# Detailed Member Calculations

**Units: N&mm**

**Regulation: ASCE 41-17**

## Calculation No. 1

beam B1, Floor 1

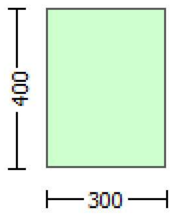
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

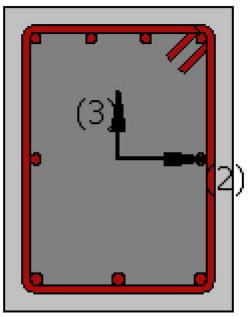
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96

Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
-----------------------------------------------------------------

Stepwise Properties
-----------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = -2.5984052E-011
Shear Force, Va = -7.8167252E-014
EDGE -B-
Bending Moment, Mb = -1.1865836E-010
Shear Force, Vb = 7.8167252E-014
BOTH EDGES
Axial Force, F = -626.4938
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 = 162939.788
Vn ((22.5.1.1), ACI 318-14) = 162939.788
-----------------------------------------------------------------
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 = 68692.008
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 2.5984052E-011
Vu = 7.8167252E-014
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 <= 285202.276
-----------------------------------------------------------------
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

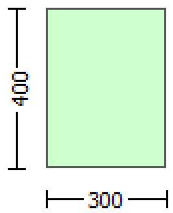
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

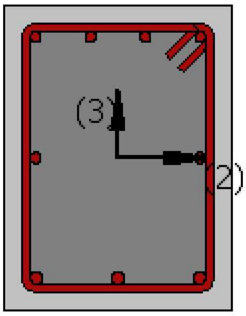
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
#################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping

---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-
Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
-----------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00

psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632

ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc  = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce  = 30.00

From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->

v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
--------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel

With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
-----------------------------------------------------------------

Stepwise Properties
-----------------------------------------------------------------
At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
-------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851

ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999

ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-------------------------------------------------------------------------
-------------------------------------------------------------------------
-------------------------------------------------------------------------
Calculation of Mu2+
-------------------------------------------------------------------------

-------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
-------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00

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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------

--------------------------------------------------------------------------
--------------------------------------------------------------------------
Calculation of Mu2-
--------------------------------------------------------------------------

--------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
--------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
--------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
-----------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars

Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
-------------------------------------------------------------------

Stepwise Properties
-------------------------------------------------------------------
Bending Moment, M = 6.8902E+006
Shear Force, V2 = -7.8167252E-014
Shear Force, V3 = -4790.151
Axial Force, F = -626.4938
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 = 0.01049175
θu = θy + θp = 0.01049175

-------------------------------------------------------------------
- Calculation of θy -
-------------------------------------------------------------------
θy = (My*Ls/3)/Eleff = 0.00549175 ((4.29),Biskinis Phd))
My = 1.4153E+008
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 1438.417
From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 1.2357E+013
-------------------------------------------------------------------
-------------------------------------------------------------------

Calculation of Yielding Moment My
-------------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
-------------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.1783717E-005
with fy = 625.00
d = 357.00
ξy = 0.25715275
A = 0.01426533
B = 0.00792416
with pt = 0.00563199
pc = 0.00574932
pv = 0.00287466
N = 626.4938
b = 300.00
δ'' = 0.11764706
Φy_comp = 2.2855779E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.25708162
A = 0.01424202
B = 0.00791481
with Es = 200000.00
-------------------------------------------------------------------

Calculation of ratio lb/ld
-------------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---

- Calculation of θp -

---

From table 10-7: θp = 0.005
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.80537227
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
       θ = 6.3962830E-005
 - Stirrup Spacing <= d/2
   d = 357.00
   s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
   Vs = 209439.51,already given in calculation of shear control ratio
   design Shear = 4790.151
 - (ρ-ρ')/ρbal = -0.23034134
   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 = 0.01298939
     fc = 30.00
     fy = 625.00
     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) = 0.48979592
         εy = 0.003125
 - V/(bw*d*fc^0.5) = 0.09833823, 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

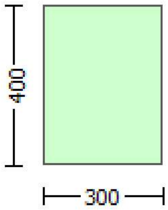
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

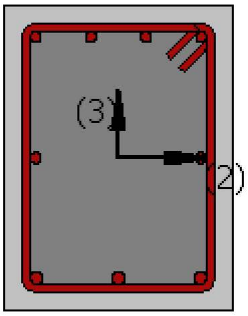
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = 6.8902E+006
Shear Force, Va = -4790.151
EDGE -B-
Bending Moment, Mb = 7.0410E+006
Shear Force, Vb = 10270.68
BOTH EDGES
Axial Force, F = -626.4938
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 = 238524.826
Vn ((22.5.1.1), ACI 318-14) = 238524.826

---------------------------------------------------------------
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 = 70973.218
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 0.22246678
Mu = 6.8902E+006
Vu = 4790.151
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 <= 285202.276
---------------------------------------------------------------
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

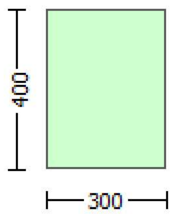
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

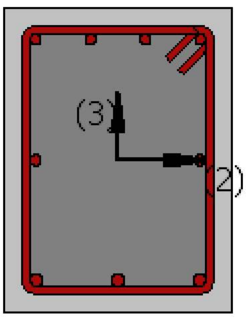
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
##############################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-
Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
--------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
--------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
Calculation of Mu1-
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00

d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799

----------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------

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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183

and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
--------------------------------------------------------------

Calculation of ratio lb/ld
--------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
Calculation of Mu2-
-----------------------------------------------------------------------------

-----------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
-----------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372

εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->

ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706

---------------------------------------------------------------

Calculation of ratio lb/ld

---------------------------------------------------------------

Adequate Lap Length: lb/ld >= 1

------------------------------------------------------------------------------

------------------------------------------------------------------------------

------------------------------------------------------------------------------

------------------------------------------------------------------------------

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853

------------------------------------------------------------------------------

Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025

------------------------------------------------------------------------------

Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025

---------------------------------------------------------------

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008

ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008

-----------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025

εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

```
        ho = 340.00
        Σbi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    ----------------------------------------------------------------------
      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 = 781.25
      fce  = 30.00
    From ((5.A5), TBDY), TBDY: εcc = 0.00283722
      λc  = confinement factor = 1.08372
  εy1 = 0.0025
  εsh1 = 0.008
  ft1 = 937.50
  fy1 = 781.25
  εsu1 = 0.032
    using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
    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 = 781.25
     with Es1 = Es = 200000.00
  εy2 = 0.0025
  εsh2 = 0.008
  ft2 = 937.50
  fy2 = 781.25
  εsu2 = 0.032
    using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
    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 = 781.25
     with Es2 = Es = 200000.00
  εyv = 0.0025
  εshv = 0.008
  ftv = 937.50
  fyv = 781.25
  εsuv = 0.032
    using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
    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 = 781.25
```

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture

δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
---------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025

---------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
Bending Moment, M = -2.5984052E-011
Shear Force, V2 = -7.8167252E-014
Shear Force, V3 = -4790.151
Axial Force, F = -626.4938
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 = 0.00933654
θu = θy + θp = 0.00933654

---------------------------------------------------------------
- Calculation of θy -
---------------------------------------------------------------
θy = (My*Ls/3)/EIeff = 0.00433654 ((4.29),Biskinis Phd))
My = 9.7756E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 925.00
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 6.9506E+012
---------------------------------------------------------------
---------------------------------------------------------------

Calculation of Yielding Moment My

---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.6556764E-005
with fy = 625.00
d = 258.00
ξy = 0.26843175
A = 0.01480442
B = 0.00861129
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 626.4938
b = 400.00
δ'' = 0.1627907
Φy_comp = 3.0296145E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.26836644
A = 0.01478024
B = 0.00860158
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.005
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.81334921
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = -1.4986515E-021
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 157079.633,already given in calculation of shear control ratio
design Shear = 7.8167252E-014
- (ρ-ρ')/ρbal = -0.2390461
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 1.6653585E-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

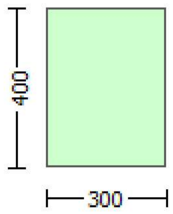
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

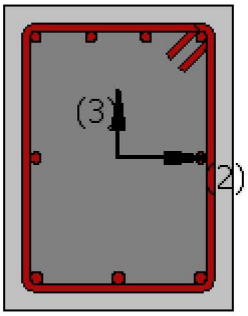
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
-----------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = -2.5984052E-011
Shear Force, Va = -7.8167252E-014
EDGE -B-
Bending Moment, Mb = -1.1865836E-010
Shear Force, Vb = 7.8167252E-014
BOTH EDGES
Axial Force, F = -626.4938
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 = 162939.788
Vn ((22.5.1.1), ACI 318-14) = 162939.788
-----------------------------------------------------------------
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 = 68692.008
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 1.1865836E-010
Vu = 7.8167252E-014
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 <= 285202.276
-----------------------------------------------------------------
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

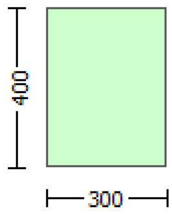
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

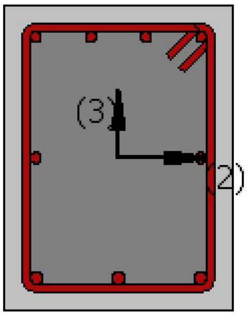
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
##################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-

Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
--------------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722

λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------

Calculation of ratio lb/ld

-----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------
--------------------------------------------------------------------------
--------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------

--------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
--------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00

d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25

εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
------------------------------------------------------------

Stepwise Properties
------------------------------------------------------------

At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00

d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008

ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008

φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
----------------------------------------------------------------------------
----------------------------------------------------------------------------
----------------------------------------------------------------------------
Calculation of Mu2+
----------------------------------------------------------------------------

----------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
----------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
--------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025

εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562

Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00

εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc  = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
--------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633

fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
-------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
-------------------------------------------------------------

Stepwise Properties

---------------------------------------------------------------
Bending Moment, M = 7.0410E+006
Shear Force, V2 = 7.8167252E-014
Shear Force, V3 = 10270.68
Axial Force, F = -626.4938
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 = 0.00766963
θu = θy + θp = 0.00766963

---------------------------------------------------------------
- Calculation of θy -
---------------------------------------------------------------
θy = (My*Ls/3)/Eleff = 0.00266963 ((4.29),Biskinis Phd))
My = 1.4436E+008
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 685.5457
From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 1.2357E+013
---------------------------------------------------------------
---------------------------------------------------------------

Calculation of Yielding Moment My
---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.1787143E-005
with fy = 625.00
d = 358.00
ξy = 0.25944309
A = 0.01422548
B = 0.00802264
with pt = 0.00573326
pc = 0.00561626
pv = 0.00286663
N = 626.4938
b = 300.00
δ'' = 0.12011173
Φy_comp = 2.2590528E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.25937365
A = 0.01420224
B = 0.00801331
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.005
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1

shear control ratio Vp/Vo = 0.80537227
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 3.0488392E-005
- Stirrup Spacing <= d/2
d = 358.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 209439.51,already given in calculation of shear control ratio
design Shear = 10270.68
- (ρ-ρ')/ρbal = -0.21168241
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 0.21026042, 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

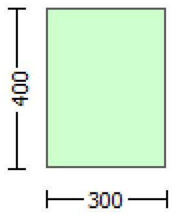
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

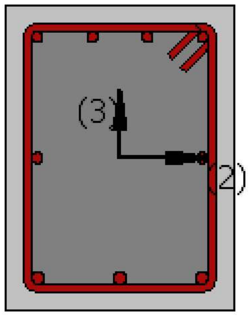
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = 6.8902E+006
Shear Force, Va = -4790.151
EDGE -B-
Bending Moment, Mb = 7.0410E+006
Shear Force, Vb = 10270.68
BOTH EDGES
Axial Force, F = -626.4938
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 = 241129.785
Vn ((22.5.1.1), ACI 318-14) = 241129.785

-----------------------------------------------------------------
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 = 73578.176
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 0.4667814
Mu = 7.0410E+006
Vu = 10270.68
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 <= 285202.276
-----------------------------------------------------------------
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

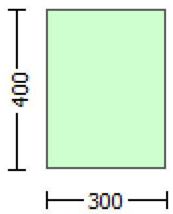
Limit State: Immediate Occupancy (data interpolation between analysis steps 1 and 2)

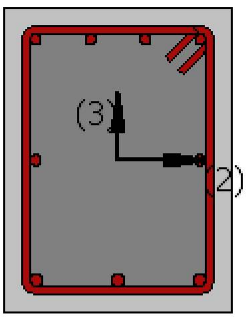
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
-----------------------------------------------------------------

Stepwise Properties
-----------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-
Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00

d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------

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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183

and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372

εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->

ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
###############################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008

ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008

---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025

εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
Calculation of Mu2+
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture

δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
----------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
----------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025

---

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping

---

Stepwise Properties

---

Bending Moment, M = -1.1865836E-010
Shear Force, V2 = 7.8167252E-014
Shear Force, V3 = 10270.68
Axial Force, F = -626.4938
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 = 0.00933654
θu = θy + θp = 0.00933654

---

- Calculation of θy -

---

θy = (My*Ls/3)/EIeff = 0.00433654 ((4.29),Biskinis Phd))
My = 9.7756E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 925.00
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 6.9506E+012

---

---

Calculation of Yielding Moment My

---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.6556764E-005
with fy = 625.00
d = 258.00
ξy = 0.26843175
A = 0.01480442
B = 0.00861129
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 626.4938
b = 400.00
δ'' = 0.1627907
Φy_comp = 3.0296145E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.26836644
A = 0.01478024
B = 0.00860158
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.005
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.81334921
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = -1.5640040E-021
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 157079.633,already given in calculation of shear control ratio
design Shear = 7.8167252E-014
- (ρ-ρ')/ρbal = -0.22029739
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 1.6653585E-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

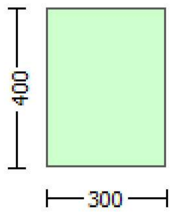
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

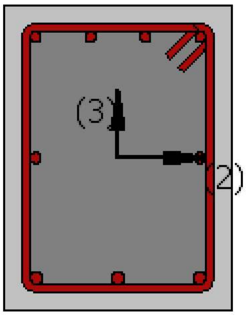
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
-----------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = -1.4665915E-011
Shear Force, Va = -4.9310428E-014
EDGE -B-
Bending Moment, Mb = -7.6579212E-011
Shear Force, Vb = 4.9310428E-014
BOTH EDGES
Axial Force, F = -467.4822
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 = 162939.788
Vn ((22.5.1.1), ACI 318-14) = 162939.788
-----------------------------------------------------------------
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 = 68692.008
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 1.4665915E-011
Vu = 4.9310428E-014
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 <= 285202.276
-----------------------------------------------------------------
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

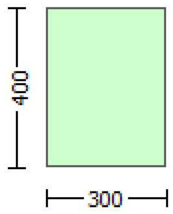
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

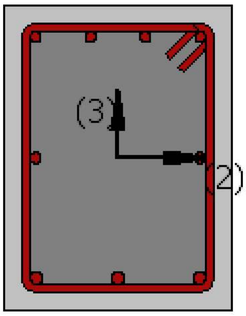
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
#################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-

Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722

λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld

-----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------
--------------------------------------------------------------------------
--------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------

--------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
--------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00

d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25

εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
-------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
----------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
------------------------------------------------------------

Stepwise Properties
------------------------------------------------------------

At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00

d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008

ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008

φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
Calculation of Mu2+
---------------------------------------------------------------------------------

---------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025

εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562

Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00

εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
--------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633

fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
------------------------------------------------------------

Stepwise Properties

---------------------------------------------------------------
Bending Moment, M = 4.3679E+006
Shear Force, V2 = -4.9310428E-014
Shear Force, V3 = -2010.166
Axial Force, F = -467.4822
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 = 0.03829457
θu = θy + θp = 0.03829457

---------------------------------------------------------------
- Calculation of θy -
---------------------------------------------------------------
θy = (My*Ls/3)/EIeff = 0.00829457 ((4.29),Biskinis Phd))
My = 1.4151E+008
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 2172.914
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.2357E+013
---------------------------------------------------------------
---------------------------------------------------------------

Calculation of Yielding Moment My
---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.1783126E-005
with fy = 625.00
d = 357.00
ξy = 0.25711549
A = 0.01426295
B = 0.00792179
with pt = 0.00563199
pc = 0.00574932
pv = 0.00287466
N = 467.4822
b = 300.00
δ'' = 0.11764706
Φy_comp = 2.2857488E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.2570624
A = 0.01424556
B = 0.00791481
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.03
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1

shear control ratio Vp/Vo = 0.80537227
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 4.7597646E-005
- Stirrup Spacing <= d/2
d = 357.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 209439.51,already given in calculation of shear control ratio
design Shear = 2010.166
- (ρ-ρ')/ρbal = -0.23034134
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 0.0412672, 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

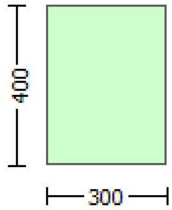
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

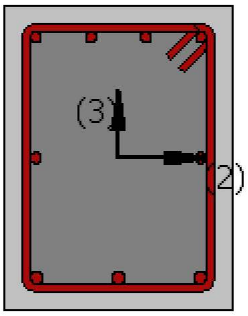
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = 4.3679E+006
Shear Force, Va = -2010.166
EDGE -B-
Bending Moment, Mb = 4.4204E+006
Shear Force, Vb = 7490.695
BOTH EDGES
Axial Force, F = -467.4822
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 = 237753.723
Vn ((22.5.1.1), ACI 318-14) = 237753.723

---------------------------------------------------------------

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 = 70202.114
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 0.14726768
Mu = 4.3679E+006
Vu = 2010.166
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 <= 285202.276

---------------------------------------------------------------

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

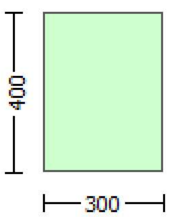
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

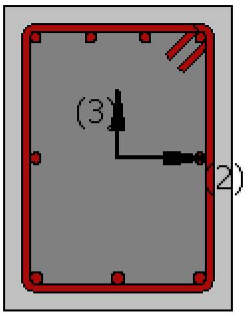
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
------------------------------------------------------------

Stepwise Properties
------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-
Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00

d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce  = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc  = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
------------------------------------------------------------

Calculation of ratio lb/ld

------------------------------------------------------------

Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------

Calculation of Mu2+

---------------------------------------------------------------------------

---------------------------------------------------------------------------

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008

---------------------------------------------------------------------------

with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799

-------------------------------------------------------------------

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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183

and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675

-----------------------------------------------------------

Calculation of ratio lb/ld

-----------------------------------------------------------

Adequate Lap Length: lb/ld >= 1

-------------------------------------------------------------------------
-------------------------------------------------------------------------
-------------------------------------------------------------------------

Calculation of Mu2-

-------------------------------------------------------------------------

-------------------------------------------------------------------------

Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008

-------------------------------------------------------------------------

with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799

-----------------------------------------------------------------

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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372

εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->

ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
#################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008

ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008

---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025

εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2+
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Calculation of Mu2-
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
-------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture

δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025

--------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
--------------------------------------------------------------

Stepwise Properties
--------------------------------------------------------------
Bending Moment, M = -1.4665915E-011
Shear Force, V2 = -4.9310428E-014
Shear Force, V3 = -2010.166
Axial Force, F = -467.4822
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 = 0.03433575
θu = θy + θp = 0.03433575

--------------------------------------------------------------
- Calculation of θy -
--------------------------------------------------------------
θy = (My*Ls/3)/EIeff = 0.00433575 ((4.29),Biskinis Phd))
My = 9.7739E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 925.00
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 6.9506E+012
--------------------------------------------------------------
--------------------------------------------------------------

Calculation of Yielding Moment My

-------------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
-------------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.6555937E-005
 with fy = 625.00
      d = 258.00
      ξy = 0.2683952
      A = 0.01480196
      B = 0.00860882
       with pt = 0.00493157
            pc = 0.00493157
            pv = 0.00493157
            N = 467.4822
            b = 400.00
            δ" = 0.1627907
Φy_comp = 3.0298401E-005
 with fc = 30.00
      Ec = 25742.96
      ξy = 0.26834646
      A = 0.01478391
      B = 0.00860158
       with Es = 200000.00
-------------------------------------------------------------------

Calculation of ratio lb/ld
-------------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

-------------------------------------------------------------------
 - Calculation of θp -
-------------------------------------------------------------------
From table 10-7: θp = 0.03
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.81334921
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
       θ = -8.3545056E-022
 - Stirrup Spacing > d/2
   d = 258.00
   s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
   Vs = 157079.633,already given in calculation of shear control ratio
   design Shear = 4.9310428E-014
 - (ρ-ρ')/ρbal = -0.2390461
   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 = 0.01298939
     fc = 30.00
     fy = 625.00
     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) = 0.48979592
         εy = 0.003125
 - V/(bw*d*fc^0.5) = 1.0505620E-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

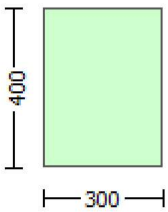
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

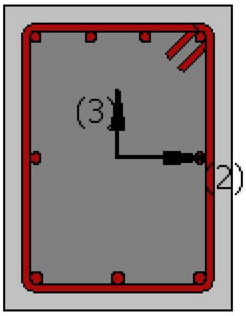
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = -1.4665915E-011
Shear Force, Va = -4.9310428E-014
EDGE -B-
Bending Moment, Mb = -7.6579212E-011
Shear Force, Vb = 4.9310428E-014
BOTH EDGES
Axial Force, F = -467.4822
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 = 162939.788
Vn ((22.5.1.1), ACI 318-14) = 162939.788
---------------------------------------------------------------
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 = 68692.008
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 7.6579212E-011
Vu = 4.9310428E-014
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 <= 285202.276
---------------------------------------------------------------
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

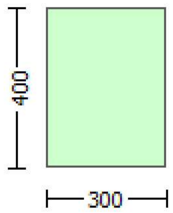
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

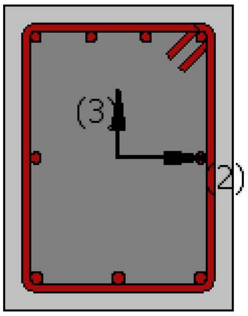
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
###################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-

Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722

λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
--------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld

--------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
Calculation of Mu2+
-----------------------------------------------------------------------------

-----------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
-----------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00

d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25

εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
----------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
----------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
----------------------------------------------------------------

Stepwise Properties
----------------------------------------------------------------

At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
-----------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00

d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008

ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008

φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025

εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------
--------------------------------------------------------------------------
--------------------------------------------------------------------------
Calculation of Mu2-
--------------------------------------------------------------------------

--------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562

Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00

εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
--------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633

fy = 625.00
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 <= 349300.025
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties

---------------------------------------------------------------
Bending Moment, M = 4.4204E+006
Shear Force, V2 = 4.9310428E-014
Shear Force, V3 = 7490.695
Axial Force, F = -467.4822
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 = 0.03229762
θu = θy + θp = 0.03229762

---------------------------------------------------------------
- Calculation of θy -
---------------------------------------------------------------
θy = (My*Ls/3)/Eleff = 0.00229762 ((4.29),Biskinis Phd))
My = 1.4433E+008
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 590.1149
From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 1.2357E+013
---------------------------------------------------------------
---------------------------------------------------------------

Calculation of Yielding Moment My
---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.1786557E-005
with fy = 625.00
d = 358.00
ξy = 0.25940624
A = 0.01422311
B = 0.00802028
with pt = 0.00573326
pc = 0.00561626
pv = 0.00286663
N = 467.4822
b = 300.00
δ'' = 0.12011173
Φy_comp = 2.2592204E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.25935442
A = 0.01420577
B = 0.00801331
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.03
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1

shear control ratio Vp/Vo = 0.80537227
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = 1.1985246E-005
- Stirrup Spacing <= d/2
d = 358.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 209439.51,already given in calculation of shear control ratio
design Shear = 7490.695
- (ρ-ρ')/ρbal = -0.21168241
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 0.15334881, 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

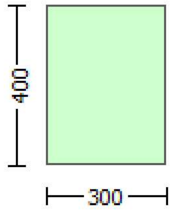
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

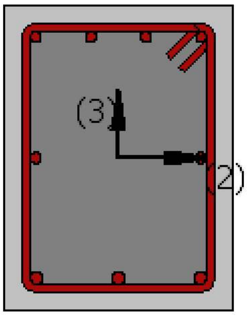
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fc_lower_bound = 20.00
New material of Primary Member: Steel Strength, fs = fs_lower_bound = 500.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min = lb/ld >=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
EDGE -A-
Bending Moment, Ma = 4.3679E+006
Shear Force, Va = -2010.166
EDGE -B-
Bending Moment, Mb = 4.4204E+006
Shear Force, Vb = 7490.695
BOTH EDGES
Axial Force, F = -467.4822
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 = 241919.955
Vn ((22.5.1.1), ACI 318-14) = 241919.955

---------------------------------------------------------------
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 = 74368.347
λ = 1 (normal-weight concrete)
fc' = 20.00, 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 = 0.54226731
Mu = 4.4204E+006
Vu = 7490.695
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 <= 285202.276
---------------------------------------------------------------
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

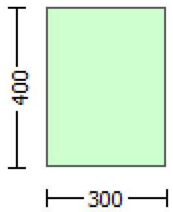
Limit State: Collapse Prevention (data interpolation between analysis steps 1 and 2)

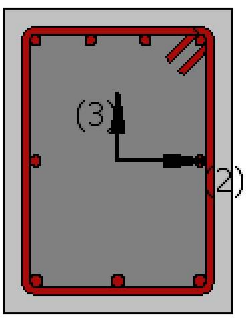
Analysis: Uniform +X

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
##############################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 3
EDGE -A-
Shear Force, Va = 2740.264
EDGE -B-
Shear Force, Vb = 2740.264
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.80537227
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 = 244691.307
with
Mpr1 = Max(Mu1+ , Mu1-) = 2.2382E+008
Mu1+ = 2.2017E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 2.2382E+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-) = 2.2379E+008
Mu2+ = 2.2020E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 2.2379E+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 = 2740.264, is the shear force acting at edge 1 for the the static loading combination
V2 = 2740.264, 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 = 0.00010685
Mu = 2.2017E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14666632
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14972187
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20015244
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20432228
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16113375
Mu = MRc (4.14) = 2.2017E+008
φu = φsu (4.1) = 0.00010685
------------------------------------------------------------

Calculation of ratio lb/ld
------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu1-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010696
Mu = 2.2382E+008
---------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00

d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032

using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14930365
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14625664
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20369935
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.19954222
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16429731
Mu = MRc (4.14) = 2.2382E+008
φu = φsu (4.1) = 0.00010696
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Calculation of Mu2+
-------------------------------------------------------------------------------

-------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010675
Mu = 2.2020E+008
-------------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 6.0758485E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
----------------------------------------------------------------------

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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14625664
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14930365
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07465183

and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.19954222
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20369935
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10184967
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.16269232
Mu = MRc (4.14) = 2.2020E+008
φu = φsu (4.1) = 0.00010675
-------------------------------------------------------------

Calculation of ratio lb/ld
-------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
Calculation of Mu2-
-----------------------------------------------------------------------------

-----------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00010706
Mu = 2.2379E+008
-----------------------------------------------------------------------------
with full section properties:
b = 300.00
d = 357.00
d' = 42.00
v = 6.0928677E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
--------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372

εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.14972187
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.14666632
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07486094
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc  = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.20432228
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.20015244
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10216114
Case/Assumption: Unconfinesd full section - Steel rupture
δ' satisfies Eq. (4.3)
--->
v < vs,y2 - LHS eq.(4.5) is satisfied
--->

ξsu (4.9) = 0.16275163
Mu = MRc (4.14) = 2.2379E+008
φu = φsu (4.1) = 0.00010706
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 303823.853
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 303823.853
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 = 94384.343
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 57789.519
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 209439.51
Av = 157079.633
fy = 625.00
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 <= 349300.025
---------------------------------------------------------------
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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
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 = 781.25
################################################################
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.08372
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lo/lou,min>=1)
No FRP Wrapping
---------------------------------------------------------------

Stepwise Properties
---------------------------------------------------------------
At local axis: 2
EDGE -A-
Shear Force, Va = 2.2095839E-020
EDGE -B-
Shear Force, Vb = -2.2095839E-020
BOTH EDGES
Axial Force, F = -195.7638
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 = 0.81334921
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 = 164247.665
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5193E+008
Mu1+ = 1.5193E+008, is the ultimate moment strength at the edge 1 of the member in the actual moment direction which is defined for the static loading combination
Mu1- = 1.5193E+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-) = 1.5193E+008
Mu2+ = 1.5193E+008, is the ultimate moment strength at the edge 2 of the member in the actual moment direction which is defined for the the static loading combination
Mu2- = 1.5193E+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 = 2.2095839E-020, is the shear force acting at edge 1 for the the static loading combination
V2 = -2.2095839E-020, 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 = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
---------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008

ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu1-
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008

---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025

εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
----------------------------------------------------------------

Calculation of ratio lb/ld
----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Calculation of Mu2+
--------------------------------------------------------------------------------

--------------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
--------------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00

ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25

with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture
δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
------------------------------------------------------------

Calculation of ratio lb/ld

------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Mu2-
---------------------------------------------------------------------------

---------------------------------------------------------------------------
Calculation of ultimate curvature φu according to 4.1, Biskinis/Fardis 2013:
φu = 0.00015562
Mu = 1.5193E+008
---------------------------------------------------------------------------
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 6.3231214E-005
N = 195.7638
fc = 30.00
εco (5A.5, TBDY) = 0.002
Final value of εcu: εcu* = shear_factor * Max(εcu,εcc) = 0.00763475
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: εcu = 0.00763475
ωwe (5.4c) = 0.0106851
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
Σbi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
-------------------------------------------------------------------
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 = 781.25
fce = 30.00
From ((5.A5), TBDY), TBDY: εcc = 0.00283722
λc = confinement factor = 1.08372
εy1 = 0.0025
εsh1 = 0.008
ft1 = 937.50
fy1 = 781.25
εsu1 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es1 = Es = 200000.00
εy2 = 0.0025
εsh2 = 0.008
ft2 = 937.50
fy2 = 781.25
εsu2 = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Es2 = Es = 200000.00
εyv = 0.0025
εshv = 0.008
ftv = 937.50
fyv = 781.25
εsuv = 0.032
using (30) in Biskinis/Fardis (2013) multiplied with 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 = 1.00
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 = 781.25
with Esv = Es = 200000.00
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.1284263
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.1284263
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.1284263
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 32.51165
εcc (5A.5, TBDY) = 0.00283722
λc = confinement factor = 1.08372
ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.17096999
ω2 = Asl,com/(b*d)*(fs2/fc) = 0.17096999
ωv = Asl,mid/(b*d)*(fsv/fc) = 0.17096999
Case/Assumption: Unconfinesd full section - Steel rupture

δ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
ξsu (4.9) = 0.20298661
Mu = MRc (4.14) = 1.5193E+008
φu = φsu (4.1) = 0.00015562
-----------------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 201939.909
-------------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744815E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025
-------------------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 201939.909
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 = 84130.185
λ = 1 (normal-weight concrete)
fc' = 30.00, 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 = 4.6744919E-012
Vu = 2.2095839E-020
From (11.5.4.8), ACI 318-14: Vs = 117809.725
Av = 157079.633
fy = 625.00
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 <= 349300.025

---

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 Primary Member: Concrete Strength, fc = fcm = 30.00
New material of Primary Member: Steel Strength, fs = fsm = 625.00
Concrete Elasticity, Ec = 25742.96
Steel Elasticity, Es = 200000.00
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Element Length, L = 1850.00
Primary Member
Smooth Bars
Ductile Steel
With Detailing for Earthquake Resistance (including stirrups closed at 135°)
Longitudinal Bars With Ends Lapped Starting at the End Sections
Adequate Lap Length (lb/ld>=1)
No FRP Wrapping

---

Stepwise Properties

---

Bending Moment, M = -7.6579212E-011
Shear Force, V2 = 4.9310428E-014
Shear Force, V3 = 7490.695
Axial Force, F = -467.4822
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 = 0.03433575
θu = θy + θp = 0.03433575

---

- Calculation of θy -

---

θy = (My*Ls/3)/EIeff = 0.00433575 ((4.29),Biskinis Phd))
My = 9.7739E+007
Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 925.00
From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 6.9506E+012

---

---

Calculation of Yielding Moment My

---------------------------------------------------------------
Calculation of Φy and My according to Annex 7A - ΚΑΝΕΠΕ
---------------------------------------------------------------
Φy = Min(Φy_ten,Φy_com)
Φy_ten = 1.6555937E-005
with fy = 625.00
d = 258.00
ξy = 0.2683952
A = 0.01480196
B = 0.00860882
with pt = 0.00493157
pc = 0.00493157
pv = 0.00493157
N = 467.4822
b = 400.00
δ'' = 0.1627907
Φy_comp = 3.0298401E-005
with fc = 30.00
Ec = 25742.96
ξy = 0.26834646
A = 0.01478391
B = 0.00860158
with Es = 200000.00
---------------------------------------------------------------

Calculation of ratio lb/ld
---------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1

---------------------------------------------------------------
- Calculation of θp -
---------------------------------------------------------------
From table 10-7: θp = 0.03
with:
- Condition i occured
Beam controlled by flexure: Vp/Vo <= 1
shear control ratio Vp/Vo = 0.81334921
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, θ/θy < 2 (table 10-6, ASCE 41-17)
θ = -1.0722573E-021
- Stirrup Spacing > d/2
d = 258.00
s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
Vs = 157079.633,already given in calculation of shear control ratio
design Shear = 4.9310428E-014
- (ρ-ρ')/ρbal = -0.22029739
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 = 0.01298939
fc = 30.00
fy = 625.00
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) = 0.48979592
εy = 0.003125
- V/(bw*d*fc^0.5) = 1.0505620E-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)

---------------------------------------------------------------