Detailed Member Calculations

Units: N&mm

Regulation: ASCE 41-17

Calculation No. 1

beam B1, Floor 1

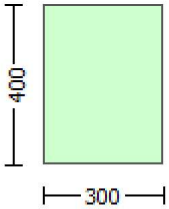
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

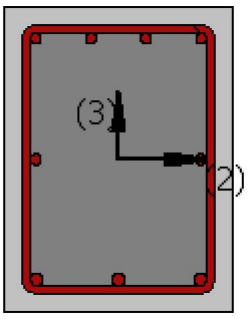
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.3404512E-010
Shear Force, Va = 1.1904950E-013
EDGE -B-
Bending Moment, Mb = 9.1297196E-011
Shear Force, Vb = -1.1904950E-013
BOTH EDGES
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL,ten = 14.66667

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 171047.78
Vn ((22.5.1.1), ACI 318-14) = 171047.78

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 (22.5.5.1), ACI 318-14: Vc = 76800.00
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 1.3404512E-010
Vu = 1.1904950E-013
From (11.5.4.8), ACI 318-14: Vs = 94247.78
Av = 157079.633
fy = 500.00
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 2

beam B1, Floor 1

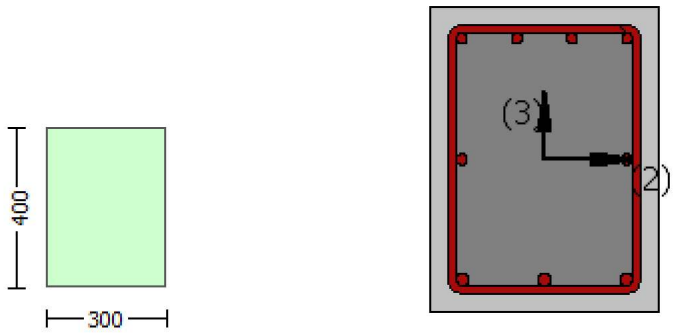
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (2)



Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##########
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00

psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00

---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693

ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139

εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##

Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00

v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139

εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799

Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)

---

psh,x (5.4d) = 0.00349066

Ash = Astir*ns = 78.53982

No stirups, ns = 2.00

bk = 300.00

---

psh,y (5.4d) = 0.00261799

Ash = Astir*ns = 78.53982

No stirups, ns = 2.00

bk = 400.00

---

s = 150.00

fywe = 694.45

fce = 33.00

From ((5.A5), TBDY), TBDY: εcc = 0.002

λc = confinement factor = 1.00

εy1 = 0.00140044

εsh1 = 0.0044814

ft1 = 466.8167

fy1 = 389.0139

εsu1 = 0.00512

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 = 0.30

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 = 389.0139

with Es1 = Es = 200000.00

εy2 = 0.00140044

εsh2 = 0.0044814

ft2 = 466.8167

fy2 = 389.0139

εsu2 = 0.00512

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 = 0.30

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 = 389.0139

with Es2 = Es = 200000.00

εyv = 0.00140044

εshv = 0.0044814

ftv = 466.8167

fyv = 389.0139

εsuv = 0.00512

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 = 0.30

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 = 389.0139

with Esv = Es = 200000.00

ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---

s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312

Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 6.0427E+006
Shear Force, V2 = 1.1904950E-013
Shear Force, V3 = -4024.902
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL = 16.00

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.00774176
θu = θy + θp = 0.00774176

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.00274176 ((4.29),Biskinis Phd))
My = 7.1003E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 1501.318
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.2960E+013

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 5.8430087E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 357.00
ξy = 0.25403164
A = 0.01433973
B = 0.00799857
with pt = 0.00563199
pc = 0.00574932

pv = 0.00287466
N = 2791.987
b = 300.00
δ'' = 0.11764706
Φy_comp = 2.4353061E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.25305204
A = 0.01419672
B = 0.00791481
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.005
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.38710195
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 5.3328783E-005
- Stirrup Spacing <= d/2
d = 357.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 186169.943,already given in calculation of shear control ratio
design Shear = 4024.902
- (ρ-ρ')/ρbal = -0.17558466
ρ = Aslt/(bw*d) = 0.00563199
Tension Reinf Area: Aslt = 603.1858
ρ' = Aslc/(bw*d) = 0.00862398
Compression Reinf Area: Aslc = 923.6282
From (B-1), ACI 318-11: ρbal = 0.01704017
fc = 33.00
fy = 555.56
From 10.2.7.3, ACI 318-11: β1 = 0.65
From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
εy = 0.0027778
- V/(bw*d*fc^0.5) = 0.07878293, NOTE: units in lb & in
bw = 300.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 3

beam B1, Floor 1

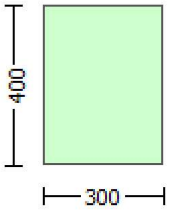
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

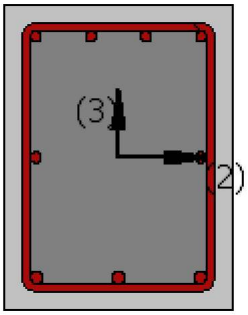
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 6.0427E+006

Shear Force, Va = -4024.902
EDGE -B-
Bending Moment, Mb = 6.7621E+006
Shear Force, Vb = 9505.431
BOTH EDGES
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL,ten = 16.00

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 246537.241
Vn ((22.5.1.1), ACI 318-14) = 246537.241

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 (22.5.5.1), ACI 318-14: Vc = 78985.633
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 0.21314602
Mu = 6.0427E+006
Vu = 4024.902
From (11.5.4.8), ACI 318-14: Vs = 167551.608
Av = 157079.633
fy = 500.00
s = 150.00
Vs 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 <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 4

beam B1, Floor 1

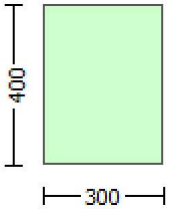
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

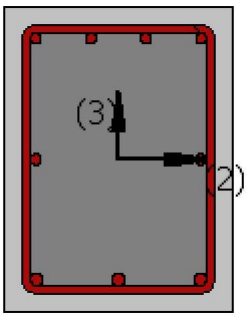
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##########
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-

Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00

---

psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00

---

s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00

fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814

ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008

φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139

with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00

Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel

Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035

ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---

psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167

fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00

εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 1.3404512E-010
Shear Force, V2 = 1.1904950E-013
Shear Force, V3 = -4024.902
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL = 14.66667

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.0071249
θu = θy + θp = 0.0071249

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.0021249 ((4.29),Biskinis Phd))
My = 4.9104E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 946.3747
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 7.2898E+012

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 8.2068008E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 258.00
ξy = 0.26509439
A = 0.01488164
B = 0.00868851
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 2791.987
b = 400.00
δ" = 0.1627907
Φy_comp = 3.2281910E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.26415126

A = 0.01473322
B = 0.00860158
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.005
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.36389875
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 1.7899265E-021
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 139627.457,already given in calculation of shear control ratio
design Shear = 1.1904950E-013
- (ρ-ρ')/ρbal = -0.18222013
ρ = Aslt/(bw*d) = 0.00584482
Tension Reinf Area: Aslt = 603.1858
ρ' = Aslc/(bw*d) = 0.00894989
Compression Reinf Area: Aslc = 923.6282
From (B-1), ACI 318-11: ρbal = 0.01704017
fc = 33.00
fy = 555.56
From 10.2.7.3, ACI 318-11: β1 = 0.65
From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
εy = 0.0027778
- V/(bw*d*fc^0.5) = 2.4183221E-018, NOTE: units in lb & in
bw = 400.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 5

beam B1, Floor 1

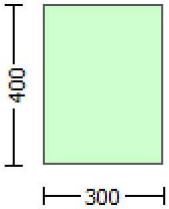
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

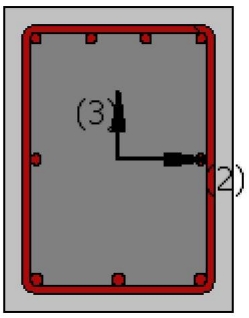
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.3404512E-010
Shear Force, Va = 1.1904950E-013
EDGE -B-
Bending Moment, Mb = 9.1297196E-011
Shear Force, Vb = -1.1904950E-013
BOTH EDGES
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)

-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL,ten = 14.66667

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 171047.78
Vn ((22.5.1.1), ACI 318-14) = 171047.78

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 (22.5.5.1), ACI 318-14: Vc = 76800.00
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00641409
As (tension reinf.) = 615.7522
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 9.1297196E-011
Vu = 1.1904950E-013
From (11.5.4.8), ACI 318-14: Vs = 94247.78
Av = 157079.633
fy = 500.00
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 6

beam B1, Floor 1

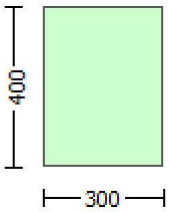
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

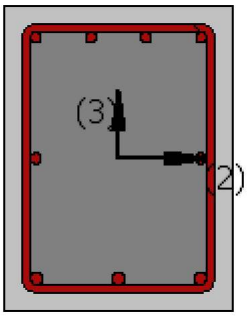
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##########
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814

ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007

φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139

with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30

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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015

BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---

psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167

fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00

εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

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

φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013

Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 6.7621E+006
Shear Force, V2 = -1.1904950E-013
Shear Force, V3 = 9505.431
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 615.7522
-Compression: Asl,com = 603.1858
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL = 14.00

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.00632504
θu = θy + θp = 0.00632504

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.00132504 ((4.29),Biskinis Phd))
My = 7.2417E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 711.3908
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.2960E+013

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 5.8441177E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 358.00
ξy = 0.25625651
A = 0.01429968
B = 0.00809684
with pt = 0.00573326
pc = 0.00561626
pv = 0.00286663
N = 2791.987
b = 300.00
δ" = 0.12011173
Φy_comp = 2.4072012E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.25529141
A = 0.01415706
B = 0.00801331
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.005
with:
- Condition iv occured
  Beam controlled by inadequate embedment into beam-column joint:
  (lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
  Beam controlled by flexure: Vp/Vo <= 1
  shear control ratio Vp/Vo = 0.38710195
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
    θ = 3.1875510E-005
- Stirrup Spacing <= d/2
  d = 358.00
  s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
  Vs = 186169.943,already given in calculation of shear control ratio
  design Shear = 9505.431
- (ρ-ρ')/ρbal = -0.16136132
  ρ = Aslt/(bw*d) = 0.00573326
    Tension Reinf Area: Aslt = 615.7522
  ρ' = Aslc/(bw*d) = 0.00848289
    Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11: ρbal = 0.01704017
    fc = 33.00
    fy = 555.56
    From 10.2.7.3, ACI 318-11: β1 = 0.65
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
      εy = 0.0027778
- V/(bw*d*fc^0.5) = 0.18553839, NOTE: units in lb & in
    bw = 300.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 7

beam B1, Floor 1

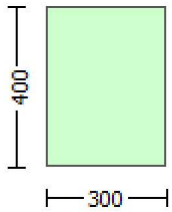
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

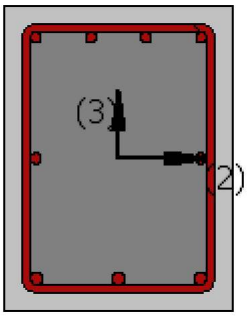
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 6.0427E+006
Shear Force, Va = -4024.902
EDGE -B-
Bending Moment, Mb = 6.7621E+006
Shear Force, Vb = 9505.431
BOTH EDGES
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 615.7522
-Compression: Asl,com = 603.1858
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL,ten = 14.00

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 249060.26
Vn ((22.5.1.1), ACI 318-14) = 249060.26

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 (22.5.5.1), ACI 318-14: Vc = 81508.652
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00641409
As (tension reinf.) = 615.7522
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 0.44982307
Mu = 6.7621E+006
Vu = 9505.431
From (11.5.4.8), ACI 318-14: Vs = 167551.608
Av = 157079.633
fy = 500.00
s = 150.00
Vs 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 <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 8

beam B1, Floor 1

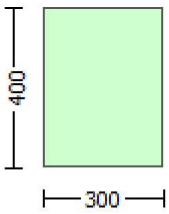
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

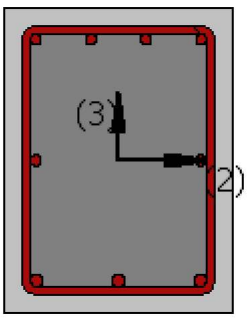
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)

Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with

V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139

εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:

b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044

εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982

No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00

ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007

Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512

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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00

d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814

ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00

Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)

fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 9.1297196E-011
Shear Force, V2 = -1.1904950E-013
Shear Force, V3 = 9505.431
Axial Force, F = -2791.987
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL = 14.66667

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.0071249
θu = θy + θp = 0.0071249

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.0021249 ((4.29),Biskinis Phd))
My = 4.9104E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 946.3747
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 7.2898E+012

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 8.2068008E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 258.00
ξy = 0.26509439
A = 0.01488164
B = 0.00868851
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 2791.987
b = 400.00
δ" = 0.1627907
Φy_comp = 3.2281910E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.26415126
A = 0.01473322
B = 0.00860158
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.005
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.36389875
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 6.9570625E-023
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 139627.457,already given in calculation of shear control ratio
design Shear = 1.1904950E-013

- (ρ-ρ')/ρbal = -0.16792835
ρ = Aslt/(bw*d) = 0.00596659
Tension Reinf Area: Aslt = 615.7522
ρ' = Aslc/(bw*d) = 0.00882812
Compression Reinf Area: Aslc = 911.0619
From (B-1), ACI 318-11: ρbal = 0.01704017
fc = 33.00
fy = 555.56
From 10.2.7.3, ACI 318-11: β1 = 0.65
From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
εy = 0.0027778
- V/(bw*d*fc^0.5) = 2.4183221E-018, NOTE: units in lb & in
bw = 400.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 9

beam B1, Floor 1

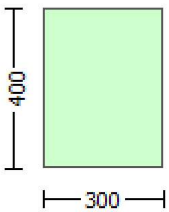
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

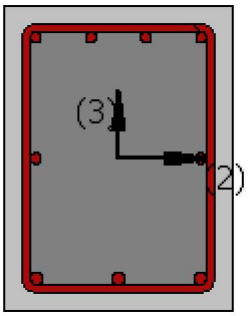
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.6217192E-010
Shear Force, Va = 1.4434338E-013
EDGE -B-
Bending Moment, Mb = 1.1104779E-010
Shear Force, Vb = -1.4434338E-013
BOTH EDGES
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL,ten = 14.66667

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 171047.78
Vn ((22.5.1.1), ACI 318-14) = 171047.78

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 (22.5.5.1), ACI 318-14: Vc = 76800.00
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 1.6217192E-010
Vu = 1.4434338E-013
From (11.5.4.8), ACI 318-14: Vs = 94247.78
Av = 157079.633
fy = 500.00
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 10

beam B1, Floor 1

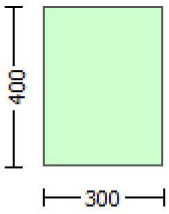
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

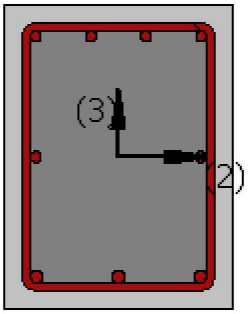
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##########
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member

Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)

From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00

bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00

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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044

εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632

Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005

Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582

ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00

---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00

fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814

ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007

φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 7.2980E+006
Shear Force, V2 = 1.4434338E-013
Shear Force, V3 = -5442.582
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL = 16.00

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.03245166
θu = θy + θp = 0.03245166

- Calculation of θy -

θy = (My*Ls/3)/Eleff = 0.00245166 ((4.29),Biskinis Phd))
My = 7.1085E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 1340.913
From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 1.2960E+013

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 5.8449467E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112

d = 357.00
ξy = 0.25427898
A = 0.01435587
B = 0.00801471
with pt = 0.00563199
pc = 0.00574932
pv = 0.00287466
N = 3329.81
b = 300.00
δ" = 0.11764706
Φy_comp = 2.4347314E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.25311177
A = 0.01418531
B = 0.00791481
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.03
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.38710195
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 6.0421622E-005
- Stirrup Spacing <= d/2
d = 357.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 186169.943,already given in calculation of shear control ratio
design Shear = 5442.582
- (ρ-ρ')/ρbal = -0.17558466
ρ = Aslt/(bw*d) = 0.00563199
Tension Reinf Area: Aslt = 603.1858
ρ' = Aslc/(bw*d) = 0.00862398
Compression Reinf Area: Aslc = 923.6282
From (B-1), ACI 318-11: ρbal = 0.01704017
fc = 33.00
fy = 555.56
From 10.2.7.3, ACI 318-11: β1 = 0.65
From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
εy = 0.0027778
- V/(bw*d*fc^0.5) = 0.10653241, NOTE: units in lb & in
bw = 300.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (a)

Calculation No. 11

beam B1, Floor 1

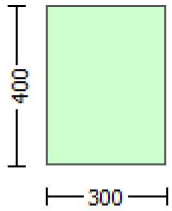
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

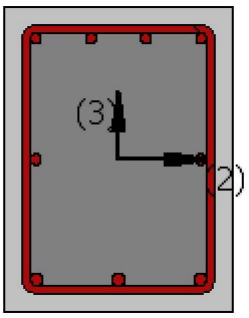
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 7.2980E+006
Shear Force, Va = -5442.582
EDGE -B-
Bending Moment, Mb = 8.1900E+006
Shear Force, Vb = 10923.11
BOTH EDGES
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL,ten = 16.00

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 246798.696
Vn ((22.5.1.1), ACI 318-14) = 246798.696

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 (22.5.5.1), ACI 318-14: Vc = 79247.087
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 0.23864342
Mu = 7.2980E+006
Vu = 5442.582
From (11.5.4.8), ACI 318-14: Vs = 167551.608
Av = 157079.633
fy = 500.00
s = 150.00
Vs 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 <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 12

beam B1, Floor 1

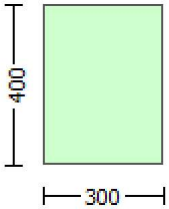
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

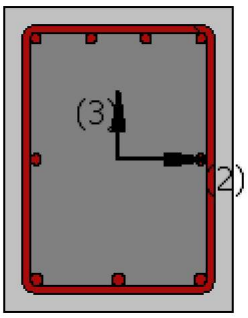
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: Start

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##########
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-

Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00

---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00

fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814

ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008

φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139

with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00

Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel

Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035

ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---

psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167

fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00

εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 1.6217192E-010
Shear Force, V2 = 1.4434338E-013
Shear Force, V3 = -5442.582
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL = 14.66667

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.03212751
θu = θy + θp = 0.03212751

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.00212751 ((4.29),Biskinis Phd))
My = 4.9164E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 946.3747
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 7.2898E+012

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 8.2095122E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 258.00
ξy = 0.26533712
A = 0.01489839
B = 0.00870525
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 3329.81
b = 400.00
δ" = 0.1627907
Φy_comp = 3.2274323E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.26421336

A = 0.01472138
B = 0.00860158
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.03
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.36389875
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 2.2238863E-021
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 139627.457,already given in calculation of shear control ratio
design Shear = 1.4434338E-013
- (ρ-ρ')/ρbal = -0.18222013
ρ = Aslt/(bw*d) = 0.00584482
Tension Reinf Area: Aslt = 603.1858
ρ' = Aslc/(bw*d) = 0.00894989
Compression Reinf Area: Aslc = 923.6282
From (B-1), ACI 318-11: ρbal = 0.01704017
fc = 33.00
fy = 555.56
From 10.2.7.3, ACI 318-11: β1 = 0.65
From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
εy = 0.0027778
- V/(bw*d*fc^0.5) = 2.9321314E-018, NOTE: units in lb & in
bw = 400.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (a)

Calculation No. 13

beam B1, Floor 1

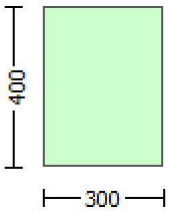
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

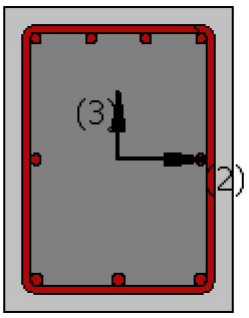
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 1.6217192E-010
Shear Force, Va = 1.4434338E-013
EDGE -B-
Bending Moment, Mb = 1.1104779E-010
Shear Force, Vb = -1.4434338E-013
BOTH EDGES
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)

-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL,ten = 14.66667

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 171047.78
Vn ((22.5.1.1), ACI 318-14) = 171047.78

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 (22.5.5.1), ACI 318-14: Vc = 76800.00
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00641409
As (tension reinf.) = 615.7522
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 1.1104779E-010
Vu = 1.4434338E-013
From (11.5.4.8), ACI 318-14: Vs = 94247.78
Av = 157079.633
fy = 500.00
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 14

beam B1, Floor 1

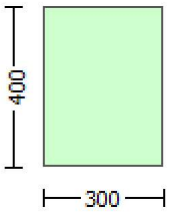
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

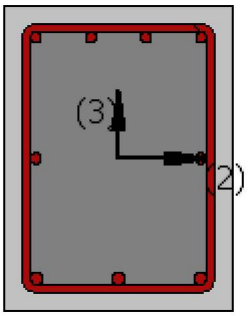
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (2)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814

ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007

φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139

with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30

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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015

BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007
Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---

psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00

εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167

fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00

εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

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

φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013

Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 8.1900E+006
Shear Force, V2 = -1.4434338E-013
Shear Force, V3 = 10923.11
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 615.7522
-Compression: Asl,com = 603.1858
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL = 14.00

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.03139815
θu = θy + θp = 0.03139815

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.00139815 ((4.29),Biskinis Phd))
My = 7.2499E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 749.7877
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.2960E+013

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 5.8460403E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 358.00
ξy = 0.25650111
A = 0.01431577
B = 0.00811293
with pt = 0.00573326
pc = 0.00561626
pv = 0.00286663
N = 3329.81
b = 300.00
δ" = 0.12011173
Φy_comp = 2.4066378E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.25535118
A = 0.01414568
B = 0.00801331
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.03
with:
- Condition iv occured
  Beam controlled by inadequate embedment into beam-column joint:
  (lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
  Beam controlled by flexure: Vp/Vo <= 1
  shear control ratio Vp/Vo = 0.38710195
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
    θ = 4.2637716E-005
- Stirrup Spacing <= d/2
  d = 358.00
  s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
  Vs = 186169.943,already given in calculation of shear control ratio
  design Shear = 10923.11
- (ρ-ρ')/ρbal = -0.16136132
  ρ = Aslt/(bw*d) = 0.00573326
    Tension Reinf Area: Aslt = 615.7522
  ρ' = Aslc/(bw*d) = 0.00848289
    Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11: ρbal = 0.01704017
    fc = 33.00
    fy = 555.56
    From 10.2.7.3, ACI 318-11: β1 = 0.65
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
      εy = 0.0027778
- V/(bw*d*fc^0.5) = 0.21321036, NOTE: units in lb & in
    bw = 300.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 2
Integration Section: (b)

Calculation No. 15

beam B1, Floor 1

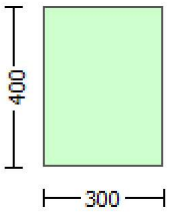
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

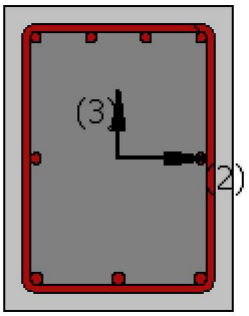
Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcars

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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min =lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

EDGE -A-
Bending Moment, Ma = 7.2980E+006
Shear Force, Va = -5442.582
EDGE -B-
Bending Moment, Mb = 8.1900E+006
Shear Force, Vb = 10923.11
BOTH EDGES
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 615.7522
-Compression: Asl,com = 603.1858
-Middle: Asl,mid = 307.8761
Mean Diameter of Tension Reinforcement, DbL,ten = 14.00

New component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = 1.0*Vn = 248819.129
Vn ((22.5.1.1), ACI 318-14) = 248819.129

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 (22.5.5.1), ACI 318-14: Vc = 81267.52
λ = 1 (normal-weight concrete)
fc' = 25.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00641409
As (tension reinf.) = 615.7522
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 0.42678748
Mu = 8.1900E+006
Vu = 10923.11
From (11.5.4.8), ACI 318-14: Vs = 167551.608
Av = 157079.633
fy = 500.00
s = 150.00
Vs 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 <= 318865.838

End Of Calculation of Shear Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)

Calculation No. 16

beam B1, Floor 1

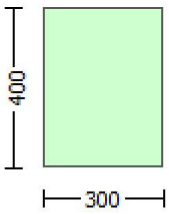
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

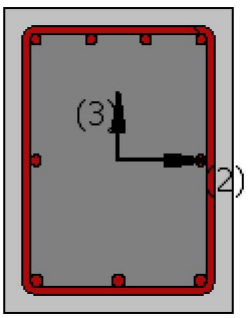
Analysis: Uniform +X

Check: Chord rotation capacity (θu)

Edge: End

Local Axis: (3)





Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 3
(Bending local axis: 2)

Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 3
EDGE -A-
Shear Force, Va = 2755.347
EDGE -B-
Shear Force, Vb = 2725.182
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 603.1858
-Compression: Asl,com = 615.7522
-Middle: Asl,mid = 307.8761

Calculation of Shear Capacity ratio , Ve/Vr = 0.38710195
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 110192.667
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0175E+008
Mu1+ = 9.9817E+007, 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- = 1.0175E+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-) = 1.0163E+008
Mu2+ = 9.9939E+007, 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- = 1.0163E+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
and
± wu*ln = (|V1| + |V2|)/2
with

V1 = 2755.347, is the shear force acting at edge 1 for the the static loading combination
V2 = 2725.182, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7580370E-005
Mu = 9.9817E+007
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139

εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06639156
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06777471
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09060316
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09249072
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18421872
Mu = MRc (4.14) = 9.9817E+007
φu = φsu (4.1) = 1.7580370E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7569815E-005
Mu = 1.0175E+008
---
with full section properties:

b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044

εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.0675854
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06620611
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09220874
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09032693
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18600873
Mu = MRc (4.14) = 1.0175E+008
φu = φsu (4.1) = 1.7569815E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7540026E-005
Mu = 9.9939E+007
---
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.2009052E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06620611
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.0675854
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.0337927
and confined core properties:
b = 240.00
d = 328.00
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) = 0.09032693
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09220874
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04610437
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18462632
Mu = MRc (4.14) = 9.9939E+007
φu = φsu (4.1) = 1.7540026E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 1.7610441E-005
Mu = 1.0163E+008
---
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.2182747E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982

No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.06777471
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.06639156
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.03388736
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00

ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.09249072
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.09060316
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.04624536
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.18561171
Mu = MRc (4.14) = 1.0163E+008
φu = φsu (4.1) = 1.7610441E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 284660.584

Calculation of Shear Strength at edge 1, Vr1 = 284660.584
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 38686.337
Vu = 2755.347
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 284660.584
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 98490.641
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 300.00
d = 320.00
Vu*d/Mu < 1 = 1.00
Mu = 67233.993
Vu = 2725.182
From (11.5.4.8), ACI 318-14: Vs = 186169.943
Av = 157079.633
fy = 555.56
s = 150.00
Vs 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 <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 3

Start Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At Shear local axis: 2
(Bending local axis: 3)
Section Type: rcars

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
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lo/lou,min = 0.30
No FRP Wrapping

Stepwise Properties

At local axis: 2
EDGE -A-
Shear Force, Va = -1.9219804E-015
EDGE -B-
Shear Force, Vb = 1.9219804E-015
BOTH EDGES
Axial Force, F = -219.7725
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 603.1858
-Compression: Aslc = 923.6282
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938

Calculation of Shear Capacity ratio , Ve/Vr = 0.36389875
Member Controlled by Flexure (Ve/Vr < 1)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 Ve = (Mpr1 + Mpr2)/ln ± wu*ln/2 = 70216.839
with
Mpr1 = Max(Mu1+ , Mu1-) = 6.6451E+007

Mu1+ = 6.6451E+007, 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- = 6.6451E+007, 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-) = 6.6451E+007
Mu2+ = 6.6451E+007, 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- = 6.6451E+007, 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
and
± wu*ln = (|V1| + |V2|)/2
with
V1 = -1.9219804E-015, is the shear force acting at edge 1 for the the static loading combination
V2 = 1.9219804E-015, is the shear force acting at edge 2 for the the static loading combination

---
Calculation of Mu1+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu1-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512

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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2+

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00

d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814

ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Mu2-

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 2.4749879E-005
Mu = 6.6451E+007
---
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.4532676E-005
N = 219.7725
fc = 33.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00553582
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00553582
ωwe (5.4c) = 0.00259035
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00

Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
---
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
---
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 400.00
---
s = 150.00
fywe = 694.45
fce = 33.00
From ((5.A5), TBDY), TBDY: εcc = 0.002
λc = confinement factor = 1.00
εy1 = 0.00140044
εsh1 = 0.0044814
ft1 = 466.8167
fy1 = 389.0139
εsu1 = 0.00512
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 = 0.30
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 = 389.0139
with Es1 = Es = 200000.00
εy2 = 0.00140044
εsh2 = 0.0044814
ft2 = 466.8167
fy2 = 389.0139
εsu2 = 0.00512
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 = 0.30
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 = 389.0139
with Es2 = Es = 200000.00
εyv = 0.00140044
εshv = 0.0044814
ftv = 466.8167
fyv = 389.0139
εsuv = 0.00512
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 = 0.30
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 = 389.0139
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.05813483
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.05813483
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.05813483
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 33.00
εcc (5A.5, TBDY) = 0.002
λc = confinement factor = 1.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.07739312
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.07739312
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07739312
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.19817948
Mu = MRc (4.14) = 6.6451E+007
φu = φsu (4.1) = 2.4749879E-005

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 192957.075

Calculation of Shear Strength at edge 1, Vr1 = 192957.075
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)
fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 4.7521961E-013
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

Calculation of Shear Strength at edge 2, Vr2 = 192957.075
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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 (22.5.5.1), ACI 318-14: Vc = 88236.482
λ = 1 (normal-weight concrete)

fc' = 33.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
pw = As/(bw*d) = 0.00628319
As (tension reinf.) = 603.1858
bw = 400.00
d = 240.00
Vu*d/Mu < 1 = 0.00
Mu = 3.1627690E-012
Vu = 1.9219804E-015
From (11.5.4.8), ACI 318-14: Vs = 104720.593
Av = 157079.633
fy = 555.56
s = 150.00
Vs has been multiplied by 2(1-s/d) (s>d/2, according to ASCE 41-17,10.3.4)
2(1-s/d) = 0.75
Vf ((11-3)-(11.4), ACI 440) = 0.00
From (11-11), ACI 440: Vs + Vf <= 366348.956

End Of Calculation of Shear Capacity ratio for element: beam B1 of floor 1
At local axis: 2

Start Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)
Section Type: rcars

Constant Properties

Knowledge Factor, κ = 1.00
Chord Rotation is generally considered as Deformation-Controlled Action according to Table C7-1, ASCE 41-17.
Mean strengths are used for Deformation-Controlled Actions according to 7.5.1.3, ASCE 41-17
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
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1892.749
Secondary Member
Ribbed Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Inadequate Lap Length with lb/ld = 0.30
No FRP Wrapping

Stepwise Properties

Bending Moment, M = 1.1104779E-010
Shear Force, V2 = -1.4434338E-013
Shear Force, V3 = 10923.11
Axial Force, F = -3329.81
Longitudinal Reinforcement Area Distribution (in 2 divisions)
-Tension: Aslt = 615.7522
-Compression: Aslc = 911.0619
Longitudinal Reinforcement Area Distribution (in 3 divisions)
-Tension: Asl,ten = 508.938
-Compression: Asl,com = 508.938
-Middle: Asl,mid = 508.938
Mean Diameter of Tension Reinforcement, DbL = 14.66667

New component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = 1.0*θu = 0.03212751
θu = θy + θp = 0.03212751

- Calculation of θy -

θy = (My*Ls/3)/EIeff = 0.00212751 ((4.29),Biskinis Phd))
My = 4.9164E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 946.3747
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 7.2898E+012

Calculation of Yielding Moment My

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

Φy = Min(Φy_ten,Φy_com)
Φy_ten = 8.2095122E-006
with ((10.1), ASCE 41-17) fy = Min(fy, 1.25*fy*(lb/ld)^2/3) = 311.2112
d = 258.00
ξy = 0.26533712
A = 0.01489839
B = 0.00870525
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 3329.81
b = 400.00
δ" = 0.1627907
Φy_comp = 3.2274323E-005
with fc = 33.00
Ec = 26999.444
ξy = 0.26421336
A = 0.01472138
B = 0.00860158
with Es = 200000.00

Calculation of ratio lb/ld

Inadequate Lap Length with lb/ld = 0.30

- Calculation of θp -

From table 10-7: θp = 0.03
with:
- Condition iv occured
Beam controlled by inadequate embedment into beam-column joint:
(lb/ld < 1 and With Lapping in the Vicinity of the End Regions
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.36389875
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 5.4811477E-023
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 139627.457,already given in calculation of shear control ratio
design Shear = 1.4434338E-013

- (ρ-ρ')/ρbal = -0.16792835
  ρ = Aslt/(bw*d) = 0.00596659
    Tension Reinf Area: Aslt = 615.7522
  ρ' = Aslc/(bw*d) = 0.00882812
    Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11: ρbal = 0.01704017
    fc = 33.00
    fy = 555.56
    From 10.2.7.3, ACI 318-11: β1 = 0.65
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+εy) = 0.51922877
      εy = 0.0027778
- V/(bw*d*fc^0.5) = 2.9321314E-018, NOTE: units in lb & in
    bw = 400.00

End Of Calculation of Chord Rotation Capacity for element: beam B1 of floor 1
At local axis: 3
Integration Section: (b)