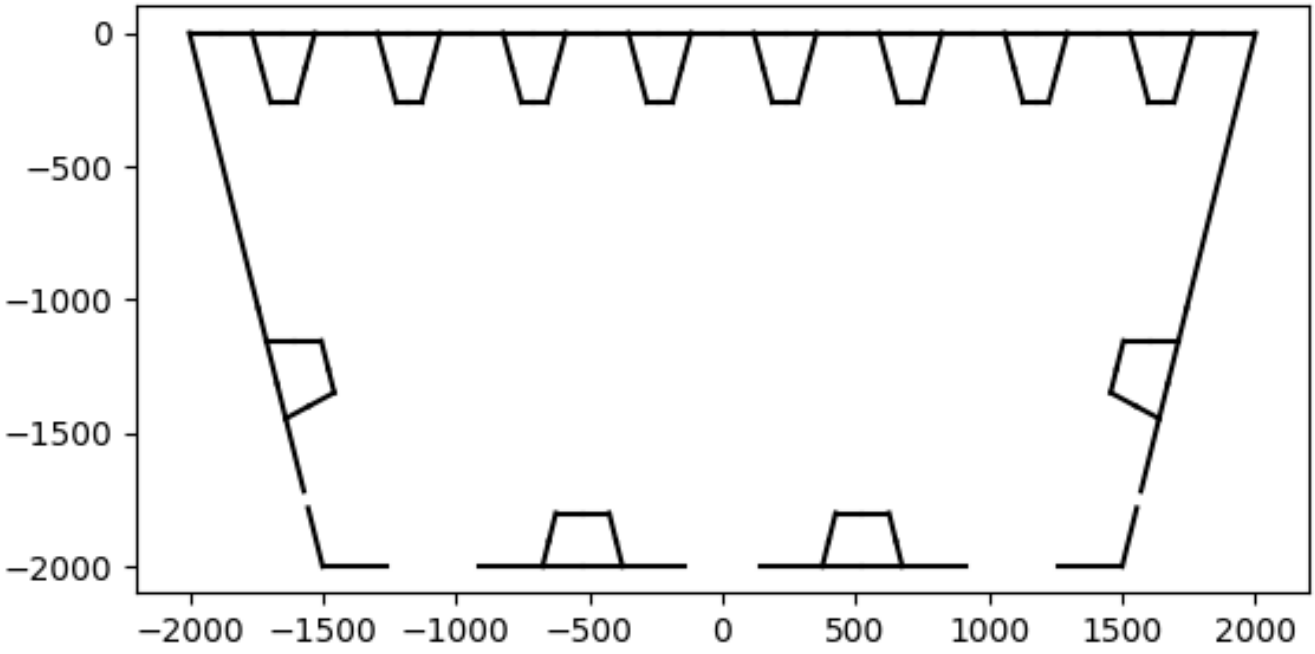

Buckling Proof according to EC 1993 Part 1-5

3.2 Effective width for elastic shear lag

Shear lag reduction for flange 1

Shear Lag is not neglectable

alpha_0: 1.7

Beta: 0.31395004434548573

Shear lag reduction for flange 3

Shear Lag is not neglectable

alpha_0: 1.3

Beta: 0.44121107679637916

4.4 Plate elements without longitudinal stiffeners

Iteratively changing the widths until M_Rd_el_eff converges to a limit of 0.02

4.5 Stiffened plate elements with longitudinal stiffeners

Side 2

4.5.2 Plate type behaviour

sigma_cr = 2555.282079228872

Lambda: 0.26007581303875243

Rho_Global: 1.0

4.5.3 Column type buckling behaviour

Column number 9

A_sl=13548.45, A_sl_eff=13190.5, I_sl=27291618.43

sigma_cr_c=260.93

e1=72.7, e2=59.95

All tension =False

Buckling Values 9

beta_A_c =0.9735800820732999

lambda_c_bar =0.9363764569980191

Phi_c =1.0840396776701264

Chi_c =0.6134044238586146

Critical buckling values

Chi_c: 0.6134044238586146

sigma_cr_c: 260.9387459785654

4.5.4 Interaction between plate and column buckling

all_tension: False

rho_c = 1.0

Side 3

4.5.2 Plate type behaviour

sigma_cr = 763.4573757020646

Lambda: 0.5017485584496578

Rho_Global: 1.0

4.5.3 Column type buckling behaviour

Column number 10

A_sl=16998.1, A_sl_eff=13902.39, I_sl=27320365.52

sigma_cr_c=208.2

e1=84.87, e2=47.78

All tension =False

Buckling Values 10

beta_A_c =0.8178792681216397

lambda_c_bar =0.960806674379394

Phi_c =1.10708338313521

Chi_c =0.6034751810906328

Column number 11

A_sl=16998.1, A_sl_eff=13902.39, I_sl=27320365.52

sigma_cr_c=208.2

e1=84.87, e2=47.78

All tension =False

Buckling Values 11

beta_A_c =0.8178792681216398

lambda_c_bar =0.960806674379394

Phi_c =1.10708338313521

Chi_c =0.6034751810906328

Critical buckling values

Chi_c: 0.6034751810906328

sigma_cr_c: 208.20206822935626

4.5.4 Interaction between plate and column buckling

all_tension: False

rho_c = 1.0

Side 4

4.5.2 Plate type behaviour

sigma_cr = 2555.282079228872

Lambda: 0.26007581303875243

Rho_Global: 1.0

4.5.3 Column type buckling behaviour

Column number 12

A_sl=13548.45, A_sl_eff=13190.5, I_sl=27291618.43

sigma_cr_c=260.93

e1=72.7, e2=59.95

All tension =False

Buckling Values 12

beta_A_c =0.9735800820732999

lambda_c_bar =0.9363764569980192

Phi_c =1.0840396776701267

Chi_c =0.6134044238586144

Critical buckling values

Chi_c: 0.6134044238586144

sigma_cr_c: 260.93874597856535

4.5.4 Interaction between plate and column buckling

all_tension: False

rho_c = 1.0

Resistance to shear and interaction shear force and bending moment for side 1

5. Resistance to shear

stiffened plate; EBPlate

k_tau: 1571.0214527033982

eta_3: 0.25205626496949346

7.1 Interaction between shear force, bending moment and axial force

Flange -> (7.1), comment (5)

eta_3 <= 0.5; no interaction needed

utilisation: -1

Proofing Resistance to shear for each subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.15703164083436558

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.13987046328644648

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.12270928573852742

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.10554810819060838

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.0883869306426893

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.07122575309477024

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.05406457554685117

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.03690339799893212

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.01974222045101305

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.03690339799893209

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.05406457554685115

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.07122575309477021

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.08838693064268928

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.10554810819060838

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.12270928573852743

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.13987046328644648

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.353840830449827

eta_3: 0.15703164083436558

eta_3_panel < 1: pass subpanel

Resistance to shear and interaction shear force and bending moment for side 2

5. Resistance to shear

stiffened plate; EBPlate

k_tau: 21.01369360902256

eta_3: 0.520359254539201

7.1 Interaction between shear force, bending moment and axial force

Web -> (7.1) without iterating

eta_3 > 0.5; interaction needed

utilisation: 0.6031112266506108

Resistance to shear and interaction shear force and bending moment for side 3

5. Resistance to shear

stiffened plate; EBPlate

k_tau: 94.90997656054232

eta_3: 0.23801478429570364

7.1 Interaction between shear force, bending moment and axial force

Flange -> (7.1), comment (5)

eta_3 <= 0.5; no interaction needed

utilisation: -1

Proofing Resistance to shear for each subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.51015625

eta_3: 0.18360775955085792

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.3625

eta_3: 0.09261316350554184

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.480625

eta_3: 0.05245412605513624

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.3625

eta_3: 0.09261316350554184

eta_3_panel < 1: pass subpanel

5. Resistance to shear

unstiffened plate; (A.5)

k_tau: 5.51015625

eta_3: 0.18360775955085792

eta_3_panel < 1: pass subpanel

Resistance to shear and interaction shear force and bending moment for side 4

5. Resistance to shear

stiffened plate; EBPlate

k_tau: 21.01353383458647

eta_3: 0.6004168070617667

7.1 Interaction between shear force, bending moment and axial force

Web -> (7.1) without iterating

eta_3 > 0.5; interaction needed

utilisation: 0.6230257777471733

cross-section with b_sup=4000, b_inf=3000, h=2000

trapezoid plate on side 1 with the number 1

a=(2000, 0) p1=(1882, 0) p2=(1882, 0) b=(1764, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 2

a=(1764, 0) p1=(1647, 0) p2=(1647, 0) b=(1529, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 3

a=(1529, 0) p1=(1411, 0) p2=(1411, 0) b=(1294, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 4

a=(1294, 0) p1=(1176, 0) p2=(1176, 0) b=(1058, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 5

a=(1058, 0) p1=(941, 0) p2=(941, 0) b=(823, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 6

a=(823, 0) p1=(705, 0) p2=(705, 0) b=(588, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 7

a=(588, 0) p1=(470, 0) p2=(470, 0) b=(352, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 8

a=(352, 0) p1=(235, 0) p2=(235, 0) b=(117, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 9

a=(117, 0) p1=(0, 0) p2=(0, 0) b=(-117, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 10

a=(-117, 0) p1=(-235, 0) p2=(-235, 0) b=(-352, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 11

a=(-352, 0) p1=(-470, 0) p2=(-470, 0) b=(-588, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 12

a=(-588, 0) p1=(-705, 0) p2=(-705, 0) b=(-823, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 13

a=(-823, 0) p1=(-941, 0) p2=(-941, 0) b=(-1058, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 14

a=(-1058, 0) p1=(-1176, 0) p2=(-1176, 0) b=(-1294, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 15

a=(-1294, 0) p1=(-1411, 0) p2=(-1411, 0) b=(-1529, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 16

a=(-1529, 0) p1=(-1647, 0) p2=(-1647, 0) b=(-1764, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 1 with the number 17

a=(-1764, 0) p1=(-1882, 0) p2=(-1882, 0) b=(-2000, 0)t=14.0

sigma_a_red=-125.65 sigma_b_red=-125.65

trapezoid plate on side 2 with the number 18

a=(-2000, 0) p1=(-1741, 1032) p2=(-1741, 1032) b=(-1711, 1154)t=10.0

sigma_a_red=-125.65 sigma_b_red=45.26

trapezoid plate on side 2 with the number 19

a=(-1711, 1154) p1=(-1671, 1315) p2=(-1671, 1315) b=(-1638, 1445)t=10.0

sigma_a_red=45.26 sigma_b_red=88.34

trapezoid plate on side 2 with the number 20

a=(-1638, 1445) p1=(-1570, 1717) p2=(-1554, 1780) b=(-1500, 2000)t=10.0

sigma_a_red=88.34 sigma_b_red=170.43

trapezoid plate on side 3 with the number 21

a=(-1500, 2000) p1=(-1258, 2000) p2=(-916, 2000) b=(-675, 2000)t=10.0

sigma_a_red=170.43 sigma_b_red=170.43

trapezoid plate on side 3 with the number 22

a=(-675, 2000) p1=(-525, 2000) p2=(-525, 2000) b=(-375, 2000)t=10.0

sigma_a_red=170.43 sigma_b_red=170.43

trapezoid plate on side 3 with the number 23

a=(-375, 2000) p1=(-138, 2000) p2=(138, 2000) b=(375, 2000)t=10.0

sigma_a_red=170.43 sigma_b_red=170.43

trapezoid plate on side 3 with the number 24

a=(375, 2000) p1=(525, 2000) p2=(525, 2000) b=(675, 2000)t=10.0

sigma_a_red=170.43 sigma_b_red=170.43

trapezoid plate on side 3 with the number 25

a=(675, 2000) p1=(916, 2000) p2=(1258, 2000) b=(1500, 2000)t=10.0

sigma_a_red=170.43 sigma_b_red=170.43

trapezoid plate on side 4 with the number 26

a=(1500, 2000) p1=(1554, 1780) p2=(1570, 1717) b=(1638, 1445)t=10.0

sigma_a_red=170.43 sigma_b_red=88.34

trapezoid plate on side 4 with the number 27

a=(1638, 1445) p1=(1671, 1315) p2=(1671, 1315) b=(1711, 1154)t=10.0

sigma_a_red=88.34 sigma_b_red=45.26

trapezoid plate on side 4 with the number 28

a=(1711, 1154) p1=(1741, 1032) p2=(1741, 1032) b=(2000, 0)t=10.0

sigma_a_red=45.26 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 1 on stiffener plate position 2

a=(1529, 0) p1=(1564, 130) p2=(1564, 130) b=(1599, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 1 on stiffener plate position 3

a=(1599, 260) p1=(1647, 260) p2=(1647, 260) b=(1695, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 1 on stiffener plate position 4

a=(1695, 260) p1=(1729, 130) p2=(1729, 130) b=(1764, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 2 on stiffener plate position 2

a=(1058, 0) p1=(1093, 130) p2=(1093, 130) b=(1128, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 2 on stiffener plate position 3

a=(1128, 260) p1=(1176, 260) p2=(1176, 260) b=(1224, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 2 on stiffener plate position 4

a=(1224, 260) p1=(1259, 130) p2=(1259, 130) b=(1294, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 3 on stiffener plate position 2

a=(588, 0) p1=(623, 130) p2=(623, 130) b=(657, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 3 on stiffener plate position 3

a=(657, 260) p1=(705, 260) p2=(705, 260) b=(753, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 3 on stiffener plate position 4

a=(753, 260) p1=(788, 130) p2=(788, 130) b=(823, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 4 on stiffener plate position 2

a=(117, 0) p1=(152, 130) p2=(152, 130) b=(187, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 4 on stiffener plate position 3

a=(187, 260) p1=(235, 260) p2=(235, 260) b=(283, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 4 on stiffener plate position 4

a=(283, 260) p1=(318, 130) p2=(318, 130) b=(352, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 5 on stiffener plate position 2

a=(-352, 0) p1=(-318, 130) p2=(-318, 130) b=(-283, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 5 on stiffener plate position 3

a=(-283, 260) p1=(-235, 260) p2=(-235, 260) b=(-187, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 5 on stiffener plate position 4

a=(-187, 260) p1=(-152, 130) p2=(-152, 130) b=(-117, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 6 on stiffener plate position 2

a=(-823, 0) p1=(-788, 130) p2=(-788, 130) b=(-753, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 6 on stiffener plate position 3

a=(-753, 260) p1=(-705, 260) p2=(-705, 260) b=(-657, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 6 on stiffener plate position 4

a=(-657, 260) p1=(-623, 130) p2=(-623, 130) b=(-588, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 7 on stiffener plate position 2

a=(-1294, 0) p1=(-1259, 130) p2=(-1259, 130) b=(-1224, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 7 on stiffener plate position 3

a=(-1224, 260) p1=(-1176, 260) p2=(-1176, 260) b=(-1128, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 7 on stiffener plate position 4

a=(-1128, 260) p1=(-1093, 130) p2=(-1093, 130) b=(-1058, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 1 of stiffener nr 8 on stiffener plate position 2

a=(-1764, 0) p1=(-1729, 130) p2=(-1729, 130) b=(-1695, 260)t=10.0

sigma_a_red=-125.65 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 8 on stiffener plate position 3

a=(-1695, 260) p1=(-1647, 260) p2=(-1647, 260) b=(-1599, 260)t=10.0

sigma_a_red=-87.16 sigma_b_red=-87.16

stiffener plate on side 1 of stiffener nr 8 on stiffener plate position 4

a=(-1599, 260) p1=(-1564, 130) p2=(-1564, 130) b=(-1529, 0)t=10.0

sigma_a_red=-87.16 sigma_b_red=-125.65

stiffener plate on side 2 of stiffener nr 9 on stiffener plate position 2

a=(-1638, 1445) p1=(-1551, 1398) p2=(-1551, 1398) b=(-1456, 1348)t=10.0

sigma_a_red=88.34 sigma_b_red=73.98

stiffener plate on side 2 of stiffener nr 9 on stiffener plate position 3

a=(-1456, 1348) p1=(-1478, 1260) p2=(-1478, 1260) b=(-1505, 1154)t=10.0

sigma_a_red=73.98 sigma_b_red=45.26

stiffener plate on side 2 of stiffener nr 9 on stiffener plate position 4

a=(-1505, 1154) p1=(-1608, 1154) p2=(-1608, 1154) b=(-1711, 1154)t=10.0

sigma_a_red=45.26 sigma_b_red=45.26

stiffener plate on side 3 of stiffener nr 10 on stiffener plate position 2

a=(-375, 2000) p1=(-398, 1904) p2=(-398, 1904) b=(-425, 1800)t=10.0

sigma_a_red=170.43 sigma_b_red=140.82

stiffener plate on side 3 of stiffener nr 10 on stiffener plate position 3

a=(-425, 1800) p1=(-525, 1800) p2=(-525, 1800) b=(-625, 1800)t=10.0

sigma_a_red=140.82 sigma_b_red=140.82

stiffener plate on side 3 of stiffener nr 10 on stiffener plate position 4

a=(-625, 1800) p1=(-651, 1904) p2=(-651, 1904) b=(-675, 2000)t=10.0

sigma_a_red=140.82 sigma_b_red=170.43

stiffener plate on side 3 of stiffener nr 11 on stiffener plate position 2

a=(675, 2000) p1=(651, 1904) p2=(651, 1904) b=(625, 1800)t=10.0

sigma_a_red=170.43 sigma_b_red=140.82

stiffener plate on side 3 of stiffener nr 11 on stiffener plate position 3

a=(625, 1800) p1=(525, 1800) p2=(525, 1800) b=(425, 1800)t=10.0

sigma_a_red=140.82 sigma_b_red=140.82

stiffener plate on side 3 of stiffener nr 11 on stiffener plate position 4

a=(425, 1800) p1=(398, 1904) p2=(398, 1904) b=(375, 2000)t=10.0

sigma_a_red=140.82 sigma_b_red=170.43

stiffener plate on side 4 of stiffener nr 12 on stiffener plate position 2

a=(1711, 1154) p1=(1608, 1154) p2=(1608, 1154) b=(1505, 1154)t=10.0

sigma_a_red=45.26 sigma_b_red=45.26

stiffener plate on side 4 of stiffener nr 12 on stiffener plate position 3

a=(1505, 1154) p1=(1478, 1260) p2=(1478, 1260) b=(1456, 1348)t=10.0

sigma_a_red=45.26 sigma_b_red=73.98

stiffener plate on side 4 of stiffener nr 12 on stiffener plate position 4

a=(1456, 1348) p1=(1551, 1398) p2=(1551, 1398) b=(1638, 1445)t=10.0

sigma_a_red=73.98 sigma_b_red=88.34

moment of inertia gross without shear lag: 131997495506.10445

moment of inertia gross with shear lag: 60364468595.56615
moment of inertia eff without shear lag: 114100942203.74236
moment of inertia eff with shear lag: 54037465137.15008