Design Calculation Sheet for ITI40

Designer: Civil

Location: Alex

City: Alex

Country: Japan

Date: 2020-06-20 08:43:49

Table of Contents

Secondary Beams

Beam ID	Start Point	End Point	Span (m)	Mmax (t.m)	Vmax (ton)
22	(20,4,6)	(20,8,6)	4	1.54	1.54
21	(20,0,6)	(20,4,6)	4	1.54	1.54
2	(0,4,6)	(0,8,6)	4	1.54	1.54
1	(0,0,6)	(0,4,6)	4	1.54	1.54

Design Limit state:

Combo: D+L

Md: 1.54 t.m

Vd: 1.54 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -0.5 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

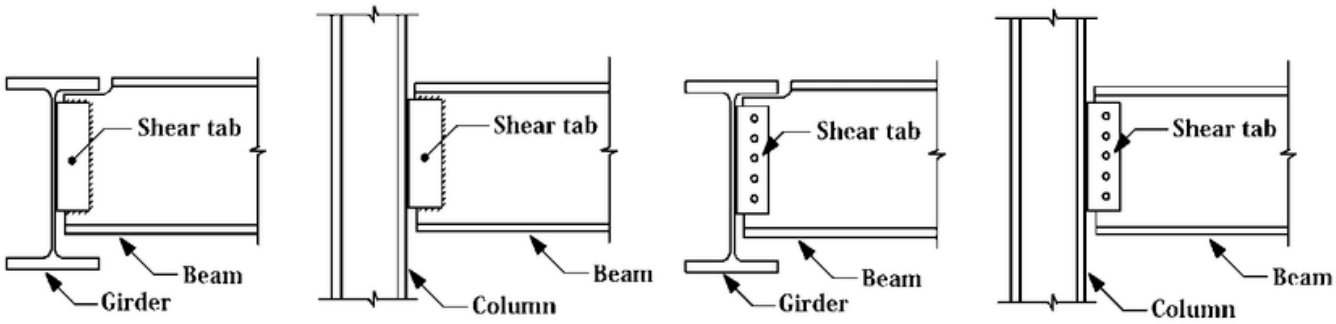
fact= 1.42 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 0.91 cm < dall= 1.33 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 1.54 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 = 0.16 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 = 0.11 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) = 0.13 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)
18	(16,4,6)	(16,8,6)	4	3.04	3.04
17	(16,0,6)	(16,4,6)	4	3.04	3.04
20	(18,4,6)	(18,8,6)	4	3.04	3.04
3	(2,0,6)	(2,4,6)	4	3.04	3.04
4	(2,4,6)	(2,8,6)	4	3.04	3.04
5	(4,0,6)	(4,4,6)	4	3.04	3.04
6	(4,4,6)	(4,8,6)	4	3.04	3.04
7	(6,0,6)	(6,4,6)	4	3.04	3.04
8	(6,4,6)	(6,8,6)	4	3.04	3.04

9	(8,0,6)	(8,4,6)	4	3.04	3.04
10	(8,4,6)	(8,8,6)	4	3.04	3.04
19	(18,0,6)	(18,4,6)	4	3.04	3.04
12	(10,4,6)	(10,8,6)	4	3.04	3.04
13	(12,0,6)	(12,4,6)	4	3.04	3.04
14	(12,4,6)	(12,8,6)	4	3.04	3.04
15	(14,0,6)	(14,4,6)	4	3.04	3.04
16	(14,4,6)	(14,8,6)	4	3.04	3.04
11	(10,0,6)	(10,4,6)	4	3.04	3.04

Design Limit state:

Combo: D+L

Md: 3.04 t.m

Vd: 3.04 ton

Service Limit State

Combo: LIVE

Span: 4 m

Load: -1 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 31.06 < 81.98 => Compact Web

c/tf= 4.66 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 142.01 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE270

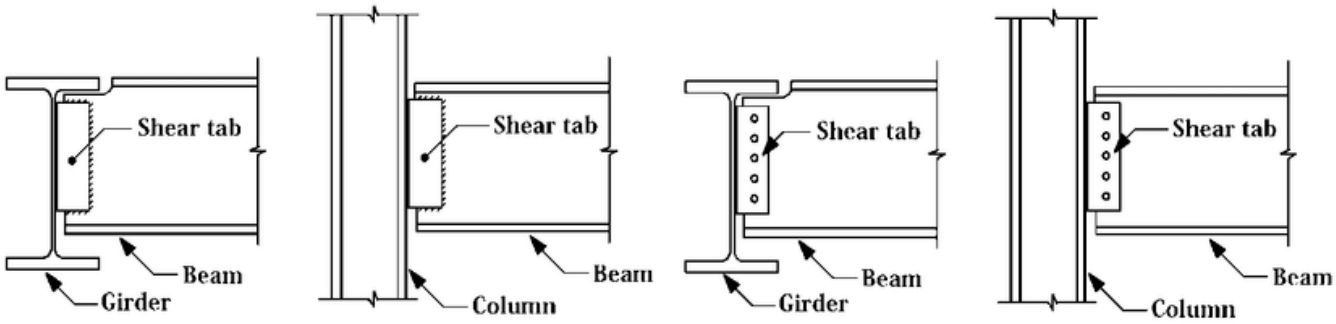
fact= 1.21 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 0.57 cm < dall= 1.33 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 3.04 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 = 0.21 t/cm^2 & q = 0.14 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.32 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) = 0.26 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)
9	(14,8,6)	(20,8,6)	6	6.25	3.15
7	(0,8,6)	(6,8,6)	6	6.25	3.15
3	(14,0,6)	(20,0,6)	6	6.25	3.15
1	(0,0,6)	(6,0,6)	6	6.25	3.15

Design Limit state:

Combo: D+L

Md: 6.25 t.m

Vd: 3.15 ton

Service Limit State

Combo: LIVE

Span: 6 m

Load: -0.67 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

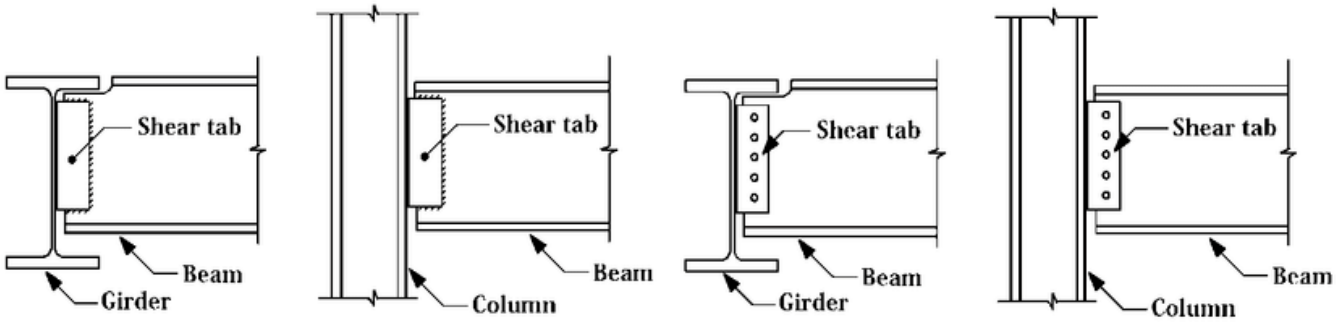
fact= 1.46 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 0.93 cm < dall= 2 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 3.15 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 = 0.22 t/cm^2 & q = 0.14 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.33 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 = 0.22 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) = 0.26 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)
6	(14,4,6)	(20,4,6)	6	12.34	6.2
4	(0,4,6)	(6,4,6)	6	12.34	6.2
8	(6,8,6)	(14,8,6)	8	12.47	4.71
2	(6,0,6)	(14,0,6)	8	12.47	4.71

Design Limit state:

Combo: D+L

Md: 12.47 t.m

Vd: 4.71 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -0.75 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 38.65 < 81.98 => Compact Web

c/tf= 5.38 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 219.47 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE360

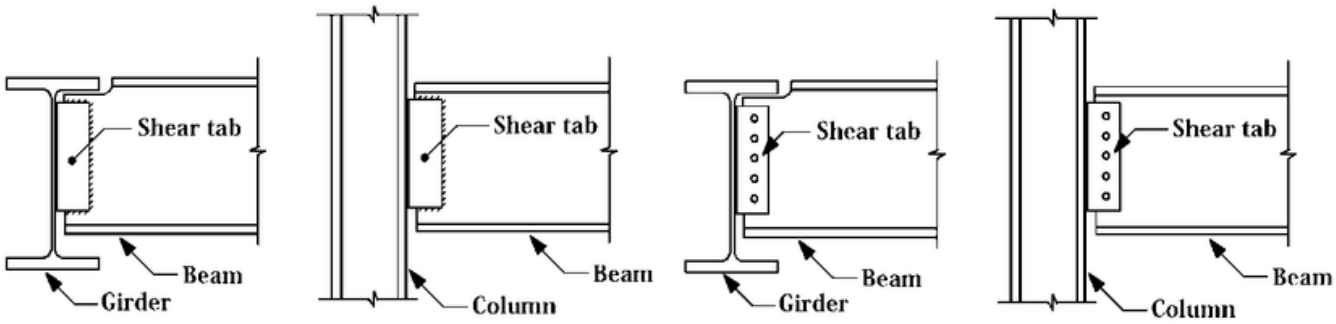
fact= 1.38 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 1.17 cm < dall= 2.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 4.71 ton

Rleast= 3.46 ton

N= 3 with Pitch= 84 mm & Full Layout: (42;84 84 42)

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

f = 0.19 t/cm^2 & q = 0.16 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.33 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 = 0.16 t/cm^2 & qmt = 0.19 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.24 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 = 252 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	24.65	9.28

Design Limit state:

Combo: D+L

Md: 24.65 t.m

Vd: 9.28 ton

Service Limit State

Combo: LIVE

Span: 8 m

Load: -1.5 t/m'

Design Checks

1-Check Local Buckling

dw/tw= 42.75 < 81.98 => Compact Web

c/tf= 4.94 < 10.91 => Compact Flange

2-Check Lateral Torsional Buckling

Luact= 0 m < Lumax= 258.2 m => Supported (No LTB)

3-Check Bending Stress

Section: IPE500

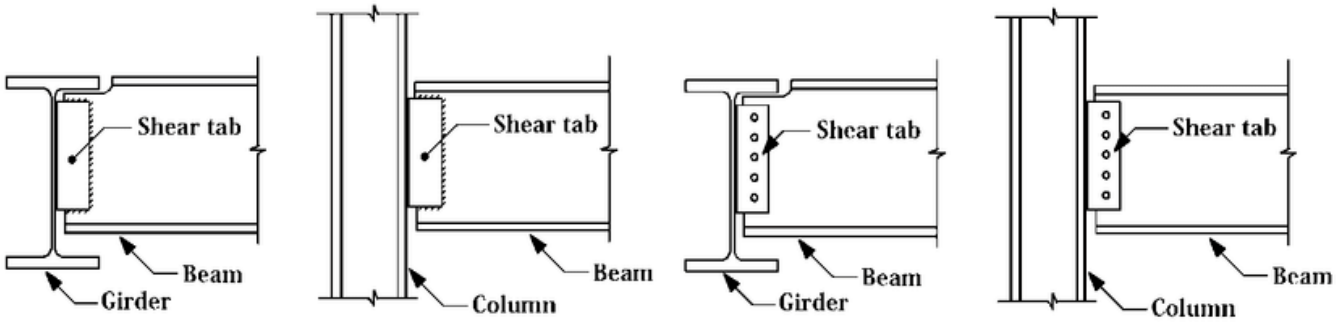
fact= 1.28 t/cm^2 < Fb= 1.54 t/cm^2

4-Check Shear Stress

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

5-Check Deflection

dact= 0.79 cm < dall= 2.67 cm



Group Connection Design (Simple Shear Plate Connection)

1-Bolts Design

Bolts: M20 of Grade 8.8

Vd= 9.28 ton

Rleast= 4.41 ton

N= 3 with Pitch= 116 mm & Full Layout: (58;116 116 60)

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

f = 0.19 t/cm^2 & q = 0.22 t/cm^2 => feq = (f^2 + 3q^2)^0.5 = 0.43 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 = 0.19 t/cm^2 => qres = (q^2 + qmt^2)^0.5 = 0.29 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 = 350 mm & tp = 10 mm & Sw = 6 mm

Columns

Column ID	Start Point	End Point	Height (m)	Nmax (ton)
6	(6,4,0)	(6,4,6)	6	-21.82
7	(14,4,0)	(14,4,6)	6	-21.82
2	(6,0,0)	(6,0,6)	6	-11.16
3	(14,0,0)	(14,0,6)	6	-11.16
10	(6,8,0)	(6,8,6)	6	-11.16
11	(14,8,0)	(14,8,6)	6	-11.16
5	(0,4,0)	(0,4,6)	6	-9.54
8	(20,4,0)	(20,4,6)	6	-9.54
4	(20,0,0)	(20,0,6)	6	-4.95
12	(20,8,0)	(20,8,6)	6	-4.95
1	(0,0,0)	(0,0,6)	6	-4.95
9	(0,8,0)	(0,8,6)	6	-4.95

Design Limit state:

Combo: D+L

Nd: -21.82 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 = 179.1 > 100

fc= 0.41 t/cm^2 < Fc= 0.23 t/cm^2
