Detailed Member Calculations

Units: N&mm

Regulation: ASCE 41-17

Calculation No. 1

wall W1, Floor 1

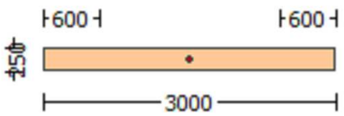
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

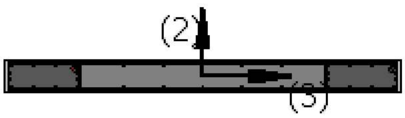
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444

Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = -1.8438483E-010
Shear Force, Va = -9.9179258E-014
EDGE -B-
Bending Moment, Mb = -1.1366247E-010
Shear Force, Vb = 9.9179258E-014
BOTH EDGES
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL,ten = 16.46154

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 508053.336
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 508053.336

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 193894.07
Mu/Vu-lw/2 = 1734.107 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 1.8438483E-010
Vu = 9.9179258E-014
Nu = 27925.142
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)

Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 2

wall W1, Floor 1

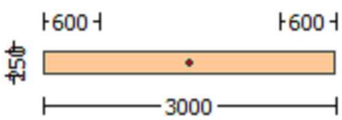
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

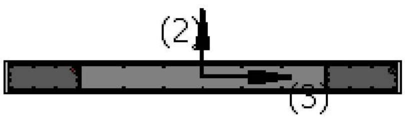
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444

Steel Elasticity, Es = 200000.00
###
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
###
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----

Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009

----

with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428

using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----

psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered

characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00

ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428

ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00

cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002

λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00

Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00

###
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
###
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:

b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor

and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472

ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.

εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00

sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748

fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00

Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00

ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00

s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472
----

with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 3
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 1.3334E+008
Shear Force, V2 = -9.9179258E-014
Shear Force, V3 = -44458.437
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL = 17.33333

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.00446269
θu = θy + θp = 0.00446269

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.00046269 ((10-5), ASCE 41-17))
My = 2.0495E+009
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.5187E+016
lp = 0.5*d = 0.5*(0.8*h) = 1200.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 4.6949925E-007
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 2957.00
ξy = 0.2121567
A = 0.01000649
B = 0.00516109
with pt = 0.00387573
pc = 0.00387573
pv = 0.00208235
N = 27925.142
b = 250.00
δ'' = 0.01454177
Φy_comp = 2.6940114E-006
with fc = 25.00
Ec = 26999.444
ξy = 0.2092218
A = 0.00972049
B = 0.00498841
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.004
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236787
As = 0.00
As' = 7269.645
fy = 500.00
P = 27925.142
tw = 250.00
lw = 3000.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 0.14277302, NOTE: units in lb & in
- Confined Boundary: Yes
Table values have been multiplied by 0.8 according to subnote b
Boundary Trans. Reinf. exceeds 75% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
With
Boundary Element 1:
Vw1 = 376991.118

s1 = 100.00
Boundary Element 2:
Vw2 = 376991.118
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 759253.261
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 44458.437

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 3

wall W1, Floor 1

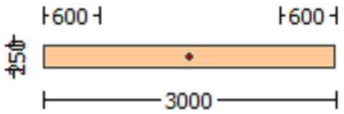
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

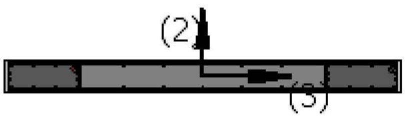
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:

New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.3334E+008
Shear Force, Va = -44458.437
EDGE -B-
Bending Moment, Mb = 49279.25
Shear Force, Vb = 44458.437
BOTH EDGES
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL,ten = 17.33333

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 2.0787E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 2.0787E+006

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 759253.261
Mu/Vu-lw/2 = 1499.219 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.3334E+008
Vu = 44458.437
Nu = 27925.142
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.3195E+006
Vs1 = 376991.118 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 376991.118 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633

s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 565486.678 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 500.00
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 250.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 4

wall W1, Floor 1

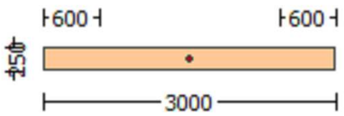
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

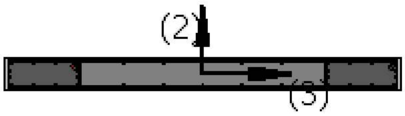
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56

Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009

----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345

εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00

----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY

For calculation of esuv_nominal and $\varepsilon yv,\varepsilon shv,ftv,fyv$, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
$\varepsilon y1,\varepsilon sh1,ft1,fy1$, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
$\omega 1$ = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
$\omega 2$ = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
$\omega 1$ = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
$\omega 2$ = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
$\varphi u = \varphi su$ (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu^* = shear_factor * Max($\varepsilon cu,\varepsilon cc$) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00

ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384

εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80

ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796

No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:

d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d

----

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444

Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----

with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626

using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----

psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered

characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00

ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626

ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00

cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002

λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00

Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472

----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 2
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = -1.8438483E-010
Shear Force, V2 = -9.9179258E-014
Shear Force, V3 = -44458.437
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL = 16.46154

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.0029294
θu = θy + θp = 0.0029294

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.0009294 ((10-5), ASCE 41-17))
My = 1.4295E+008
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.0547E+014
lp = 0.5*d = 0.5*(0.8*h) = 240.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 7.0161634E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 208.00
ξy = 0.25051483
A = 0.01185465
B = 0.00720582
with pt = 0.00453618
pc = 0.00453618
pv = 0.00257772
N = 27925.142
b = 3000.00
δ'' = 0.20192308
Φy_comp = 3.2328137E-005
with fc = 25.00
Ec = 26999.444
ξy = 0.24786413
A = 0.01151582
B = 0.00700125
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.002
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236787
As = 0.00
As' = 7269.645
fy = 500.00
P = 27925.142
tw = 3000.00
lw = 250.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 3.1850248E-019, NOTE: units in lb & in
- Confined Boundary: No
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
Boundary Trans. Reinf. does not exceed 50% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
With
Boundary Element 1:
Vw1 = 157079.633

s1 = 100.00
Boundary Element 2:
Vw2 = 157079.633
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 193894.07
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 9.9179258E-014

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 5

wall W1, Floor 1

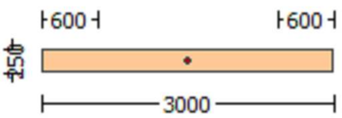
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

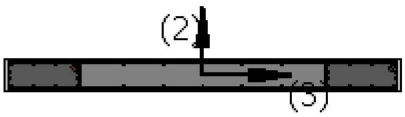
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:

New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = -1.8438483E-010
Shear Force, Va = -9.9179258E-014
EDGE -B-
Bending Moment, Mb = -1.1366247E-010
Shear Force, Vb = 9.9179258E-014
BOTH EDGES
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL,ten = 16.46154

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 538708.451
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 538708.451

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 224549.186
Mu/Vu-lw/2 = 1021.031 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 1.1366247E-010
Vu = 9.9179258E-014
Nu = 27925.142
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633

s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 6

wall W1, Floor 1

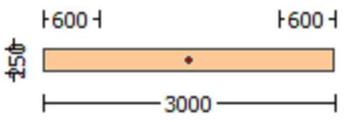
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

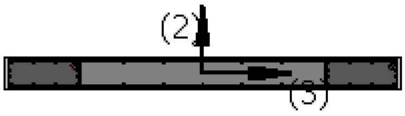
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00

New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006

Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814

fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009

----

with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472

----

psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00

No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,

considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035

ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00

$\varepsilon y2 = 0.00096384$
$\varepsilon sh2 = 0.00308428$
ft2 = 321.2814
fy2 = 267.7345
$\varepsilon su2 = 0.00308428$
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
$\varepsilon su2$ = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
$\varepsilon yv = 0.00096384$
$\varepsilon shv = 0.00308428$
ftv = 321.2814
fyv = 267.7345
$\varepsilon suv = 0.00308428$
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
$\omega 1$ = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
$\omega 2$ = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
$\omega 1$ = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
$\omega 2$ = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
$\varphi u = \varphi su$ (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00

ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00

As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00

fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)

Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00

Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008

----

with full section properties:

b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472

----

psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00

----

psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456

εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00

----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY

For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00

ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258

εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80

ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796

No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:

d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d

----

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17

ρn = 0.0010472
----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 3
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 49279.25
Shear Force, V2 = 9.9179258E-014
Shear Force, V3 = 44458.437
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL = 17.33333

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.00446269
θu = θy + θp = 0.00446269

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.00046269 ((10-5), ASCE 41-17))
My = 2.0495E+009
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.5187E+016
lp = 0.5*d = 0.5*(0.8*h) = 1200.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 4.6949925E-007
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 2957.00
ξy = 0.2121567
A = 0.01000649
B = 0.00516109
with pt = 0.00387573
pc = 0.00387573
pv = 0.00208235
N = 27925.142
b = 250.00
δ'' = 0.01454177
Φy_comp = 2.6940114E-006
with fc = 25.00
Ec = 26999.444
ξy = 0.2092218
A = 0.00972049
B = 0.00498841
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.004
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236787
As = 0.00
As' = 7269.645
fy = 500.00
P = 27925.142
tw = 250.00
lw = 3000.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 0.14277302, NOTE: units in lb & in
- Confined Boundary: Yes
Table values have been multiplied by 0.8 according to subnote b
Boundary Trans. Reinf. exceeds 75% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
With

Boundary Element 1:
Vw1 = 376991.118
s1 = 100.00
Boundary Element 2:
Vw2 = 376991.118
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 815585.028
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 44458.437

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 7

wall W1, Floor 1

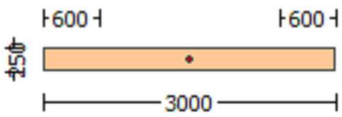
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

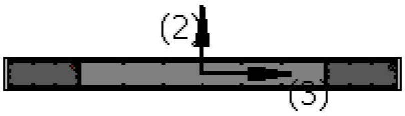
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.

Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.3334E+008
Shear Force, Va = -44458.437
EDGE -B-
Bending Moment, Mb = 49279.25
Shear Force, Vb = 44458.437
BOTH EDGES
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL,ten = 17.33333

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 2.1351E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 2.1351E+006

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815585.028
Mu/Vu-lw/2 = -1498.892 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 49279.25
Vu = 44458.437
Nu = 27925.142
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.3195E+006
Vs1 = 376991.118 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 376991.118 is calculated for pseudo-Column 2, with:

d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 565486.678 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 500.00
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 250.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 8

wall W1, Floor 1

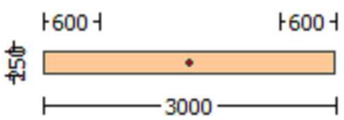
Limit State: Operational Level (data interpolation between analysis steps 1 and 2)

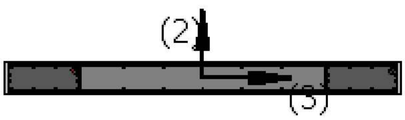
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.

Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384

εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175

Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496

h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923

εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294

Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00

ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00

d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00

fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:

New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:

φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626

ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008

φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00

As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032

From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)

From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456

with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00

ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00

h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00

d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00

Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with

transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472
----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 2
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = -1.1366247E-010
Shear Force, V2 = 9.9179258E-014
Shear Force, V3 = 44458.437
Axial Force, F = -27925.142
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL = 16.46154

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.0029294
θu = θy + θp = 0.0029294

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.0009294 ((10-5), ASCE 41-17))
My = 1.4295E+008
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.0547E+014

lp = 0.5*d = 0.5*(0.8*h) = 240.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 7.0161634E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 208.00
ξy = 0.25051483
A = 0.01185465
B = 0.00720582
with pt = 0.00453618
pc = 0.00453618
pv = 0.00257772
N = 27925.142
b = 3000.00
δ'' = 0.20192308
Φy_comp = 3.2328137E-005
with fc = 25.00
Ec = 26999.444
ξy = 0.24786413
A = 0.01151582
B = 0.00700125
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.002
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236787
As = 0.00
As' = 7269.645
fy = 500.00
P = 27925.142
tw = 3000.00
lw = 250.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 3.1850248E-019, NOTE: units in lb & in
- Confined Boundary: No
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
Boundary Trans. Reinf. does not exceed 50% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)

With
Boundary Element 1:
Vw1 = 157079.633
s1 = 100.00
Boundary Element 2:
Vw2 = 157079.633
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 224549.186
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 9.9179258E-014

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 9

wall W1, Floor 1

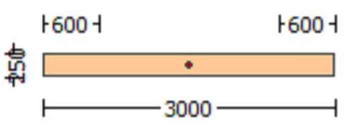
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

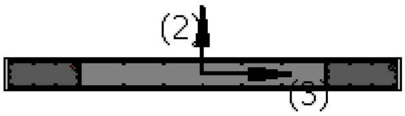
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00

Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = -2.2306748E-010
Shear Force, Va = -1.1969937E-013
EDGE -B-
Bending Moment, Mb = -1.3664558E-010
Shear Force, Vb = 1.1969937E-013
BOTH EDGES
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL,ten = 16.46154

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 507942.395
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 507942.395

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 193783.13
Mu/Vu-lw/2 = 1738.564 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.2306748E-010
Vu = 1.1969937E-013
Nu = 27994.722
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)

Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 10

wall W1, Floor 1

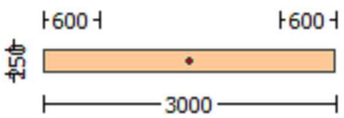
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

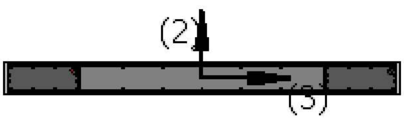
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00

Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00

εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->

ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00

ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00

lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002

Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.

εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1

db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796

No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:

b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633

s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.

Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258

εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534

Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496

h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482

εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294

Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00

ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00

d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00

fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00

According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472
----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 3
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 1.6093E+008
Shear Force, V2 = -1.1969937E-013
Shear Force, V3 = -53656.852
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL = 17.33333

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.01246271
θu = θy + θp = 0.01246271

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.00046271 ((10-5), ASCE 41-17))
My = 2.0496E+009
(EI)Eff = 0.35*Ec*I (table 10-5)

Ec*I = 1.5187E+016
lp = 0.5*d = 0.5*(0.8*h) = 1200.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 4.6950448E-007
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 2957.00
ξy = 0.21216547
A = 0.01000692
B = 0.00516152
with pt = 0.00387573
pc = 0.00387573
pv = 0.00208235
N = 27994.722
b = 250.00
δ'' = 0.01454177
Φy_comp = 2.6939913E-006
with fc = 25.00
Ec = 26999.444
ξy = 0.20922336
A = 0.00972021
B = 0.00498841
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.012
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236416
As = 0.00
As' = 7269.645
fy = 500.00
P = 27994.722
tw = 250.00
lw = 3000.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 0.17231265, NOTE: units in lb & in
- Confined Boundary: Yes
Table values have been multiplied by 0.8 according to subnote b

Boundary Trans. Reinf. exceeds 75% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
With
Boundary Element 1:
Vw1 = 376991.118
s1 = 100.00
Boundary Element 2:
Vw2 = 376991.118
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 759275.539
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 53656.852

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 11

wall W1, Floor 1

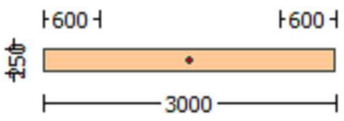
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

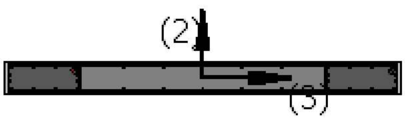
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.6093E+008
Shear Force, Va = -53656.852
EDGE -B-
Bending Moment, Mb = 59475.088
Shear Force, Vb = 53656.852
BOTH EDGES
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL,ten = 17.33333

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 2.0787E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 2.0787E+006

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 759275.539
Mu/Vu-lw/2 = 1499.219 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.6093E+008
Vu = 53656.852
Nu = 27994.722
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.3195E+006
Vs1 = 376991.118 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00

fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 376991.118 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 565486.678 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 500.00
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 250.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 12

wall W1, Floor 1

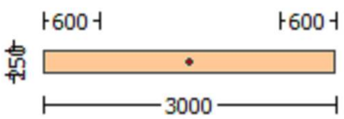
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

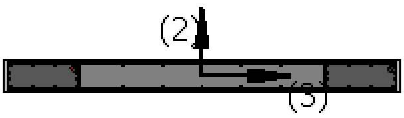
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
###
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
###
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00

From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->

v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00

As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor

and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841

fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,

For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.

ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236

h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444

ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:

d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002

λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied

--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796

No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with

Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00

εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered

characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)

λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00

As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ρs3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711

and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00

Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcrws

Constant Properties

Knowledge Factor, $\kappa = 1.00$
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, $\rho n < 0.0015$
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
$\rho n = 0.0010472$
----
with $\rho n = ps1 + ps2 + ps3$, being the shear reinf. ratio in a plane perpedicular to the shear axis 2
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = -2.2306748E-010
Shear Force, V2 = -1.1969937E-013
Shear Force, V3 = -53656.852
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL = 16.46154

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity $\theta u,R = 1.0*\theta u = 0.00892944$
$\theta u = \theta y + \theta p = 0.00892944$

- Calculation of θy -

$\theta y = (My*lp)/(EI)Eff = 0.00092944$ ((10-5), ASCE 41-17))

My = 1.4295E+008
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.0547E+014
lp = 0.5*d = 0.5*(0.8*h) = 240.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 7.0162417E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 208.00
ξy = 0.2505232
A = 0.01185516
B = 0.00720633
with pt = 0.00453618
pc = 0.00453618
pv = 0.00257772
N = 27994.722
b = 3000.00
δ'' = 0.20192308
Φy_comp = 3.2327896E-005
with fc = 25.00
Ec = 26999.444
ξy = 0.24786597
A = 0.01151549
B = 0.00700125
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.008
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236416
As = 0.00
As' = 7269.645
fy = 500.00
P = 27994.722
tw = 3000.00
lw = 250.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 3.8440039E-019, NOTE: units in lb & in

- Confined Boundary: No
  Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
  Boundary Trans. Reinf. does not exceed 50% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
  With
  Boundary Element 1:
    Vw1 = 157079.633
    s1 = 100.00
  Boundary Element 2:
    Vw2 = 157079.633
    s2 = 100.00
   Grid Shear Force, Vw3 = 0.00
   Concrete Shear Force, Vc = 193783.13
(The variables above have already been given in Shear control ratio calculation)
   Mean diameter of all bars, db = 17.33333
   Design Shear Force, V = 1.1969937E-013

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 13

wall W1, Floor 1

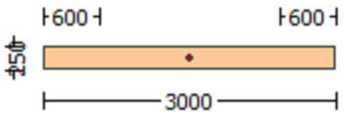
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

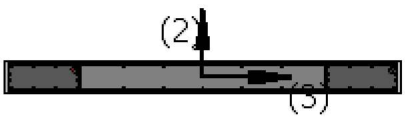
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = -2.2306748E-010
Shear Force, Va = -1.1969937E-013
EDGE -B-
Bending Moment, Mb = -1.3664558E-010
Shear Force, Vb = 1.1969937E-013
BOTH EDGES
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL,ten = 16.46154

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 539038.079
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 539038.079

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 224878.814
Mu/Vu-lw/2 = 1016.573 > 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 1.3664558E-010
Vu = 1.1969937E-013
Nu = 27994.722
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633

s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 14

wall W1, Floor 1

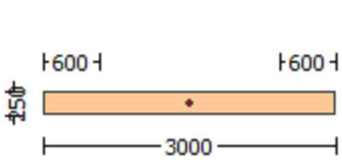
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

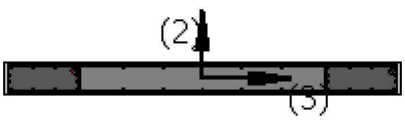
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----

Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45

fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)

--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664

h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428

using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091

N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032

From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424

Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00

ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444

ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)

Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00

From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->

v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00

As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor

and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841

fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,

For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.

ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008

---

with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472

---

psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00

---

psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236

h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722

ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:

d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472
----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 3
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 59475.088
Shear Force, V2 = 1.1969937E-013
Shear Force, V3 = 53656.852
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL = 17.33333

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.01246271
θu = θy + θp = 0.01246271

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.00046271 ((10-5), ASCE 41-17))
My = 2.0496E+009
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.5187E+016
lp = 0.5*d = 0.5*(0.8*h) = 1200.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 4.6950448E-007
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 2957.00
ξy = 0.21216547
A = 0.01000692
B = 0.00516152
with pt = 0.00387573
pc = 0.00387573
pv = 0.00208235
N = 27994.722
b = 250.00
δ'' = 0.01454177
Φy_comp = 2.6939913E-006
with fc = 25.00
Ec = 26999.444
ξy = 0.20922336
A = 0.00972021
B = 0.00498841
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.012
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236416
As = 0.00
As' = 7269.645
fy = 500.00
P = 27994.722
tw = 250.00
lw = 3000.00
fc = 25.00

- V/(tw*lw*fc^0.5) = 0.17231265, NOTE: units in lb & in
- Confined Boundary: Yes

Table values have been multiplied by 0.8 according to subnote b
Boundary Trans. Reinf. exceeds 75% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
With
Boundary Element 1:
Vw1 = 376991.118
s1 = 100.00
Boundary Element 2:
Vw2 = 376991.118
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 815598.944
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 53656.852

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 15

wall W1, Floor 1

Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)

Start Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)

Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Member Shear Force is generally considered as Force-Controlled Action according to Table C7-1, ASCE 41-17.
Lower-bound strengths are used for Force-Controlled Actions according to 7.5.1.3, ASCE 41-17
Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = lb = 300.00
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.6093E+008
Shear Force, Va = -53656.852
EDGE -B-
Bending Moment, Mb = 59475.088
Shear Force, Vb = 53656.852
BOTH EDGES
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 1539.38
Mean Diameter of Tension Reinforcement, DbL,ten = 17.33333

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 2.1351E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vn < 0.83*fc'^0.5*h*d = 2.1351E+006

NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815598.944
Mu/Vu-lw/2 = -1498.892 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 59475.088
Vu = 53656.852
Nu = 27994.722
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.3195E+006
Vs1 = 376991.118 is calculated for pseudo-Column 1, with:

d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 376991.118 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 565486.678 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 500.00
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 250.00

End Of Calculation of Shear Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 16

wall W1, Floor 1

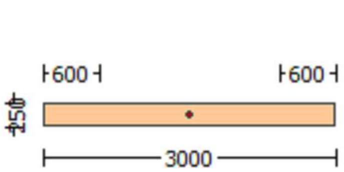
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

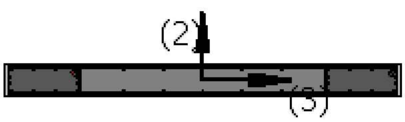
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)

Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 33.00
New material of Secondary Member: Steel Strength, fs = fsm = 555.56
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
##
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 694.45
##
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 1.5016185E-058
EDGE -B-
Shear Force, Vb = -1.5016185E-058
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2865.133
-Compression: Asl,com = 2865.133
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.69050088
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 1.6587E+006
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.4881E+009
Mu1+ = 2.1705E+009, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.4881E+009, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 2.4881E+009
Mu2+ = 2.1705E+009, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.4881E+009, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00

s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00

Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796

No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814

fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2902105E-006
Mu = 2.1705E+009
----
with full section properties:
b = 250.00
d = 2957.00

d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00

lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19157175
Mu = MRc (4.14) = 2.1705E+009
φu = φsu (4.1) = 1.2902105E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923

lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.2974768E-006
Mu = 2.4881E+009
----
with full section properties:
b = 250.00
d = 2957.00
d' = 43.00
v = 0.00113091
N = 27588.841
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00

As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00096384
εsh1 = 0.00308428
ft1 = 321.2814
fy1 = 267.7345
εsu1 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 267.7345
with Es1 = Es = 200000.00
εy2 = 0.00096384
εsh2 = 0.00308428
ft2 = 321.2814
fy2 = 267.7345
εsu2 = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.17128923
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 267.7345
with Es2 = Es = 200000.00
εyv = 0.00096384
εshv = 0.00308428
ftv = 321.2814
fyv = 267.7345
εsuv = 0.00308428
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.17128923
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 267.7345

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.03144444
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.03144444
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.01689449
and confined core properties:
b = 190.00
d = 2927.00
d' = 13.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04179832
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04179832
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02245743
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19609924
Mu = MRc (4.14) = 2.4881E+009
φu = φsu (4.1) = 1.2974768E-006

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.17128923
lb = 300.00
ld = 1751.424
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 694.45
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 2.4022E+006

Calculation of Shear Strength at edge 1, Vr1 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00

fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

Calculation of Shear Strength at edge 2, Vr2 = 2.4022E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 936136.917
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 250.00
d = 2400.00
lw = 3000.00
Mu = 1.2001755E-010
Vu = 1.5016185E-058
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 1.4661E+006
Vs1 = 418882.372 is calculated for pseudo-Column 1, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 418882.372 is calculated for pseudo-Column 2, with:
d = 480.00
Av = 157079.633
s = 100.00
fy = 555.56
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 628323.557 is calculated for web, with:
d = 1440.00
Av = 157079.633
s = 200.00
fy = 555.56
Vs3 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 2.2897E+006
bw = 250.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
Mean strength values are used for both shear and moment calculations.
Consequently:
New material of Secondary Member: Concrete Strength, fc = fcm = 25.00
New material of Secondary Member: Steel Strength, fs = fsm = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
###
Note: Especially for the calculation of moment strengths,
the above steel re-bar strengths are multiplied by 1.25 according to R18.6.5, ACI 318-14
New material: Steel Strength, fs = 1.25*fsm = 625.00
###
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lo = 300.00
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = 0.00
EDGE -B-
Shear Force, Vb = 0.00
BOTH EDGES
Axial Force, F = -27588.841
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 0.00
(According to 10.7.2.3 Asl,mid is setted equal to zero)

Calculation of Shear Capacity ratio , Ve/Vr = 0.08521711
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln = 96267.817
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.4440E+008
Mu1+ = 1.2341E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.4440E+008, is the ultimate moment strength at the edge 1 of the member in the opposite moment direction which is defined for the static loading combination
Mpr2 = Max(Mu2+ , Mu2-) = 1.4440E+008
Mu2+ = 1.2341E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.4440E+008, is the ultimate moment strength at the edge 2 of the member in the opposite moment direction which is defined for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00

fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture

δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00

ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456

εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8630672E-005
Mu = 1.2341E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00

v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482

εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.00
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.22164534
Mu = MRc (4.14) = 1.2341E+008
φu = φsu (4.1) = 1.8630672E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00

ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.8844503E-005
Mu = 1.4440E+008
----
with full section properties:
b = 3000.00
d = 208.00
d' = 42.00
v = 0.00176852
N = 27588.841
fc = 25.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.0035
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.0035
ωwe (5.4c) = 0.00
ase ((5.4d), TBDY) = (ase1*Acol1+ase2*Acol2+ase3*Aweb)/Asec = 0.00
ase1 = 0.00
sh_1 = 100.00
bo_1 = 190.00
ho_1 = 540.00
Σbi2_1 = 655400.00
ase2 = 0.00
sh_2 = 100.00
bo_2 = 190.00
ho_2 = 540.00
Σbi2_2 = 655400.00
ase3 = 0 (grid does not provide confinement)
psh,min = Min(psh,x , psh,y) = 0.0010472
----
psh,x = ps1,x+ps2,x+ps3,x = 0.00439823
ps1,x (column 1) = (As1*h1/s_1)/Ac = 0.00125664
h1 = 600.00
As1 = Astir1*ns1 = 157.0796
No stirups, ns1 = 2.00
ps2,x (column 2) = (As2*h2/s_2)/Ac = 0.00125664
h2 = 600.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,x (web) = (As3*h3/s_3)/Ac = 0.00188496
h3 = 1800.00
As3 = Astir3*ns3 = 0.00
No stirups, ns3 = 2.00
----
psh,y = ps1,y+ps2,y+ps3,y = 0.0010472
ps1,y (column 1) = (As1*h1/s_1)/Ac = 0.0005236
h1 = 250.00
As1 = Astir1*ns1 = 157.0796

No stirups, ns1 = 2.00
ps2,y (column 2) = (As2*h2/s_2)/Ac = 0.0005236
h2 = 250.00
As2 = Astir2*ns2 = 157.0796
No stirups, ns2 = 2.00
ps3,y (web) = (As3*h3/s_3)/Ac = 0.00
h3 = 250.00
As3 = Astir3*ns3 = 157.0796
No stirups, ns3 = 0.00

Asec = 750000.00
s_1 = 100.00
s_2 = 100.00
s_3 = 200.00
fywe = 625.00
fce = 25.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00094258
εsh1 = 0.00301626
ft1 = 282.7748
fy1 = 235.6456
εsu1 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsu1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and εy1,εsh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 235.6456
with Es1 = Es = 200000.00
εy2 = 0.00094258
εsh2 = 0.00301626
ft2 = 282.7748
fy2 = 235.6456
εsu2 = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/lb,min = 0.16565482
εsu2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and εy2,εsh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 235.6456
with Es2 = Es = 200000.00
εyv = 0.00094258
εshv = 0.00301626
ftv = 282.7748
fyv = 235.6456
εsuv = 0.00301626
using (30) in Biskinis/Fardis (2013) multiplied with shear_factor
and also multiplied by the shear_factor according to 15.7.1.4, with
Shear_factor = 1.00
lo/lou,min = lb/ld = 0.16565482
εsuv = 0.4*esuv_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esuv_nominal = 0.08,
considering characteristic value fsyv = fsv/1.2, from table 5.1, TBDY
For calculation of esuv_nominal and εyv,εshv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
εy1,εsh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 235.6456
with Esv = Es = 200000.00

ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.04275722
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.04275722
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02429711
and confined core properties:
b = 2940.00
d = 178.00
d' = 12.00
fcc (5A.2, TBDY) = 25.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05098316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05098316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.02897156
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.23047746
Mu = MRc (4.14) = 1.4440E+008
φu = φsu (4.1) = 1.8844503E-005

Calculation of ratio lb/ld

Lap Length: lb/ld = 0.16565482
lb = 300.00
ld = 1810.995
Calculation of lb,min according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (9.1.2, TS500 - No provision in ACI 318)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 625.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 1.1297E+006

Calculation of Shear Strength at edge 1, Vr1 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr1 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00

Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

Calculation of Shear Strength at edge 2, Vr2 = 1.1297E+006
From (22.5.1.1) and 11.5.4.3, ACI 318-14: Vr2 = Vn < 0.83*fc'^0.5*h*d
----
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+ψf*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).

From Table (11.5.4.6(d-e)), ACI 318-14: Vc = 815517.768
Mu/Vu-lw/2 = 0.00 <= 0
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
h = 3000.00
d = 200.00
lw = 250.00
Mu = 2.5788780E-012
Vu = 0.00
Nu = 27588.841
From (11.5.4.8), ACI 318-14: Vs = Vs1 + Vs2 + Vs3 = 314159.265
Vs1 = 157079.633 is calculated for pseudo-Column 1, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs1 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs2 = 157079.633 is calculated for pseudo-Column 2, with:
d = 200.00
Av = 157079.633
s = 100.00
fy = 500.00
Vs2 has been multiplied by 1 (s<d/2, according to ASCE 41-17,10.3.4)
Vs3 = 0.00 is calculated for web, with:
d = 200.00
Av = 0.00
s = 200.00
fy = 500.00
Vs3 has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.00
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 1.9929E+006
bw = 3000.00

End Of Calculation of Shear Capacity ratio for element: wall W1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)

Section Type: rcrws

Constant Properties

Knowledge Factor, κ = 1.00
According to 10.7.2.3, ASCE 41-17, shear walls with
transverse reinforcement percentage, ρn < 0.0015
are considered Force-Controlled and lower-bound strengths are used according to 7.5.1.3, ASCE 41-17
ρn = 0.0010472
----
with ρn = ps1 + ps2 + ps3, being the shear reinf. ratio in a plane perpedicular to the shear axis 2
(pseudo-col.1 ps1 = As1*b1/s1 = (As1*h1/s1) / Ac = 0.0005236
h1 = 250.00
s1 = 100.00
total area of hoops perpedicular to shear axis, As1 = 157.0796
(pseudo-col.2 ps2 = As2*b2/s2 = (As2*h2/s2) / Ac = 0.0005236
h2 = 250.00
s2 = 100.00
total area of hoops perpedicular to shear axis, As2 = 157.0796
(grid ps3 = As3*b3/s3 = (As3*h3/s3) / Ac = 0.00
h3 = 250.00
s3 = 200.00
total area of hoops perpedicular to shear axis, As3 = 0.00
total section area, Ac = 750000.00

Consequently:
New material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 25.00
New material of Secondary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 26999.444
Steel Elasticity, Es = 200000.00
Total Height, Htot = 3000.00
Edges Width, Wedg = 250.00
Edges Height, Hedg = 600.00
Web Width, Wweb = 250.00
Cover Thickness, c = 25.00
Element Length, L = 3000.00
Secondary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Lap Length lb = 300.00
No FRP Wrapping

Stepwise Properties

Bending Moment, M = -1.3664558E-010
Shear Force, V2 = 1.1969937E-013
Shear Force, V3 = 53656.852
Axial Force, F = -27994.722
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 0.00
-Compression: Aslc = 7269.645
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 2830.575
-Compression: Asl,com = 2830.575
-Middle: Asl,mid = 1608.495
Mean Diameter of Tension Reinforcement, DbL = 16.46154

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.00892944
θu = θy + θp = 0.00892944

- Calculation of θy -

θy = (My*lp)/(EI)Eff = 0.00092944 ((10-5), ASCE 41-17))
My = 1.4295E+008
(EI)Eff = 0.35*Ec*I (table 10-5)
Ec*I = 1.0547E+014
lp = 0.5*d = 0.5*(0.8*h) = 240.00

Calculation of Yielding Moment My

Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 7.0162417E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 218.754
d = 208.00
ξy = 0.2505232
A = 0.01185516
B = 0.00720633
with pt = 0.00453618
pc = 0.00453618
pv = 0.00257772
N = 27994.722
b = 3000.00
δ'' = 0.20192308
Φy_comp = 3.2327896E-005
with fc = 25.00
Ec = 26999.444
ξy = 0.24786597
A = 0.01151549
B = 0.00700125
with Es = 200000.00

Calculation of ratio lb/ld

Lap Length: ld/ld,min = 0.20706852
lb = 300.00
ld = 1448.796
Calculation of l according to (25.4.3.2), ACI 318-14, using mean values for all the section re-bars.
ld,min from (25.4.3.2) is multiplied 2 times to account for smooth re-bars (10.3.5, ASCE 41-17)
λ = 1
db = 16.35294
Mean strength value of all re-bars: fy = 500.00
ψt = 1.00
ψs = 0.80
ψe = 1.00
cb = 25.00
Ktr = 1.848
n = 34.00

- Calculation of θp -

Considering wall controlled by flexure (shear control ratio <= 1),
from table 10-19: θp = 0.008
with:
- Condition i (shear wall and wall segments)
- (As-As')*fy+P)/(tw*lw*fc') = -0.19236416
As = 0.00
As' = 7269.645
fy = 500.00
P = 27994.722
tw = 3000.00

lw = 250.00
fc = 25.00
- V/(tw*lw*fc^0.5) = 3.8440039E-019, NOTE: units in lb & in
- Confined Boundary: No
Boundary hoops spacing does not exceed 8db (s1 < 8*db and s2 < 8*db)
Boundary Trans. Reinf. does not exceed 50% of ACI 318 provision (Vw1 + Vw2 > 0.50*(V-Vc-Vw3)
With
Boundary Element 1:
Vw1 = 157079.633
s1 = 100.00
Boundary Element 2:
Vw2 = 157079.633
s2 = 100.00
Grid Shear Force, Vw3 = 0.00
Concrete Shear Force, Vc = 224878.814
(The variables above have already been given in Shear control ratio calculation)
Mean diameter of all bars, db = 17.33333
Design Shear Force, V = 1.1969937E-013

End Of Calculation of Chord Rotation Capacity for element: wall W1 of floor 1
At local axis: 3
Integration Section: (b)
