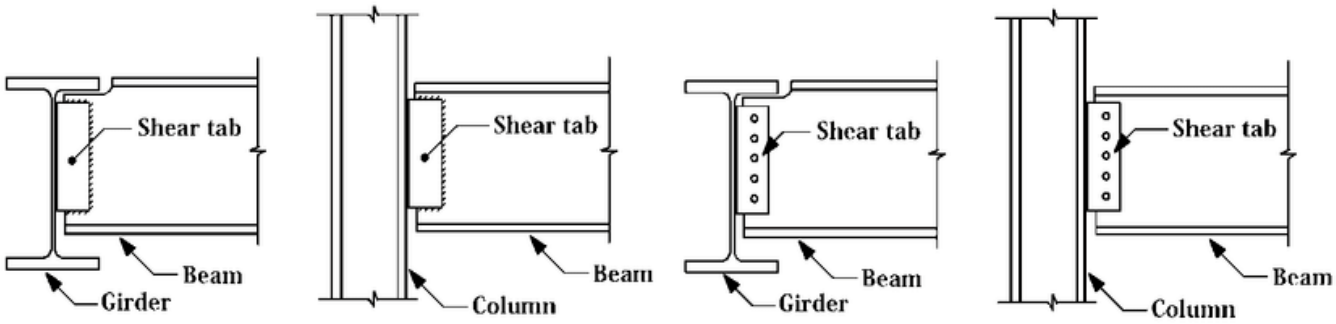
fact= 1.23 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.24 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.57 cm < dall= 2 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 5.89 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 = 0.28 t/cm^2 & q = 0.22 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.47 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 = 0.22 t/cm^2 & qmt = 0.28 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.35 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.33 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

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

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)

12	(10,18.5,3)	(10,23.7,3)	5.2	13.27	7.68
8	(5,18.5,3)	(5,23.7,3)	5.2	13.27	7.68
10	(10,4.5,3)	(10,10.5,3)	6	15.52	7.79
6	(5,4.5,3)	(5,10.5,3)	6	15.52	7.79
15	(15,10.5,3)	(15,18.5,3)	8	15.65	5.9
3	(0,10.5,3)	(0,18.5,3)	8	15.65	5.9

Design Limit state:

Combo: D+L

Md: 15.65 t.m

Vd: 5.9 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -0.94 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 40.24 < 81.98 => Compact Web

c/tf= 5.35 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 232.38 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE400

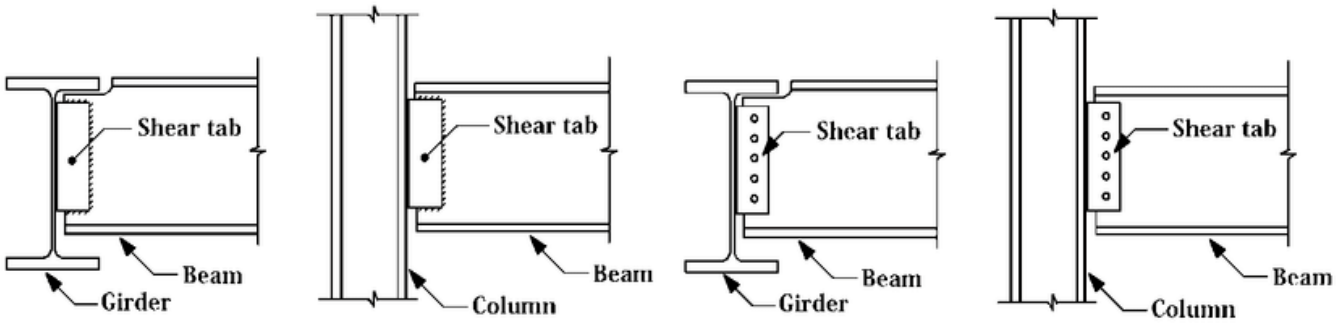
fact= 1.35 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 1.03 cm < dall= 2.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 5.9 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 t/cm^2 & q = 0.18 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 = 0.18 t/cm^2 & qmt = 0.19 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.26 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.23 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 280 mm & tp = 10 mm & Sw = 6 mm

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
11	(10,10.5,3)	(10,18.5,3)	8	31.01	11.67
7	(5,10.5,3)	(5,18.5,3)	8	31.01	11.67

Design Limit state:

Combo: D+L

Md: 31.01 t.m

Vd: 11.67 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -1.88 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 43.36 < 81.98 => Compact Web

c/tf= 4.79 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 271.11 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE550

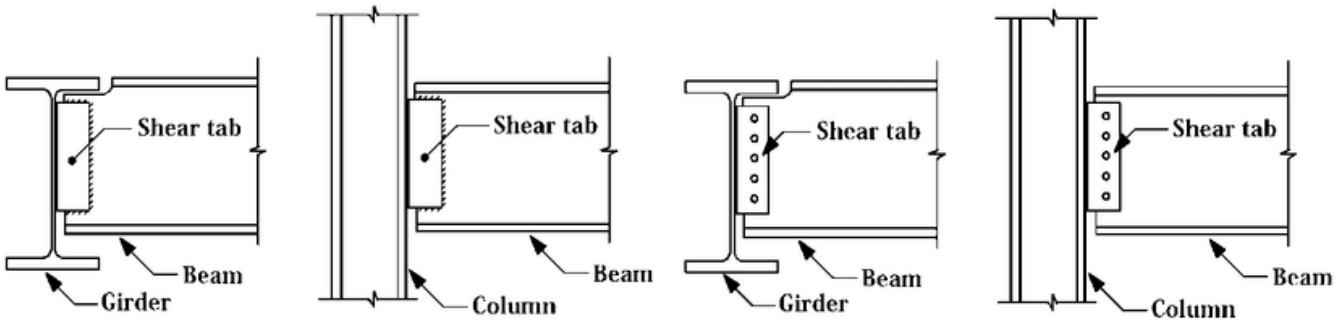
fact= 1.27 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

qact= 0.19 t/cm^2 < qall= 0.84 t/cm^2

5-Check Deflection

dact= 0.71 cm < dall= 2.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 11.67 ton

Rleast= 4.8 ton

N= 4 with Pitch= 80 mm & Full Layout: (40;80 80 80 40)

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

f = 0.28 t/cm^2 & q = 0.31 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.6 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 = 0.31 t/cm^2 & qmt = 0.28 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.42 t/cm^2 < 0.2Fu = 0.72 t/cm^2 => OK

4-Check Thickness of Plate

f = (6*Vd*e)/(tp*L^2) = 0.34 t/cm^2 < 0.72*Fy = 1.73 t/cm^2 => OK

Plate Layout => L = 320 mm & tp = 10 mm & Sw = 6 mm

Columns

Column ID	Start Point	End Point	Height (m)	Nmax (ton)
8	(5,10.5,0)	(5,10.5,3)	3	-27.26
13	(10,10.5,0)	(10,10.5,3)	3	-27.26
9	(5,18.5,0)	(5,18.5,3)	3	-25.84
14	(10,18.5,0)	(10,18.5,3)	3	-25.84
7	(5,4.5,0)	(5,4.5,3)	3	-20.55
12	(10,4.5,0)	(10,4.5,3)	3	-20.55
3	(0,10.5,0)	(0,10.5,3)	3	-13.82
18	(15,10.5,0)	(15,10.5,3)	3	-13.82
4	(0,18.5,0)	(0,18.5,3)	3	-13.1
19	(15,18.5,0)	(15,18.5,3)	3	-13.1
2	(0,4.5,0)	(0,4.5,3)	3	-10.43
17	(15,4.5,0)	(15,4.5,3)	3	-10.43
10	(5,23.7,0)	(5,23.7,3)	3	-10.42
15	(10,23.7,0)	(10,23.7,3)	3	-10.42
6	(5,0,0)	(5,0,3)	3	-9.01
11	(10,0,0)	(10,0,3)	3	-9.01
20	(15,23.7,0)	(15,23.7,3)	3	-5.32
5	(0,23.7,0)	(0,23.7,3)	3	-5.32
16	(15,0,0)	(15,0,3)	3	-4.61
1	(0,0,0)	(0,0,3)	3	-4.61

Design Limit state:

Combo: D+L

Nd: -27.26 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= 0.51 t/cm^2 < Fc= 0.88 t/cm^2
