Detailed Member Calculations

Units: N & mm

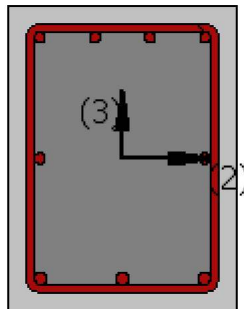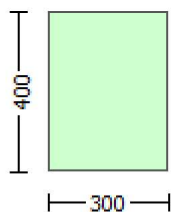**Regulation: ASCE 41-17**

Calculation No. 1

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)

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

Constant Properties

Knowledge Factor, = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039

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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -4.6301801E-012
Shear Force, Va = -3.4466031E-014
EDGE -B-
Bending Moment, Mb = -5.9084780E-011
Shear Force, Vb = 3.4466031E-014
BOTH EDGES
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 102628.668
Vn ((22.5.1.1), ACI 318-14) = 136838.224

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

  From Table (22.5.5.1), ACI 318-14: Vc = 61440.00
       = 1 (normal-weight concrete)
     fc' = 16.00, 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 = 4.6301801E-012
        Vu = 3.4466031E-014
  From (11.5.4.8), ACI 318-14: Vs = 75398.224
     Av = 157079.633
     fy = 400.00
     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 <= 255092.67

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

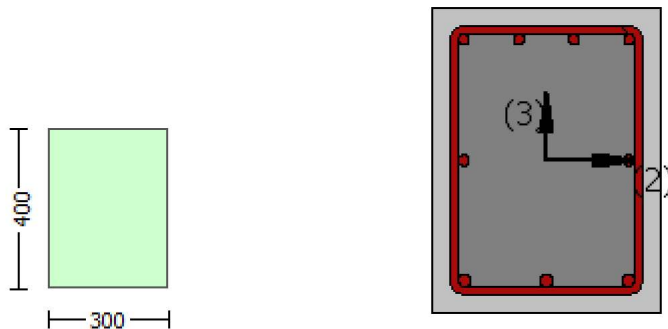
Calculation No. 2

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
Member Controlled by Flexure ($Ve/Vr < 1$)
Calculation of Shear Demand from fig. R18.6.5, ACI 318-14 $Ve = (Mpr1 + Mpr2)/ln \pm wu*ln/2$ = 175486.019
with
$Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008$
  $Mu1+ = 1.5719E+008$, 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
  $Mu1- = 1.5980E+008$, 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
$Mpr2 = Max(Mu2+ , Mu2-) = 1.5978E+008$
  $Mu2+ = 1.5721E+008$, 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
  $Mu2- = 1.5978E+008$, 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
$\pm wu*ln = (|V1| + |V2|)/2$
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 = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: εcu = 0.00583896
      ωwe (5.4c) = 0.0034192
      αse ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00

psh,min = Min(psh,x , psh,y) = 0.00261799
        Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
        ----
        psh,x (5.4d) = 0.00349066
            Ash = Astir*ns = 78.53982
                No stirups, ns = 2.00
            bk = 300.00
        ----
        psh,y (5.4d) = 0.00261799
            Ash = Astir*ns = 78.53982
                No stirups, ns = 2.00
            bk = 400.00
        ----
            s = 150.00
        fywe = 555.55
        fce = 20.00
        From ((5.A5), TBDY), TBDY: cc = 0.002
            c = confinement factor = 1.00
    y1 = 0.00231479
    sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
    su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu1_nominal = 0.08,
        For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
        characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
    sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
    su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
  ftv = 666.66
  fyv = 555.55
    suv = 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
        suv = 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 yv, shv,ftv,fyv, it is considered
        characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55

with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
  2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
  v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
  u = su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
   N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
        bi2 = 346400.00
     psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
     ----
     psh,x (5.4d) = 0.00349066
       Ash = Astir*ns = 78.53982
         No stirups, ns = 2.00
       bk = 300.00
     ----
     psh,y (5.4d) = 0.00261799
       Ash = Astir*ns = 78.53982
         No stirups, ns = 2.00
       bk = 400.00

```
        ------------------------------------------------------------------
            s = 150.00
          fywe = 555.55
           fce = 20.00
       From ((5.A5), TBDY), TBDY:  cc = 0.002
           c = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
       su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
    y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
       su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
    yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
       suv = 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  yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fsv = fs = 555.55
       with Esv = Es = 200000.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
     2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
     v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
 and confined core properties:
   b = 240.00
   d = 328.00
   d' = 13.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
        c = confinement factor = 1.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
     2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
```

v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
   ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
  u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
        we (5.4c) = 0.0034192
         ase ((5.4d), TBDY) = 0.15672608
           bo = 240.00
           ho = 340.00
            bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        ----
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 300.00
        ----
        psh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 400.00
        ----
           s = 150.00
          fywe = 555.55
          fce = 20.00
        From ((5.A5), TBDY), TBDY: cc = 0.002
           c = confinement factor = 1.00
    y1 = 0.00231479
    sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
    su1 = 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
su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 555.55
with Es1 = Es = 200000.00
y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 555.55
with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
u = su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
      ----
        psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
      ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
    y1 = 0.00231479
    sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
    su1 = 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
       su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
    sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55

su2 = 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
　　su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
　From table 5A.1, TBDY: esu2_nominal = 0.08,
　For calculation of esu2_nominal and　y2, sh2,ft2,fy2, it is considered
　characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
　　y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
　　with fs2 = fs = 555.55
　　with Es2 = Es = 200000.00
　yv = 0.00231479
　shv = 0.008
　ftv = 666.66
　fyv = 555.55
　suv = 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
　　suv = 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　yv, shv,ftv,fyv, it is considered
　characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
　　y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
　　with fsv = fs = 555.55
　　with Esv = Es = 200000.00
　1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
　2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
　v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
　b = 240.00
　d = 327.00
　d' = 12.00
　fcc (5A.2, TBDY) = 20.00
　cc (5A.5, TBDY) = 0.002
　　c = confinement factor = 1.00
　1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
　2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
　v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
　' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
　su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
　u =　su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
    = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
 From (11.5.4.8), ACI 318-14: Vs = 148933.273
    Av = 157079.633
    fy = 444.44
    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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

 From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
    = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
 From (11.5.4.8), ACI 318-14: Vs = 148933.273
    Av = 157079.633
    fy = 444.44
    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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
###

Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
  Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
  Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
  V2 = 8.7724203E-020, is the shear force acting at edge 2 for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00

v = 0.00010855
   N = 224.0403
fc = 20.00
  co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
    we (5.4c) = 0.0034192
     ase ((5.4d), TBDY) = 0.15672608
       bo = 240.00
       ho = 340.00
        bi2 = 346400.00
     psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)

    ----
    psh,x (5.4d) = 0.00349066
     Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
     bk = 300.00
    ----
    psh,y (5.4d) = 0.00261799
     Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
     bk = 400.00
    ----
     s = 150.00
    fywe = 555.55
    fce = 20.00
  From ((5A.5), TBDY), TBDY: cc = 0.002
    c = confinement factor = 1.00
 y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
   su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu1_nominal = 0.08,
  For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
  characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs1 = fs = 555.55
   with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
   su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu2_nominal = 0.08,
  For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
  characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55

suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
  2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
  v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
   N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
    we (5.4c) = 0.0034192
    ase ((5.4d), TBDY) = 0.15672608
     bo = 240.00
     ho = 340.00
     bi2 = 346400.00
    psh,min = Min(psh,x , psh,y) = 0.00261799

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

----
psh,x (5.4d) = 0.00349066
   Ash = Astir*ns = 78.53982
     No stirups, ns = 2.00
   bk = 300.00
----
psh,y (5.4d) = 0.00261799
   Ash = Astir*ns = 78.53982
     No stirups, ns = 2.00
   bk = 400.00
----
   s = 150.00
   fywe = 555.55
   fce = 20.00
From ((5.A5), TBDY), TBDY: cc = 0.002
   c = confinement factor = 1.00
y1 = 0.00231479
sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
su1 = 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
  su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu1_nominal = 0.08,
  For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
  characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
  with fs1 = fs = 555.55
  with Es1 = Es = 200000.00
y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
  su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu2_nominal = 0.08,
  For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
  characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
  with fs2 = fs = 555.55
  with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
  suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
  with fsv = fs = 555.55
  with Esv = Es = 200000.00

```
       1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
       2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
       v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
     cc (5A.5, TBDY) = 0.002
        c = confinement factor = 1.00
       1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
       2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
       v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
  su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595
------------------------------------------------------------

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


---------------------------------------------------------------------
Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
---------------------------------------------------------------------------
with full section properties:
   b = 400.00
   d = 258.00
   d' = 42.00
   v = 0.00010855
     N = 224.0403
   fc = 20.00
     co (5A.5, TBDY) = 0.002
   Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
      The Shear_factor is considered equal to 1 (pure moment strength)
      From (5.4b), TBDY:  cu = 0.00583896
        we (5.4c) = 0.0034192
         ase ((5.4d), TBDY) = 0.15672608
            bo = 240.00
            ho = 340.00
             bi2 = 346400.00
         psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      -------------------------------------------------------------------
         psh,x (5.4d) = 0.00349066
            Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
            bk = 300.00
      -------------------------------------------------------------------
         psh,y (5.4d) = 0.00261799
            Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
            bk = 400.00
      -------------------------------------------------------------------
```

```
           s = 150.00
        fywe = 555.55
         fce = 20.00
     From ((5.A5), TBDY), TBDY:  cc = 0.002
         c = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
    y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
    yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
      suv = 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  yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
 and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
```

Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
  su1 = 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
              su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
            From table 5A.1, TBDY: esu1_nominal = 0.08,
            For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
            characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
              y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
              with fs1 = fs = 555.55
              with Es1 = Es = 200000.00
       y2 = 0.00231479
       sh2 = 0.008
     ft2 = 666.66
    fy2 = 555.55
      su2 = 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
          su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
          y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
          with fs2 = fs = 555.55
          with Es2 = Es = 200000.00
     yv = 0.00231479
     shv = 0.008
   ftv = 666.66
  fyv = 555.55
    suv = 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
        suv = 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 yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
        = 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 = 1.8491887E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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

Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
        = 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 = 1.8491916E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 5.3884E+006
Shear Force, V2 = -3.4466031E-014
Shear Force, V3 = -3205.681
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R =   * θu = 0.00790463
 θu = θy + θp = 0.01053951

 - Calculation of θy -

 θy = (My*Ls/3)/EIeff = 0.00553951 ((4.29),Biskinis Phd))
  My = 9.9749E+007
  Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 1680.883
  From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.0089E+013

Calculation of Yielding Moment My

Calculation of θy and My according to Annex 7 -

 ϕy = Min(ϕy_ten, ϕy_com)
 ϕy_ten = 8.5937621E-006
with fy = 444.44
    d = 357.00
     ξy = 0.27567813
    A = 0.0142681
    B = 0.00792694
     with pt = 0.00563199
        pc = 0.00574932

pv = 0.00287466
        N = 577.527
        b = 300.00
         " = 0.11764706
   y_comp = 1.7409301E-005
 with fc = 20.00
     Ec = 21019.039
      y = 0.27557517
      A = 0.01424022
      B = 0.00791481
       with Es = 200000.00

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

 - Calculation of   p -

From table 10-7:   p = 0.005
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.77008272
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand,   / y < 2 (table 10-6, ASCE 41-17)
        = 6.3712927E-005
 - Stirrup Spacing <= d/2
   d = 357.00
   s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
   Vs = 148933.273,already given in calculation of shear control ratio
   design Shear = 3205.681
 - (- ')/ bal = -0.160191
     = Aslt/(bw*d) = 0.00563199
   Tension Reinf Area: Aslt = 603.1858
   ' = Aslc/(bw*d) = 0.00862398
   Compression Reinf Area: Aslc = 923.6282
  From (B-1), ACI 318-11:   bal = 0.01867766
    fc = 20.00
    fy = 444.44
    From 10.2.7.3, ACI 318-11: 1 = 0.85
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
        y = 0.0022222
 - V/(bw*d*fc^0.5) = 0.08060074, 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)

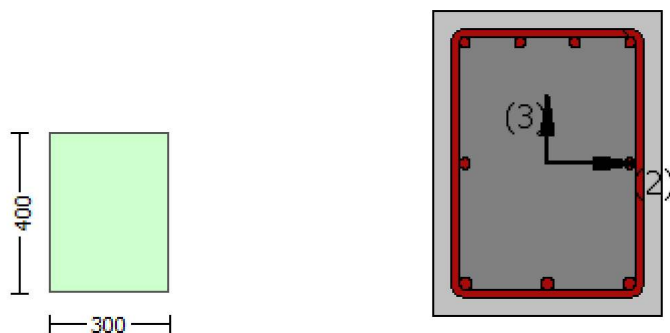
Calculation No. 3

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)

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

Constant Properties

Knowledge Factor,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 5.3884E+006
Shear Force, Va = -3205.681
EDGE -B-
Bending Moment, Mb = 5.6116E+006
Shear Force, Vb = 8686.209
BOTH EDGES
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 148075.075
Vn ((22.5.1.1), ACI 318-14) = 197433.433

NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+ f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
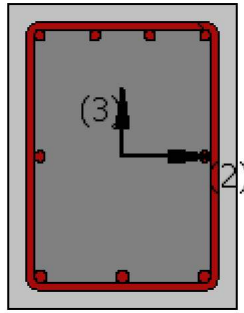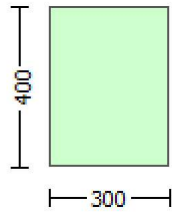--
  From Table (22.5.5.1), ACI 318-14: Vc = 63392.147
      = 1 (normal-weight concrete)
    fc' = 16.00, but fc^0.5 <= 8.3 MPa (22.5.3.1, ACI 318-14)
    pw = As/(bw*d) = 0.00628319
      As (tension reinf.) = 603.1858
      bw = 300.00
      d = 320.00
    Vu*d/Mu < 1 = 0.19037609
      Mu = 5.3884E+006
      Vu = 3205.681
  From (11.5.4.8), ACI 318-14: Vs = 134041.287
    Av = 157079.633
    fy = 400.00
    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 <= 255092.67

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
###
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
  Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
  Mu2+ = 1.5721E+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- = 1.5978E+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 u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
    ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
    ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
    ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
       c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008

ft1 = 666.66
fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
ftv = 666.66
fyv = 555.55
  suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
    2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
  su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008

u =   su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of   cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
       psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 300.00
      ----
       psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 400.00
      ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
     From ((5A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55

with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
   2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
   v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
   2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
  u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
       ----
       psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
       ----
       psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
       ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
     From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered

characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
    2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
  u =   su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: cu = 0.00583896
   we (5.4c) = 0.0034192
    ase ((5.4d), TBDY) = 0.15672608
       bo = 240.00
       ho = 340.00
        bi2 = 346400.00
    psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
----
   psh,x (5.4d) = 0.00349066
      Ash = Astir*ns = 78.53982
        No stirups, ns = 2.00
      bk = 300.00
----
   psh,y (5.4d) = 0.00261799
      Ash = Astir*ns = 78.53982
        No stirups, ns = 2.00
      bk = 400.00
----
      s = 150.00
      fywe = 555.55
      fce = 20.00
   From ((5.A5), TBDY), TBDY: cc = 0.002
      c = confinement factor = 1.00
 y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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

suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
 y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
 2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
 v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
 b = 240.00
 d = 327.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
 2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
 v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
 u =   su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

 From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
     = 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 = 1.00
     Mu = 6710.981
     Vu = 2740.264
 From (11.5.4.8), ACI 318-14: Vs = 148933.273
   Av = 157079.633
   fy = 444.44
   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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
    Av = 157079.633
    fy = 444.44
    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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020

BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
   Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
   Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
   V2 = 8.7724203E-020, is the shear force acting at edge 2 for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
     N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
           bo = 240.00
           ho = 340.00
            bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        ----
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 300.00

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

                    ---------------------------------------------------------------
                          s = 150.00
                       fywe = 555.55
                       fce  = 20.00
                  From ((5.A5), TBDY), TBDY:   cc = 0.002
                        c  = confinement factor = 1.00
          y1 = 0.00231479
          sh1 = 0.008
        ft1 = 666.66
        fy1 = 555.55
         su1 = 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
             su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
            From table 5A.1, TBDY: esu1_nominal = 0.08,
            For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered
            characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
             y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
              with fs1 = fs = 555.55
              with Es1 = Es = 200000.00
          y2 = 0.00231479
          sh2 = 0.008
        ft2 = 666.66
        fy2 = 555.55
         su2 = 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
             su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
            From table 5A.1, TBDY: esu2_nominal = 0.08,
            For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered
            characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
             y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
              with fs2 = fs = 555.55
              with Es2 = Es = 200000.00
          yv = 0.00231479
          shv = 0.008
        ftv = 666.66
        fyv = 555.55
         suv = 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
             suv = 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   yv, shv,ftv,fyv, it is considered
            characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
             y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
              with fsv = fs = 555.55
              with Esv = Es = 200000.00
           1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
           2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
           v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
     and confined core properties:
        b = 340.00
        d = 228.00
        d' = 12.00
        fcc (5A.2, TBDY) = 20.00
```

cc (5A.5, TBDY) = 0.002
        c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
     N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
       we (5.4c) = 0.0034192
         ase ((5.4d), TBDY) = 0.15672608
             bo = 240.00
             ho = 340.00
              bi2 = 346400.00
         psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
         ----
         psh,x (5.4d) = 0.00349066
            Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
            bk = 300.00
         ----
         psh,y (5.4d) = 0.00261799
            Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
            bk = 400.00
         ----
            s = 150.00
         fywe = 555.55
          fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66

fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

```
-------------------------------------------------------------

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 = 0.00015595
Mu = 1.0873E+008
---------------------------------------------------------------------------
with full section properties:
  b =  400.00
  d =  258.00
  d' =  42.00
  v = 0.00010855
    N =  224.0403
  fc = 20.00
   εco (5A.5, TBDY) = 0.002
  Final value of  εcu:  εcu* = shear_factor * Max( εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY:  εcu = 0.00583896
      ωwe (5.4c) = 0.0034192
       αse ((5.4d), TBDY) = 0.15672608
         bo =  240.00
         ho =  340.00
          bi2 =  346400.00
      ρsh,min = Min(ρsh,x , ρsh,y) = 0.00261799
    Expression ((5.4d), TBDY) for ρsh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)

      -------------------------------------------------------------------
      ρsh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      -------------------------------------------------------------------
      ρsh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      -------------------------------------------------------------------
        s = 150.00
       fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY:  εcc = 0.002
        αc = confinement factor = 1.00
   εy1 = 0.00231479
   εsh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   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 = 555.55
      with Es1 = Es = 200000.00
```

y2 = 0.00231479
    sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
    su2 = 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
       su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
       suv = 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 yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fsv = fs = 555.55
       with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

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

```
  u = 0.00015595
Mu = 1.0873E+008
--------------------------------------------------------------------------
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY:  cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
           bo = 240.00
           ho = 340.00
            bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        --------------------------------------------------------------
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 300.00
        --------------------------------------------------------------
        psh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 400.00
        --------------------------------------------------------------
           s = 150.00
         fywe = 555.55
         fce  = 20.00
     From ((5.A5), TBDY), TBDY:  cc = 0.002
         c  = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
   y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
```

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
 2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
 v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
 b = 340.00
 d = 228.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
   c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
  2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
  v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u = su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

 From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
   = 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 = 1.8491887E-012

```
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
      Av = 157079.633
      fy = 444.44
      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
-----------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)
-----------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+  f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
-----------------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
        = 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 = 1.8491916E-012
         Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
      Av = 157079.633
      fy = 444.44
      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 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,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -4.6301801E-012
Shear Force, V2 = -3.4466031E-014
Shear Force, V3 = -3205.681
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = * θu = 0.00654577
 θu = θy + θp = 0.0087277

 - Calculation of θy -

 θy = (My*Ls/3)/Eleff = 0.0037277 ((4.29),Biskinis Phd))
  My = 6.8611E+007
  Ls = M/V (with Ls > 0.1*L and Ls < 2*L) = 925.00
  From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 5.6751E+012

Calculation of Yielding Moment My

Calculation of θy and My according to Annex 7 -

 φy = Min(φy_ten, φy_com)
 φy_ten = 1.2093827E-005
with fy = 444.44
   d = 258.00
    ξy = 0.28780375
   A = 0.0148073
   B = 0.00861417
    with pt = 0.00493157
        pc = 0.00493157
        pv = 0.00493157
        N = 577.527
        b = 400.00
         " = 0.1627907
  φy_comp = 2.3073660E-005
with fc = 20.00
    Ec = 21019.039
    ξy = 0.287709
    A = 0.01477837
    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 = 0.77093353
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, / y < 2 (table 10-6, ASCE 41-17)
       = -2.8762001E-022
 - Stirrup Spacing > d/2
  d = 258.00
  s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
  Vs = 111699.955,already given in calculation of shear control ratio
  design Shear = 3.4466031E-014
 - (- ')/ bal = -0.16624473
   = Aslt/(bw*d) = 0.00584482
   Tension Reinf Area: Aslt = 603.1858
   ' = Aslc/(bw*d) = 0.00894989
   Compression Reinf Area: Aslc = 923.6282
  From (B-1), ACI 318-11: bal = 0.01867766
   fc = 20.00
   fy = 444.44
   From 10.2.7.3, ACI 318-11: 1 = 0.85
   From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
       y = 0.0022222
 - V/(bw*d*fc^0.5) = 8.9933150E-019, 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)

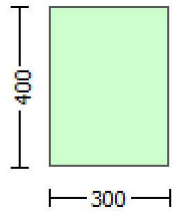
Calculation No. 5

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)

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

Constant Properties

Knowledge Factor, = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -4.6301801E-012
Shear Force, Va = -3.4466031E-014
EDGE -B-
Bending Moment, Mb = -5.9084780E-011
Shear Force, Vb = 3.4466031E-014
BOTH EDGES
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR = *Vn = 102628.668
Vn ((22.5.1.1), ACI 318-14) = 136838.224

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

  From Table (22.5.5.1), ACI 318-14: Vc = 61440.00
      = 1 (normal-weight concrete)
    fc' = 16.00, 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 = 5.9084780E-011
      Vu = 3.4466031E-014
  From (11.5.4.8), ACI 318-14: Vs = 75398.224
    Av = 157079.633
    fy = 400.00
    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 <= 255092.67

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

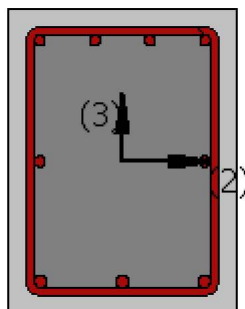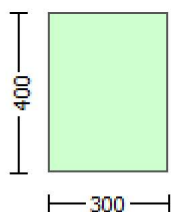# Calculation No. 6

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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, = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
###
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
   Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
   Mu2+ = 1.5721E+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- = 1.5978E+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 = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  ν = 0.00010459
    N = 224.0403
  fc = 20.00
   εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: εcu = 0.00583896
      ωwe (5.4c) = 0.0034192
      αase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
        fywe = 555.55
        fce = 20.00
    From ((5.A5), TBDY), TBDY: εcc = 0.002
        αc = confinement factor = 1.00
  εy1 = 0.00231479
  εsh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  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 = 555.55
    with Es1 = Es = 200000.00
  εy2 = 0.00231479
  εsh2 = 0.008
 ft2 = 666.66

fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
    2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
  u =   su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010702
Mu = 1.5980E+008
----

with full section properties:

  b = 300.00

  d = 358.00

  d' = 43.00

  v = 0.0001043

    N = 224.0403

  fc = 20.00

   co (5A.5, TBDY) = 0.002

  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896

    The Shear_factor is considered equal to 1 (pure moment strength)

    From (5.4b), TBDY: cu = 0.00583896

      we (5.4c) = 0.0034192

      ase ((5.4d), TBDY) = 0.15672608

        bo = 240.00

        ho = 340.00

         bi2 = 346400.00

      psh,min = Min(psh,x , psh,y) = 0.00261799

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

      ----

      psh,x (5.4d) = 0.00349066

        Ash = Astir*ns = 78.53982

          No stirups, ns = 2.00

        bk = 300.00

      ----

      psh,y (5.4d) = 0.00261799

        Ash = Astir*ns = 78.53982

          No stirups, ns = 2.00

        bk = 400.00

      ----

      s = 150.00

      fywe = 555.55

      fce = 20.00

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

      c = confinement factor = 1.00

  y1 = 0.00231479

  sh1 = 0.008

 ft1 = 666.66

 fy1 = 555.55

  su1 = 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

    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032

    From table 5A.1, TBDY: esu1_nominal = 0.08,

    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered

    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.

    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

    with fs1 = fs = 555.55

    with Es1 = Es = 200000.00

  y2 = 0.00231479

  sh2 = 0.008

 ft2 = 666.66

 fy2 = 555.55

  su2 = 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

    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032

    From table 5A.1, TBDY: esu2_nominal = 0.08,

    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered

    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.

    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

    with fs2 = fs = 555.55

    with Es2 = Es = 200000.00

yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
   2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
 u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608

```
             bo = 240.00
             ho = 340.00
               bi2 = 346400.00
          psh,min = Min(psh,x , psh,y) = 0.00261799
       Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
       ----------------------------------------------------------------
          psh,x (5.4d) = 0.00349066
             Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
             bk = 300.00
       ----------------------------------------------------------------
          psh,y (5.4d) = 0.00261799
             Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
             bk = 400.00
       ----------------------------------------------------------------
             s = 150.00
          fywe = 555.55
          fce = 20.00
       From ((5.A5), TBDY:  cc = 0.002
            c = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
    y2 = 0.00231479
   sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
    yv = 0.00231479
   shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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  yv, shv,ftv,fyv, it is considered
```

characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   εy1, εsh1,εft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
  ω2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
  ωv = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   εcc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
  ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
  ω2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
  ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 εsu (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
 φu = φsu (4.1) = 0.00010682

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 = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: εcu = 0.00583896
     αωe (5.4c) = 0.0034192
      αase ((5.4d), TBDY) = 0.15672608
       bo = 240.00
       ho = 340.00
        Σbi2 = 346400.00
     ρsh,min = Min(ρsh,x , ρsh,y) = 0.00261799
    Expression ((5.4d), TBDY) for ρsh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)

     ρsh,x (5.4d) = 0.00349066
      Ash = Astir*ns = 78.53982
       No stirups, ns = 2.00
      bk = 300.00

     ρsh,y (5.4d) = 0.00261799

```
              Ash = Astir*ns = 78.53982
                 No stirups, ns = 2.00
              bk = 400.00

         -----------------------------------------------------------------
              s = 150.00
           fywe = 555.55
           fce  = 20.00
        From ((5.A5), TBDY),  TBDY:  cc = 0.002
             c  = confinement factor = 1.00
      y1 = 0.00231479
      sh1 = 0.008
    ft1 = 666.66
    fy1 = 555.55
     su1 = 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
          su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu1_nominal = 0.08,
        For calculation of esu1_nominal and   y1,  sh1,ft1,fy1, it is considered
        characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
          y1,  sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
          with fs1 = fs = 555.55
          with Es1 = Es = 200000.00
      y2 = 0.00231479
      sh2 = 0.008
    ft2 = 666.66
    fy2 = 555.55
     su2 = 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
          su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and   y2,  sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
          y1,  sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
          with fs2 = fs = 555.55
          with Es2 = Es = 200000.00
      yv = 0.00231479
      shv = 0.008
    ftv = 666.66
    fyv = 555.55
     suv = 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
          suv = 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   yv,  shv,ftv,fyv, it is considered
        characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
          y1,  sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
          with fsv = fs = 555.55
          with Esv = Es = 200000.00
      1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
      2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
      v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
 and confined core properties:
   b = 240.00
   d = 327.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
```

c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
    2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
  u =   su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
       Mu = 6710.981
       Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
       Mu = 6710.981
       Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with

Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
  Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
  Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
  V2 = 8.7724203E-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 = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
  ϵco (5A.5, TBDY) = 0.002
  Final value of ϵcu: ϵcu* = shear_factor * Max(ϵcu, ϵcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: ϵcu = 0.00583896
      ωwe (5.4c) = 0.0034192
       αse ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
      ρsh,min = Min(ρsh,x , ρsh,y) = 0.00261799
    Expression ((5.4d), TBDY) for ρsh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)

      ρsh,x (5.4d) = 0.00349066
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 300.00

      ρsh,y (5.4d) = 0.00261799
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 400.00
      ----
         s = 150.00
       fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY: ϵcc = 0.002
        αc = confinement factor = 1.00
   ϵy1 = 0.00231479
   ϵsh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
   su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
 ftv = 666.66
 fyv = 555.55
   suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
     N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
        we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
           bo = 240.00
           ho = 340.00
             bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        ----
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 300.00
        ----
        psh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 400.00
        ----
           s = 150.00
           fywe = 555.55
           fce = 20.00
     From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55

su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
   c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
  2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
  v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:

b = 400.00
d = 258.00
d' = 42.00
v = 0.00010855
  N = 224.0403
fc = 20.00
 co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
         Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
         bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
         Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
         bk = 400.00
      ----
         s = 150.00
        fywe = 555.55
        fce = 20.00
   From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
  y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479

shv = 0.008
ftv = 666.66
fyv = 555.55
  suv = 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
     suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fsv = fs = 555.55
     with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
   2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
   v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
     we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
       bo = 240.00

ho = 340.00
          bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
     ----
       psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 300.00
     ----
       psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 400.00
     ----
          s = 150.00
       fywe = 555.55
       fce = 20.00
     From ((5.A5), TBDY): cc = 0.002
          c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs2 = fs = 555.55
     with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
     suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^ 2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
      = 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 = 1.8491887E-012
      Vu = 8.7724203E-020
  From (11.5.4.8), ACI 318-14: Vs = 83774.966
    Av = 157079.633
    fy = 444.44
    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

Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 68692.008

```
        = 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 = 1.8491916E-012
        Vu = 8.7724203E-020
  From (11.5.4.8), ACI 318-14: Vs = 83774.966
    Av = 157079.633
    fy = 444.44
    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 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,    = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 5.6116E+006
Shear Force, V2 = 3.4466031E-014
Shear Force, V3 = 8686.209
Axial Force, F = -577.527
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
-------------------------------------------------------------
```

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity $\theta u,R = \kappa * \theta u = 0.00537844$
$\theta u = \theta y + \theta p = 0.00717126$

 - Calculation of θy -

 $\theta y = (My*Ls/3)/Eleff = 0.00217126$ ((4.29),Biskinis Phd))
 $My = 1.0173E+008$
 $Ls = M/V$ (with $Ls > 0.1*L$ and $Ls < 2*L$) $= 646.037$
 From table 10.5, ASCE 41_17: $Eleff = 0.3*Ec*Ig = 1.0089E+013$

Calculation of Yielding Moment My

Calculation of ϕy and My according to Annex 7   -

 $\phi y = Min(\phi y\_ten, \phi y\_com)$
 $\phi y\_ten = 8.5997478E-006$
with $fy = 444.44$
    $d = 358.00$
     $y = 0.27820412$
    $A = 0.01422824$
    $B = 0.00802541$
     with $pt = 0.00573326$
        $pc = 0.00561626$
        $pv = 0.00286663$
        $N = 577.527$
        $b = 300.00$
         " $= 0.12011173$
 $\phi y\_comp = 1.7202834E-005$
with $fc = 20.00$
    $Ec = 21019.039$
     $y = 0.2781036$
    $A = 0.01420045$
    $B = 0.00801331$
     with $Es = 200000.00$

Calculation of ratio lb/ld

Adequate Lap Length: $lb/ld >= 1$

 - Calculation of θp -

From table 10-7: $\theta p = 0.005$
with:
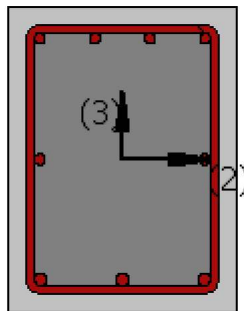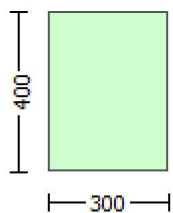 - Condition i occured
   Beam controlled by flexure: $Vp/Vo <= 1$
   shear control ratio $Vp/Vo = 0.77008272$
 - Transverse Reinforcement: NC
 - Stirrup Spacing $> d/3$
 - Low ductility demand, $\mu/\mu y < 2$ (table 10-6, ASCE 41-17)
       $\mu = 2.4995476E-005$
 - Stirrup Spacing $<= d/2$
   $d = 358.00$
   $s = 150.00$
 - Strength provided by hoops $Vs < 3/4*$design Shear
   $Vs = 148933.273$,already given in calculation of shear control ratio
   design Shear $= 8686.209$
 - $(\rho - \rho')/\rho bal = -0.14721463$
     $\rho = Aslt/(bw*d) = 0.00573326$
    Tension Reinf Area: $Aslt = 615.7522$

' = Aslc/(bw*d) = 0.00848289
   Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11:   bal = 0.01867766
    fc = 20.00
    fy = 444.44
    From 10.2.7.3, ACI 318-11:   1 = 0.85
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
       y = 0.0022222
  - V/(bw*d*fc^0.5) = 0.21778815, 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: Operational Level (data interpolation between analysis steps 1 and 2)

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)

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

Constant Properties

Knowledge Factor,   = 0.75
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:

Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 5.3884E+006
Shear Force, Va = -3205.681
EDGE -B-
Bending Moment, Mb = 5.6116E+006
Shear Force, Vb = 8686.209
BOTH EDGES
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 150499.703
Vn ((22.5.1.1), ACI 318-14) = 200666.271

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

  From Table (22.5.5.1), ACI 318-14: Vc = 66624.984
       = 1 (normal-weight concrete)
     fc' = 16.00, 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 = 0.49532763
        Mu = 5.6116E+006
        Vu = 8686.209
  From (11.5.4.8), ACI 318-14: Vs = 134041.287
     Av = 157079.633
     fy = 400.00
     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 <= 255092.67

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

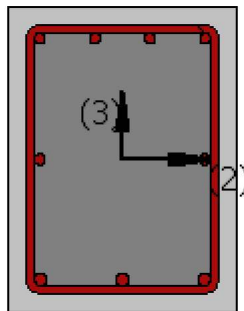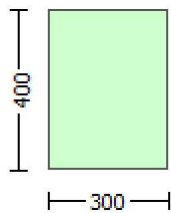
Calculation No. 8

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
  Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
  Mu2+ = 1.5721E+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- = 1.5978E+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   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00

ho = 340.00
          bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
      ----
        psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
      ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5.A5), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
   su1 = 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
       su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
   su2 = 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
       su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
 ftv = 666.66
 fyv = 555.55
   suv = 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
       suv = 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 yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
  with fsv = fs = 555.55
  with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
  2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
  v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
 u = su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
   N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
    we (5.4c) = 0.0034192
     ase ((5.4d), TBDY) = 0.15672608
      bo = 240.00
      ho = 340.00
       bi2 = 346400.00
    psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
    ----
    psh,x (5.4d) = 0.00349066
     Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
     bk = 300.00
    ----
    psh,y (5.4d) = 0.00261799
     Ash = Astir*ns = 78.53982

No stirups, ns = 2.00
          bk = 400.00
     ----
           s = 150.00
        fywe = 555.55
         fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
 fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
 fy2 = 555.55
   su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
  ftv = 666.66
 fyv = 555.55
   suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
 and confined core properties:
   b = 240.00
   d = 328.00
   d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00

1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
 2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
 v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
 u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
 b = 300.00
 d = 358.00
 d' = 43.00
 v = 0.0001043
   N = 224.0403
 fc = 20.00
  co (5A.5, TBDY) = 0.002
 Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
     we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
     psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
     ----
     psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
        bk = 300.00
     ----
     psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
        bk = 400.00
     ----
        s = 150.00
        fywe = 555.55
        fce = 20.00
     From ((5.A5), TBDY), TBDY: cc = 0.002
         c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 555.55
with Es1 = Es = 200000.00
y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 555.55
with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
u = su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008

```
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^ 2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
    suv = 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  yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^ 2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
    c  = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
  2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
  v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
  u =   su (4.1) = 0.00010711
-------------------------------------------------------------

Calculation of ratio lb/ld
-------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------
-----------------------------------------------------------------------
-----------------------------------------------------------------------
-----------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44
-----------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)
-------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+   f*Vf'
```

where Vf is the contribution of FRPs (11.3), ACI 440).

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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

Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
   Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
   Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
   V2 = 8.7724203E-020, is the shear force acting at edge 2 for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00

d = 258.00
d' = 42.00
v = 0.00010855
  N = 224.0403
fc = 20.00
 co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
     we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
       fywe = 555.55
       fce = 20.00
   From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008

ftv = 666.66
fyv = 555.55
  suv = 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
     suv = 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   yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fsv = fs = 555.55
     with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
  2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
  v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of   cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00

```
            bi2 = 346400.00
         psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
         ----------------------------------------------------------------
         psh,x (5.4d) = 0.00349066
            Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
            bk = 300.00
         ----------------------------------------------------------------
         psh,y (5.4d) = 0.00261799
            Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
            bk = 400.00
         ----------------------------------------------------------------
            s = 150.00
         fywe = 555.55
         fce = 20.00
      From ((5.A5), TBDY), TBDY:  cc = 0.002
            c  = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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  yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
```

with fsv = fs = 555.55
       with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
       c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
   ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
   u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
   b = 400.00
   d = 258.00
   d' = 42.00
   v = 0.00010855
      N = 224.0403
   fc = 20.00
    co (5A.5, TBDY) = 0.002
   Final value of   cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
      The Shear_factor is considered equal to 1 (pure moment strength)
      From (5.4b), TBDY: cu = 0.00583896
        we (5.4c) = 0.0034192
         ase ((5.4d), TBDY) = 0.15672608
            bo = 240.00
            ho = 340.00
             bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
       psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 300.00
      ----
       psh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00

```
              bk = 400.00

        ----------------------------------------------------------------
             s = 150.00
          fywe = 555.55
           fce  = 20.00
       From ((5.A5), TBDY), TBDY:  cc = 0.002
            c  = confinement factor = 1.00
     y1 = 0.00231479
    sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
     su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu1_nominal = 0.08,
       For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
       characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
     y2 = 0.00231479
    sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
     su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu2_nominal = 0.08,
       For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
       characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
     yv = 0.00231479
    shv = 0.008
   ftv = 666.66
   fyv = 555.55
     suv = 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
        suv = 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  yv, shv,ftv,fyv, it is considered
       characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
     2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
     v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
 and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
     cc (5A.5, TBDY) = 0.002
       c  = confinement factor = 1.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
```

```
     2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
     v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
  su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =    su (4.1) = 0.00015595
----------------------------------------------------------

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


----------------------------------------------------------------------------
Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----------------------------------------------------------------------------
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY:  cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
     ----------------------------------------------------------------
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 300.00
     ----------------------------------------------------------------
        psh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 400.00
     ----------------------------------------------------------------
          s = 150.00
        fywe = 555.55
        fce  = 20.00
      From ((5.A5), TBDY), TBDY:  cc = 0.002
          c = confinement factor = 1.00
    y1 = 0.00231479
    sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
    su1 = 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
su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 555.55
with Es1 = Es = 200000.00
y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 555.55
with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

```
-------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
---------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975
---------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)
-------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+  f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
-------------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
        = 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 = 1.8491887E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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
-----------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)
-------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+  f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
-------------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
        = 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 = 1.8491916E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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, = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -5.9084780E-011
Shear Force, V2 = 3.4466031E-014
Shear Force, V3 = 8686.209
Axial Force, F = -577.527
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity $\theta_{u,R}$ = * θ_u = 0.00654577
 θ_u = θ_y + θ_p = 0.0087277

 - Calculation of θ_y -

 θ_y = (My*Ls/3)/EIeff = 0.0037277 ((4.29),Biskinis Phd))
  My = 6.8611E+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 = 5.6751E+012

Calculation of Yielding Moment My

Calculation of ϕ_y and My according to Annex 7 -

 ϕ_y = Min(ϕ_y_ten, ϕ_y_com)
 ϕ_y_ten = 1.2093827E-005
 with fy = 444.44
    d = 258.00
    ξ_y = 0.28780375
    A = 0.0148073
    B = 0.00861417

with pt = 0.00493157
        pc = 0.00493157
        pv = 0.00493157
         N = 577.527
         b = 400.00
         " = 0.1627907
  y_comp = 2.3073660E-005
 with fc = 20.00
     Ec = 21019.039
      y = 0.287709
     A = 0.01477837
     B = 0.00860158
      with Es = 200000.00

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

 - Calculation of p -

From table 10-7: p = 0.005
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.77093353
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, / y < 2 (table 10-6, ASCE 41-17)
        = -8.8463222E-022
 - Stirrup Spacing > d/2
  d = 258.00
  s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
  Vs = 111699.955,already given in calculation of shear control ratio
  design Shear = 3.4466031E-014
 - (- ')/ bal = -0.15320593
     = Aslt/(bw*d) = 0.00596659
   Tension Reinf Area: Aslt = 615.7522
   ' = Aslc/(bw*d) = 0.00882812
   Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11: bal = 0.01867766
   fc = 20.00
   fy = 444.44
   From 10.2.7.3, ACI 318-11: 1 = 0.85
   From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
        y = 0.0022222
 - V/(bw*d*fc^0.5) = 8.9933150E-019, 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)

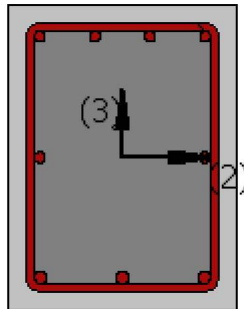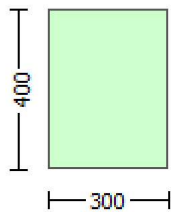
Calculation No. 9

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (2)

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

Constant Properties

Knowledge Factor,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.0944479E-012

Shear Force, Va = -5.2893637E-014
EDGE -B-
Bending Moment, Mb = -8.9686435E-011
Shear Force, Vb = 5.2893637E-014
BOTH EDGES
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 102628.668
Vn ((22.5.1.1), ACI 318-14) = 136838.224

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

  From Table (22.5.5.1), ACI 318-14: Vc = 61440.00
     = 1 (normal-weight concrete)
   fc' = 16.00, 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 = 8.0944479E-012
     Vu = 5.2893637E-014
  From (11.5.4.8), ACI 318-14: Vs = 75398.224
    Av = 157079.633
    fy = 400.00
    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 <= 255092.67

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

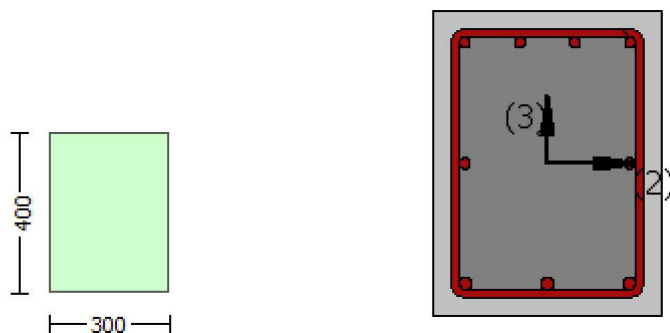
Calculation No. 10

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
 Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
 Mu2+ = 1.5721E+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- = 1.5978E+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 = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
 b = 300.00
 d = 357.00
 d' = 42.00
 v = 0.00010459
 N = 224.0403
 fc = 20.00
 εco (5A.5, TBDY) = 0.002
 Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
 The Shear_factor is considered equal to 1 (pure moment strength)
 From (5.4b), TBDY: εcu = 0.00583896
 ωwe (5.4c) = 0.0034192
 αse ((5.4d), TBDY) = 0.15672608
 bo = 240.00
 ho = 340.00
 bi2 = 346400.00
 psh,min = Min(psh,x , psh,y) = 0.00261799
 Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
 ----
 psh,x (5.4d) = 0.00349066
 Ash = Astir*ns = 78.53982
 No stirups, ns = 2.00
 bk = 300.00

```
        -------------------------------------------------------------------
        psh,y (5.4d) = 0.00261799
            Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
            bk = 400.00
        -------------------------------------------------------------------
            s = 150.00
          fywe = 555.55
          fce = 20.00
      From ((5.A5), TBDY):  cc = 0.002
          c = confinement factor = 1.00
    y1 = 0.00231479
    sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
    su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
    sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
    su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
  ftv = 666.66
  fyv = 555.55
    suv = 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
        suv = 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  yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
```

fcc (5A.2, TBDY) = 20.00
  εcc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    ω1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
    ω2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
    ωv = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 εsu (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
 φu = φsu (4.1) = 0.00010691

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 = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
  εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: εcu = 0.00583896
      αωe (5.4c) = 0.0034192
      αse ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
          bi2 = 346400.00
      ρsh,min = Min(ρsh,x , ρsh,y) = 0.00261799
    Expression ((5.4d), TBDY) for ρsh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)

      ρsh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00

      ρsh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
    ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: εcc = 0.002
        c = confinement factor = 1.00
  εy1 = 0.00231479
  εsh1 = 0.008

ft1 = 666.66

fy1 = 555.55

su1 = 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

su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032

From table 5A.1, TBDY: esu1_nominal = 0.08,

For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered

characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

with fs1 = fs = 555.55

with Es1 = Es = 200000.00

y2 = 0.00231479

sh2 = 0.008

ft2 = 666.66

fy2 = 555.55

su2 = 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

su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032

From table 5A.1, TBDY: esu2_nominal = 0.08,

For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered

characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

with fs2 = fs = 555.55

with Es2 = Es = 200000.00

yv = 0.00231479

shv = 0.008

ftv = 666.66

fyv = 555.55

suv = 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

suv = 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   yv, shv,ftv,fyv, it is considered

characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.

with fsv = fs = 555.55

with Esv = Es = 200000.00

1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564

2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552

v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782

and confined core properties:

b = 240.00

d = 328.00

d' = 13.00

fcc (5A.2, TBDY) = 20.00

cc (5A.5, TBDY) = 0.002

c = confinement factor = 1.00

1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713

2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429

v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856

Case/Assumption: Unconfinesd full section - Steel rupture

' does not satisfy Eq. (4.3)

--->

v < vs,c - RHS eq.(4.5) is satisfied

--->

su (4.9) = 0.1647931

Mu = MRc (4.14) = 1.5980E+008

u = su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        ----
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
        ----
        psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
        ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5A.5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55

with Es1 = Es = 200000.00
    y2 = 0.00231479
    sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
    su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu2_nominal = 0.08,
       For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
       characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
        suv = 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 yv, shv,ftv,fyv, it is considered
       characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
       c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
    2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
  u =   su (4.1) = 0.00010682

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 = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
     N = 224.0403
  fc = 20.00
   εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: εcu = 0.00583896
        αwe (5.4c) = 0.0034192
         αase ((5.4d), TBDY) = 0.15672608
             bo = 240.00
             ho = 340.00
              bi2 = 346400.00
        ρsh,min = Min(ρsh,x , ρsh,y) = 0.00261799
     Expression ((5.4d), TBDY) for ρsh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)

        ρsh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 300.00

        ρsh,y (5.4d) = 0.00261799
           Ash = Astir*ns = 78.53982
              No stirups, ns = 2.00
           bk = 400.00
        ----
           s = 150.00
          fywe = 555.55
          fce = 20.00
     From ((5.A5), TBDY), TBDY: εcc = 0.002
         αc = confinement factor = 1.00
   εy1 = 0.00231479
   εsh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   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 = 555.55
       with Es1 = Es = 200000.00
   εy2 = 0.00231479
   εsh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   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.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
 2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
 v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
 b = 240.00
 d = 327.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
   c = confinement factor = 1.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
 2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
 v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
 u =   su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
    = 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 = 1.00

Mu = 6710.981
        Vu = 2740.264
    From (11.5.4.8), ACI 318-14: Vs = 148933.273
       Av = 157079.633
       fy = 444.44
       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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

   From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
        = 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 = 1.00
        Mu = 6710.981
        Vu = 2740.264
    From (11.5.4.8), ACI 318-14: Vs = 148933.273
       Av = 157079.633
       fy = 444.44
       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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel

Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
   Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
   Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
   V2 = 8.7724203E-020, is the shear force acting at edge 2 for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY: cu = 0.00583896
       we (5.4c) = 0.0034192

ase ((5.4d), TBDY) = 0.15672608
   bo = 240.00
   ho = 340.00
    bi2 = 346400.00
  psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
----
  psh,x (5.4d) = 0.00349066
    Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
    bk = 300.00
----
  psh,y (5.4d) = 0.00261799
    Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
    bk = 400.00
----
    s = 150.00
   fywe = 555.55
   fce = 20.00
  From ((5.A5), TBDY), TBDY: cc = 0.002
     c = confinement factor = 1.00
 y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
 y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
 with fsv = fs = 555.55
 with Esv = Es = 20000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
 b = 340.00
 d = 228.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
 2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
 v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
 b = 400.00
 d = 258.00
 d' = 42.00
 v = 0.00010855
   N = 224.0403
 fc = 20.00
  co (5A.5, TBDY) = 0.002
 Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
     we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
     psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
     ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00

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

        ---------------------------------------------------------------
                s = 150.00
            fywe = 555.55
            fce = 20.00
        From ((5.A5), TBDY),  TBDY:  cc = 0.002
                c = confinement factor = 1.00
    y1 = 0.00231479
     sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
    su1 = 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
         su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu1_nominal = 0.08,
        For calculation of esu1_nominal and   y1,  sh1,ft1,fy1, it is considered
        characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
         y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fs1 = fs = 555.55
         with Es1 = Es = 200000.00
    y2 = 0.00231479
     sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
    su2 = 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
         su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and   y2,  sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
         y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fs2 = fs = 555.55
         with Es2 = Es = 200000.00
    yv = 0.00231479
     shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
         suv = 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   yv,  shv,ftv,fyv, it is considered
        characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
         y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fsv = fs = 555.55
         with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
```

cc (5A.5, TBDY) = 0.002
        c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
      ----
          s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66

fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
ftv = 666.66
fyv = 555.55
  suv = 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
      suv = 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   yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
       fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00

y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
  c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
u = su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

```
----------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+ f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
----------------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
       = 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 = 1.8491887E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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
----------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)
----------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+ f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
----------------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
       = 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 = 1.8491916E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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, = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
```

Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 8.2657E+006
Shear Force, V2 = -5.2893637E-014
Shear Force, V3 = -6384.747
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = * θu = 0.01820078
  θu = θy + θp = 0.02426771

 - Calculation of θy -

 θy = (My*Ls/3)/EIeff = 0.00426771 ((4.29),Biskinis Phd))
  My = 9.9777E+007
  Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 1294.608
  From table 10.5, ASCE 41_17: EIeff = 0.3*Ec*Ig = 1.0089E+013

Calculation of Yielding Moment My

Calculation of ϕy and My according to Annex 7   -

 ϕy = Min(ϕy_ten, ϕy_com)
  ϕy_ten = 8.5945512E-006
 with fy = 444.44
    d = 357.00
     ξy = 0.27574463
    A = 0.01427207
    B = 0.00793091
    with pt = 0.00563199
       pc = 0.00574932
       pv = 0.00287466
       N = 766.5227
       b = 300.00
        " = 0.11764706
  ϕy_comp = 1.7407225E-005
 with fc = 20.00
    Ec = 21019.039
     ξy = 0.27560804

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A = 0.01423507
B = 0.00791481
with Es = 200000.00

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

- Calculation of p -

From table 10-7: p = 0.02
with:
- Condition i occured
  Beam controlled by flexure: Vp/Vo <= 1
  shear control ratio Vp/Vo = 0.77008272
- Transverse Reinforcement: NC
- Stirrup Spacing > d/3
- Low ductility demand, / y < 2 (table 10-6, ASCE 41-17)
      = 8.5758849E-005
- Stirrup Spacing <= d/2
  d = 357.00
  s = 150.00
- Strength provided by hoops Vs < 3/4*design Shear
  Vs = 148933.273,already given in calculation of shear control ratio
  design Shear = 6384.747
- (- ')/ bal = -0.160191
    = Aslt/(bw*d) = 0.00563199
   Tension Reinf Area: Aslt = 603.1858
   ' = Aslc/(bw*d) = 0.00862398
   Compression Reinf Area: Aslc = 923.6282
  From (B-1), ACI 318-11: bal = 0.01867766
   fc = 20.00
   fy = 444.44
   From 10.2.7.3, ACI 318-11: 1 = 0.85
   From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
      y = 0.0022222
- V/(bw*d*fc^0.5) = 0.16053232, 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
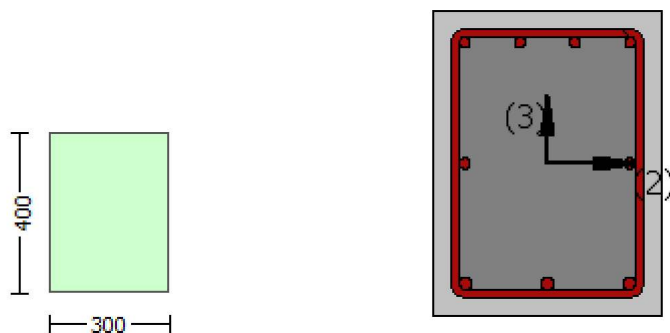
Limit State: Life Safety (data interpolation between analysis steps 1 and 2)

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: Start

Local Axis: (3)

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

Constant Properties

Knowledge Factor,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 8.2657E+006
Shear Force, Va = -6384.747
EDGE -B-
Bending Moment, Mb = 8.6155E+006
Shear Force, Vb = 11865.276
BOTH EDGES
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 148511.925
Vn ((22.5.1.1), ACI 318-14) = 198015.901

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

  From Table (22.5.5.1), ACI 318-14: Vc = 63974.614
      = 1 (normal-weight concrete)
    fc' = 16.00, 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 = 0.24717913
       Mu = 8.2657E+006
       Vu = 6384.747
  From (11.5.4.8), ACI 318-14: Vs = 134041.287
    Av = 157079.633
    fy = 400.00
    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 <= 255092.67

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

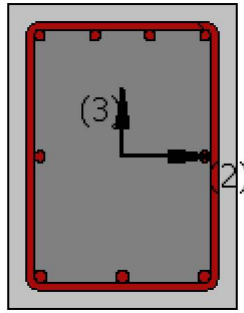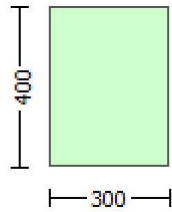
Calculation No. 12

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
  Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
  Mu2+ = 1.5721E+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- = 1.5978E+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 = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   ϵco (5A.5, TBDY) = 0.002
  Final value of ϵcu: ϵcu^* = shear_factor * Max(ϵcu, ϵcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: ϵcu = 0.00583896
      ωwe (5.4c) = 0.0034192
       αse ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
           bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 400.00
      ----
         s = 150.00
       fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY: ϵcc = 0.002
       αc = confinement factor = 1.00
  $\epsilon y1$ = 0.00231479
  $\epsilon sh1$ = 0.008

ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs2 = fs = 555.55
     with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fsv = fs = 555.55
     with Esv = Es = 200000.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
   2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
   v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
   2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008

u = su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55

with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fsv = fs = 555.55
      with Esv = Es = 200000.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
   2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
   v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
 fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
    2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
  u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
 b = 300.00
 d = 358.00
 d' = 43.00
 v = 0.0001043
   N = 224.0403
 fc = 20.00
  co (5A.5, TBDY) = 0.002
 Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
     we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 400.00
      ----
         s = 150.00
        fywe = 555.55
        fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
         c = confinement factor = 1.00
  y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered

characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
  b = 240.00
  d = 328.00
  d' = 13.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
   2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
  u =   su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
     N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896

The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: cu = 0.00583896
   we (5.4c) = 0.0034192
    ase ((5.4d), TBDY) = 0.15672608
       bo = 240.00
       ho = 340.00
        bi2 = 346400.00
     psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
----
   psh,x (5.4d) = 0.00349066
      Ash = Astir*ns = 78.53982
        No stirups, ns = 2.00
      bk = 300.00
----
   psh,y (5.4d) = 0.00261799
      Ash = Astir*ns = 78.53982
        No stirups, ns = 2.00
      bk = 400.00
----
      s = 150.00
      fywe = 555.55
      fce = 20.00
   From ((5.A5), TBDY), TBDY: cc = 0.002
      c = confinement factor = 1.00
 y1 = 0.00231479
 sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
 su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu2_nominal = 0.08,
   For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
   characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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

suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
 y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
b = 240.00
d = 327.00
d' = 12.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
u =   su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
= 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 = 1.00
Mu = 6710.981
Vu = 2740.264
From (11.5.4.8), ACI 318-14: Vs = 148933.273
Av = 157079.633
fy = 444.44
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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
        Mu = 6710.981
        Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
      Av = 157079.633
      fy = 444.44
      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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020

BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
  Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
  Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
  V2 = 8.7724203E-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 = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  ν = 0.00010855
    N = 224.0403
  fc = 20.00
  εco (5A.5, TBDY) = 0.002
  Final value of εcu: εcu* = shear_factor * Max(εcu, εcc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: εcu = 0.00583896
      αwe (5.4c) = 0.0034192
      αse ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00

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

        ---------------------------------------------------------------
               s = 150.00
             fywe = 555.55
             fce = 20.00
        From ((5.A5), TBDY),  TBDY:   cc = 0.002
              c = confinement factor = 1.00
    y1 = 0.00231479
     sh1 = 0.008
   ft1 = 666.66
   fy1 = 555.55
    su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu1_nominal = 0.08,
       For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered
       characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
     sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
    su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu2_nominal = 0.08,
       For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered
       characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
     shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
        suv = 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   yv, shv,ftv,fyv, it is considered
       characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
```

```
    cc (5A.5, TBDY) = 0.002
       c  = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =    su (4.1) = 0.00015595
-----------------------------------------------------------

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

----------------------------------------------------------------------
Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----------------------------------------------------------------------
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of   cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY:  cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----------------------------------------------------------------
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----------------------------------------------------------------
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----------------------------------------------------------------
        s = 150.00
      fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY:  cc = 0.002
         c  = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
```

fy1 = 555.55
    su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu1_nominal = 0.08,
        For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
        characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
    sh2 = 0.008
   ft2 = 666.66
   fy2 = 555.55
    su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
        suv = 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 yv, shv,ftv,fyv, it is considered
        characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
        c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

```
------------------------------------------------------------

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


--------------------------------------------------------------------------
Calculation of ultimate curvature  u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
--------------------------------------------------------------------------
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY:  cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      --------------------------------------------------------------------
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      --------------------------------------------------------------------
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      --------------------------------------------------------------------
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY:  cc = 0.002
        c = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
```

y2 = 0.00231479
  sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
  su2 = 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
    su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
ftv = 666.66
fyv = 555.55
  suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

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

```
   u = 0.00015595
Mu = 1.0873E+008
----------------------------------------------------------------------------
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY:  cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
           bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)

        ----------------------------------------------------------------
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
        ----------------------------------------------------------------
        psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
        ----------------------------------------------------------------
          s = 150.00
         fywe = 555.55
         fce = 20.00
     From ((5.A5), TBDY), TBDY:  cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
```

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs2 = fs = 555.55
    with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
    suv = 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   yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
    = 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 = 1.8491887E-012

```
        Vu = 8.7724203E-020
  From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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
-----------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)
-------------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+ ϕf*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 = 1.8491916E-012
       Vu = 8.7724203E-020
  From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.0944479E-012
Shear Force, V2 = -5.2893637E-014
Shear Force, V3 = -6384.747
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = * θu = 0.01779661
 θu = θy + θp = 0.02372882

 - Calculation of θy -

 θy = (My*Ls/3)/Eleff = 0.00372882 ((4.29),Biskinis Phd))
  My = 6.8632E+007
  Ls = M/V (with Ls >0.1*L and Ls < 2*L) = 925.00
  From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 5.6751E+012

Calculation of Yielding Moment My

Calculation of θy and My according to Annex 7 -

 θy = Min(θy_ten, θy_com)
 θy_ten = 1.2094933E-005
with fy = 444.44
   d = 258.00
    ξy = 0.28786888
   A = 0.01481142
   B = 0.00861829
    with pt = 0.00493157
       pc = 0.00493157
       pv = 0.00493157
       N = 766.5227
       b = 400.00
        " = 0.1627907
  θy_comp = 2.3070920E-005
with fc = 20.00
   Ec = 21019.039
    ξy = 0.28774317
   A = 0.01477303
   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 = 0.02

with:
 - Condition i occured
  Beam controlled by flexure: Vp/Vo <= 1
  shear control ratio Vp/Vo = 0.77093353
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, / y < 2 (table 10-6, ASCE 41-17)
      = -5.3657545E-022
 - Stirrup Spacing > d/2
  d = 258.00
  s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
  Vs = 111699.955,already given in calculation of shear control ratio
  design Shear = 5.2893637E-014
 - (- ')/ bal = -0.16624473
     = Aslt/(bw*d) = 0.00584482
   Tension Reinf Area: Aslt = 603.1858
   ' = Aslc/(bw*d) = 0.00894989
   Compression Reinf Area: Aslc = 923.6282
  From (B-1), ACI 318-11: bal = 0.01867766
   fc = 20.00
   fy = 444.44
   From 10.2.7.3, ACI 318-11: 1 = 0.85
   From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
      y = 0.0022222
 - V/(bw*d*fc^0.5) = 1.3801680E-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)

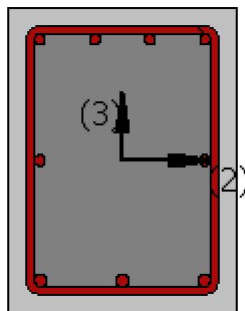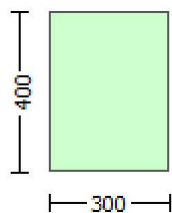
Calculation No. 13

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (2)

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

Constant Properties

Knowledge Factor,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.0944479E-012
Shear Force, Va = -5.2893637E-014
EDGE -B-
Bending Moment, Mb = -8.9686435E-011
Shear Force, Vb = 5.2893637E-014
BOTH EDGES
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 102628.668
Vn ((22.5.1.1), ACI 318-14) = 136838.224

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

  From Table (22.5.5.1), ACI 318-14: Vc = 61440.00
      = 1 (normal-weight concrete)
    fc' = 16.00, 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 = 8.9686435E-011
      Vu = 5.2893637E-014
  From (11.5.4.8), ACI 318-14: Vs = 75398.224
      Av = 157079.633
      fy = 400.00
      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 <= 255092.67

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

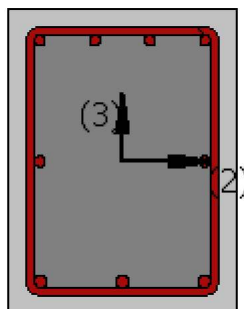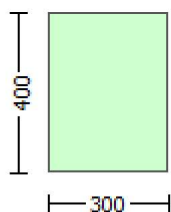# Calculation No. 14

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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, = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
   Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
   Mu2+ = 1.5721E+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- = 1.5978E+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 u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
        fywe = 555.55
        fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
  su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
  ft2 = 666.66

fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
      suv = 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 yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fsv = fs = 555.55
       with Esv = Es = 200000.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
   2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
   v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
   b = 240.00
   d = 327.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
   2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
  u =   su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00010702
Mu = 1.5980E+008
----

with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
         bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
    ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
    ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
    ----
      s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
      c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs2 = fs = 555.55
     with Es2 = Es = 200000.00

yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
    suv = 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   yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by $Min(1,1.25*(lb/ld)^{2/3})$, from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
    2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
 u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
b = 300.00
d = 358.00
d' = 43.00
v = 0.0001043
    N = 224.0403
fc = 20.00
co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
        we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608

```
            bo = 240.00
            ho = 340.00
             bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
        -----------------------------------------------------------------
        psh,x (5.4d) = 0.00349066
           Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
           bk = 300.00

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

        -----------------------------------------------------------------
           s = 150.00
         fywe = 555.55
         fce  = 20.00
     From ((5.A5), TBDY:  cc = 0.002
           c  = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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   yv, shv,ftv,fyv, it is considered
```

characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
   b = 240.00
   d = 328.00
   d' = 13.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
    2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
  su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
   u =   su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
   u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
   b = 300.00
   d = 357.00
   d' = 42.00
   v = 0.00010459
     N = 224.0403
   fc = 20.00
    co (5A.5, TBDY) = 0.002
   Final value of   cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
      The Shear_factor is considered equal to 1 (pure moment strength)
      From (5.4b), TBDY: cu = 0.00583896
        we (5.4c) = 0.0034192
         ase ((5.4d), TBDY) = 0.15672608
            bo = 240.00
            ho = 340.00
             bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
      ----
        psh,y (5.4d) = 0.00261799

```
            Ash = Astir*ns = 78.53982
                No stirups, ns = 2.00
            bk = 400.00

        ----------------------------------------------------------------
              s = 150.00
           fywe = 555.55
           fce  = 20.00
       From ((5.A5), TBDY),  TBDY:  cc = 0.002
            c  = confinement factor = 1.00
    y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and   y1,  sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs1 = fs = 555.55
        with Es1 = Es = 200000.00
    y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and   y2,  sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
        suv = 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   yv,  shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fsv = fs = 555.55
        with Esv = Es = 200000.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
     2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
     v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
   b = 240.00
   d = 327.00
   d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
```

c = confinement factor = 1.00
     1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
     2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
     v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
  u =   su (4.1) = 0.00010711

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44

Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
       = 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 = 1.00
        Mu = 6710.981
        Vu = 2740.264
   From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
       = 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 = 1.00
        Mu = 6710.981
        Vu = 2740.264
   From (11.5.4.8), ACI 318-14: Vs = 148933.273
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with

Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008

Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008

Mu2+ = 1.0873E+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- = 1.0873E+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

$\pm$ wu*ln = (|V1| + |V2|)/2

with

V1 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination

V2 = 8.7724203E-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 = 0.00015595

Mu = 1.0873E+008
----
with full section properties:

b = 400.00

d = 258.00

d' = 42.00

v = 0.00010855

N = 224.0403

fc = 20.00

ϵco (5A.5, TBDY) = 0.002

Final value of ϵcu: ϵcu* = shear_factor * Max(ϵcu, ϵcc) = 0.00583896

The Shear_factor is considered equal to 1 (pure moment strength)

From (5.4b), TBDY: ϵcu = 0.00583896

ωwe (5.4c) = 0.0034192

αse ((5.4d), TBDY) = 0.15672608

bo = 240.00

ho = 340.00

bi2 = 346400.00

psh,min = Min(psh,x , psh,y) = 0.00261799

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

----
psh,x (5.4d) = 0.00349066

Ash = Astir*ns = 78.53982

No stirups, ns = 2.00

bk = 300.00

----
psh,y (5.4d) = 0.00261799

Ash = Astir*ns = 78.53982

No stirups, ns = 2.00

bk = 400.00

----
s = 150.00

fywe = 555.55

fce = 20.00

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

αc = confinement factor = 1.00

ϵy1 = 0.00231479

ϵsh1 = 0.008

ft1 = 666.66

fy1 = 555.55

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
           su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
          From table 5A.1, TBDY: esu1_nominal = 0.08,
          For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
          characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
           y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
           with fs1 = fs = 555.55
           with Es1 = Es = 200000.00
      y2 = 0.00231479
      sh2 = 0.008
    ft2 = 666.66
    fy2 = 555.55
      su2 = 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
         su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
        From table 5A.1, TBDY: esu2_nominal = 0.08,
        For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
        characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
         y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fs2 = fs = 555.55
         with Es2 = Es = 200000.00
      yv = 0.00231479
      shv = 0.008
    ftv = 666.66
    fyv = 555.55
      suv = 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
         suv = 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 yv, shv,ftv,fyv, it is considered
        characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
         y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fsv = fs = 555.55
         with Esv = Es = 200000.00
      1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
      2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
      v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
      1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
      2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
      v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
            bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55

su2 = 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
   su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu2_nominal = 0.08,
  For calculation of esu2_nominal and $y2$, sh2,ft2,fy2, it is considered
  characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
   c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
  2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
  v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u = su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:

b = 400.00
d = 258.00
d' = 42.00
v = 0.00010855
    N = 224.0403
fc = 20.00
  co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
      fywe = 555.55
      fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
     y1, ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
  yv = 0.00231479

shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
 2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
 v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00

```
        ho = 340.00
          bi2 = 346400.00
        psh,min = Min(psh,x , psh,y) = 0.00261799
      Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      -----------------------------------------------------------------
        psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 300.00
      -----------------------------------------------------------------
        psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
            No stirups, ns = 2.00
          bk = 400.00
      -----------------------------------------------------------------
          s = 150.00
        fywe = 555.55
        fce = 20.00
      From ((5.A5), TBDY):  cc = 0.002
          c  = confinement factor = 1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs1 = fs = 555.55
      with Es1 = Es = 200000.00
   y2 = 0.00231479
   sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
      with fs2 = fs = 555.55
      with Es2 = Es = 200000.00
   yv = 0.00231479
   shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
      suv = 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  yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
```

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
  2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
  v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
 b = 340.00
 d = 228.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
   2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
   v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975

Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
      = 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 = 1.8491887E-012
      Vu = 8.7724203E-020
  From (11.5.4.8), ACI 318-14: Vs = 83774.966
    Av = 157079.633
    fy = 444.44
    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

Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 68692.008

= 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 = 1.8491916E-012
          Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 8.6155E+006
Shear Force, V2 = 5.2893637E-014
Shear Force, V3 = 11865.276
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity θu,R = ∗ θu = 0.0168308
θu = θy + θp = 0.02244106

- Calculation of θy -

θy = (My*Ls/3)/Eleff = 0.00244106 ((4.29),Biskinis Phd))
My = 1.0175E+008
Ls = M/V (with Ls > 0.1*L and Ls < 2*L) = 726.1115
From table 10.5, ASCE 41_17: Eleff = 0.3*Ec*Ig = 1.0089E+013

Calculation of Yielding Moment My

Calculation of φy and My according to Annex 7 -

φy = Min(φy_ten, φy_com)
φy_ten = 8.6005312E-006
with fy = 444.44
    d = 358.00
    ξy = 0.27826986
    A = 0.0142322
    B = 0.00802937
     with pt = 0.00573326
         pc = 0.00561626
         pv = 0.00286663
         N = 766.5227
         b = 300.00
         " = 0.12011173
φy_comp = 1.7200799E-005
with fc = 20.00
    Ec = 21019.039
    ξy = 0.2781365
    A = 0.01419531
    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 = 0.02
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.77008272
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, μ/θy < 2 (table 10-6, ASCE 41-17)
        = 5.0378505E-005
 - Stirrup Spacing <= d/2
   d = 358.00
   s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
   Vs = 148933.273,already given in calculation of shear control ratio
   design Shear = 11865.276
 - (ρ - ρ')/ρbal = -0.14721463
     ρ = Aslt/(bw*d) = 0.00573326
   Tension Reinf Area: Aslt = 615.7522

' = Aslc/(bw*d) = 0.00848289
   Compression Reinf Area: Aslc = 911.0619
 From (B-1), ACI 318-11:   bal = 0.01867766
   fc = 20.00
   fy = 444.44
   From 10.2.7.3, ACI 318-11:   1 = 0.85
   From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
       y = 0.0022222
 - V/(bw*d*fc^0.5) = 0.29749645, 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)

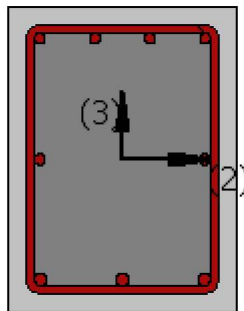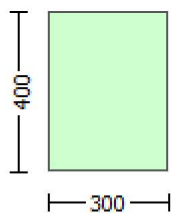
Calculation No. 15

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Shear capacity VRd

Edge: End

Local Axis: (3)

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

Constant Properties

Knowledge Factor,   = 0.75
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:

Existing material of Secondary Member: Concrete Strength, fc = fc_lower_bound = 16.00
Existing material of Secondary Member: Steel Strength, fs = fs_lower_bound = 400.00
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = 8.2657E+006
Shear Force, Va = -6384.747
EDGE -B-
Bending Moment, Mb = 8.6155E+006
Shear Force, Vb = 11865.276
BOTH EDGES
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final Shear Capacity VR =   *Vn = 150070.859
Vn ((22.5.1.1), ACI 318-14) = 200094.479

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

  From Table (22.5.5.1), ACI 318-14: Vc = 66053.192
       = 1 (normal-weight concrete)
     fc' = 16.00, 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 = 0.44070366
        Mu = 8.6155E+006
        Vu = 11865.276
  From (11.5.4.8), ACI 318-14: Vs = 134041.287
     Av = 157079.633
     fy = 400.00
     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 <= 255092.67

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

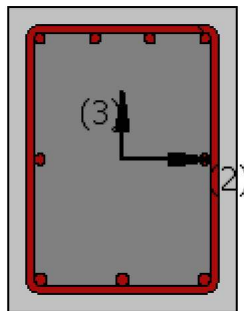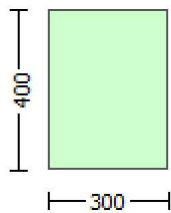
Calculation No. 16

beam B1, Floor 1

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

Analysis: Uniform +X

Check: Chord rotation capacity (u)

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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Existing material: Steel Strength, fs = 1.25*fsm = 555.55
##
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -224.0403
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 = 0.77008272
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 = 175486.019
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.5980E+008
  Mu1+ = 1.5719E+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- = 1.5980E+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-) = 1.5978E+008
  Mu2+ = 1.5721E+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- = 1.5978E+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 u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010691
Mu = 1.5719E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00

```
          ho = 340.00
            bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
       ----------------------------------------------------------------------
       psh,x (5.4d) = 0.00349066
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 300.00
       ----------------------------------------------------------------------
       psh,y (5.4d) = 0.00261799
          Ash = Astir*ns = 78.53982
             No stirups, ns = 2.00
          bk = 400.00
       ----------------------------------------------------------------------
          s = 150.00
        fywe = 555.55
        fce  = 20.00
     From ((5.A5), TBDY):  cc = 0.002
          c  = confinement factor = 1.00
   y1 = 0.00231479
    sh1 = 0.008
  ft1 = 666.66
  fy1 = 555.55
   su1 = 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
       su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu1_nominal = 0.08,
      For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
      characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
   y2 = 0.00231479
    sh2 = 0.008
  ft2 = 666.66
  fy2 = 555.55
   su2 = 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
       su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
      From table 5A.1, TBDY: esu2_nominal = 0.08,
      For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
      characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
   yv = 0.00231479
    shv = 0.008
  ftv = 666.66
  fyv = 555.55
   suv = 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
       suv = 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  yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
```

y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.15644251
  2 = Asl,com/(b*d)*(fs2/fc) = 0.15970173
  v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
  b = 240.00
  d = 327.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.2134938
   2 = Asl,com/(b*d)*(fs2/fc) = 0.21794159
   v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16156243
Mu = MRc (4.14) = 1.5719E+008
 u =   su (4.1) = 0.00010691

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010702
Mu = 1.5980E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
   N = 224.0403
  fc = 20.00
  co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
   The Shear_factor is considered equal to 1 (pure moment strength)
   From (5.4b), TBDY: cu = 0.00583896
    we (5.4c) = 0.0034192
     ase ((5.4d), TBDY) = 0.15672608
      bo = 240.00
      ho = 340.00
       bi2 = 346400.00
    psh,min = Min(psh,x , psh,y) = 0.00261799
   Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
    ----
    psh,x (5.4d) = 0.00349066
     Ash = Astir*ns = 78.53982
      No stirups, ns = 2.00
     bk = 300.00
    ----
    psh,y (5.4d) = 0.00261799
     Ash = Astir*ns = 78.53982

No stirups, ns = 2.00
bk = 400.00

----

s = 150.00
fywe = 555.55
fce = 20.00
From ((5.A5), TBDY), TBDY: cc = 0.002
c = confinement factor = 1.00
y1 = 0.00231479
sh1 = 0.008
ft1 = 666.66
fy1 = 555.55
su1 = 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
su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs1 = fs = 555.55
with Es1 = Es = 200000.00
y2 = 0.00231479
sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
su2 = 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
su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu2_nominal = 0.08,
For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fs2 = fs = 555.55
with Es2 = Es = 200000.00
yv = 0.00231479
shv = 0.008
ftv = 666.66
fyv = 555.55
suv = 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
suv = 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 yv, shv,ftv,fyv, it is considered
characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.15925564
2 = Asl,com/(b*d)*(fs2/fc) = 0.15600552
v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
b = 240.00
d = 328.00
d' = 13.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00

1 = Asl,ten/(b*d)*(fs1/fc) = 0.21727713
    2 = Asl,com/(b*d)*(fs2/fc) = 0.2128429
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.1647931
Mu = MRc (4.14) = 1.5980E+008
 u =   su (4.1) = 0.00010702

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
 u = 0.00010682
Mu = 1.5721E+008
----
with full section properties:
  b = 300.00
  d = 358.00
  d' = 43.00
  v = 0.0001043
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of   cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
         bo = 240.00
         ho = 340.00
          bi2 = 346400.00
      psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
         Ash = Astir*ns = 78.53982
           No stirups, ns = 2.00
         bk = 400.00
      ----
         s = 150.00
         fywe = 555.55
         fce = 20.00
      From ((5.A5), TBDY), TBDY: cc = 0.002
          c = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
  su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
From table 5A.1, TBDY: esu1_nominal = 0.08,
For calculation of esu1_nominal and   y1, sh1,ft1,fy1, it is considered
characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
  y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
  with fs1 = fs = 555.55
  with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
   su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu2_nominal = 0.08,
  For calculation of esu2_nominal and   y2, sh2,ft2,fy2, it is considered
  characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
   suv = 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   yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.15600552
 2 = Asl,com/(b*d)*(fs2/fc) = 0.15925564
 v = Asl,mid/(b*d)*(fsv/fc) = 0.07962782
and confined core properties:
 b = 240.00
 d = 328.00
 d' = 13.00
 fcc (5A.2, TBDY) = 20.00
  cc (5A.5, TBDY) = 0.002
    c = confinement factor = 1.00
  1 = Asl,ten/(b*d)*(fs1/fc) = 0.2128429
  2 = Asl,com/(b*d)*(fs2/fc) = 0.21727713
  v = Asl,mid/(b*d)*(fsv/fc) = 0.10863856
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16319614
Mu = MRc (4.14) = 1.5721E+008
 u =   su (4.1) = 0.00010682

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
   u = 0.00010711
Mu = 1.5978E+008
----
with full section properties:
  b = 300.00
  d = 357.00
  d' = 42.00
  v = 0.00010459
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
       ase ((5.4d), TBDY) = 0.15672608
          bo = 240.00
          ho = 340.00
            bi2 = 346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
    Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
      ----
      psh,x (5.4d) = 0.00349066
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 300.00
      ----
      psh,y (5.4d) = 0.00261799
        Ash = Astir*ns = 78.53982
          No stirups, ns = 2.00
        bk = 400.00
      ----
        s = 150.00
       fywe = 555.55
       fce = 20.00
    From ((5.A5), TBDY), TBDY: cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008

```
    ft2 = 666.66
    fy2 = 555.55
     su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu2_nominal = 0.08,
       For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
       characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
        with fs2 = fs = 555.55
        with Es2 = Es = 200000.00
    yv = 0.00231479
    shv = 0.008
   ftv = 666.66
   fyv = 555.55
    suv = 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
       suv = 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  yv, shv,ftv,fyv, it is considered
      characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
       y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fsv = fs = 555.55
       with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.15970173
    2 = Asl,com/(b*d)*(fs2/fc) = 0.15644251
    v = Asl,mid/(b*d)*(fsv/fc) = 0.07985087
and confined core properties:
   b = 240.00
   d = 327.00
   d' = 12.00
   fcc (5A.2, TBDY) = 20.00
    cc (5A.5, TBDY) = 0.002
      c  = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.21794159
    2 = Asl,com/(b*d)*(fs2/fc) = 0.2134938
    v = Asl,mid/(b*d)*(fsv/fc) = 0.10897079
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.16317177
Mu = MRc (4.14) = 1.5978E+008
  u =    su (4.1) = 0.00010711
-----------------------------------------------------------

Calculation of ratio lb/ld
-----------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 227879.44
-----------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 227879.44
Vr1 = Vn ((22.5.1.1), ACI 318-14)
-----------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw ' is replaced by 'Vw+   f*Vf'
```

where Vf is the contribution of FRPs (11.3), ACI 440).

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
    Av = 157079.633
    fy = 444.44
    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

Calculation of Shear Strength at edge 2, Vr2 = 227879.44
Vr2 = Vn ((22.5.1.1), ACI 318-14)

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

  From Table (22.5.5.1), ACI 318-14: Vc = 78946.167
      = 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 = 1.00
      Mu = 6710.981
      Vu = 2740.264
  From (11.5.4.8), ACI 318-14: Vs = 148933.273
    Av = 157079.633
    fy = 444.44
    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 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,   = 0.75
Mean strength values are used for both shear and moment calculations.
Consequently:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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

Existing material: Steel Strength, fs = 1.25*fsm = 555.55
###
Section Height, H = 400.00
Section Width, W = 300.00
Cover Thickness, c = 25.00
Mean Confinement Factor overall section = 1.00
Element Length, L = 1850.00
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.7724203E-020
EDGE -B-
Shear Force, Vb = 8.7724203E-020
BOTH EDGES
Axial Force, F = -224.0403
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 = 0.77093353
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 = 117541.903
with
Mpr1 = Max(Mu1+ , Mu1-) = 1.0873E+008
  Mu1+ = 1.0873E+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- = 1.0873E+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-) = 1.0873E+008
  Mu2+ = 1.0873E+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- = 1.0873E+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 = -8.7724203E-020, is the shear force acting at edge 1 for the the static loading combination
  V2 = 8.7724203E-020, is the shear force acting at edge 2 for the the static loading combination

----
Calculation of Mu1+

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00

```
    d = 258.00
    d' = 42.00
    v = 0.00010855
      N = 224.0403
    fc = 20.00
     co (5A.5, TBDY) = 0.002
    Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
       The Shear_factor is considered equal to 1 (pure moment strength)
       From (5.4b), TBDY:  cu = 0.00583896
         we (5.4c) = 0.0034192
          ase ((5.4d), TBDY) = 0.15672608
             bo = 240.00
             ho = 340.00
              bi2 = 346400.00
          psh,min = Min(psh,x , psh,y) = 0.00261799
       Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)

       ----------------------------------------------------------------
          psh,x (5.4d) = 0.00349066
             Ash = Astir*ns = 78.53982
               No stirups, ns = 2.00
             bk = 300.00

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

       ----------------------------------------------------------------
             s = 150.00
           fywe = 555.55
           fce  = 20.00
       From ((5.A5), TBDY), TBDY:  cc = 0.002
            c = confinement factor = 1.00
     y1 = 0.00231479
      sh1 = 0.008
    ft1 = 666.66
    fy1 = 555.55
     su1 = 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
        su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu1_nominal = 0.08,
       For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
       characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fs1 = fs = 555.55
         with Es1 = Es = 200000.00
     y2 = 0.00231479
      sh2 = 0.008
    ft2 = 666.66
    fy2 = 555.55
     su2 = 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
        su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
       From table 5A.1, TBDY: esu2_nominal = 0.08,
       For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
       characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
        y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
         with fs2 = fs = 555.55
         with Es2 = Es = 200000.00
     yv = 0.00231479
      shv = 0.008
```

ftv = 666.66
fyv = 555.55
 suv = 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
    suv = 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 yv, shv,ftv,fyv, it is considered
   characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fsv = fs = 555.55
    with Esv = Es = 200000.00
   1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
   2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
   v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
  b = 340.00
  d = 228.00
  d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
     c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
    2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
    v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =   su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu1-

Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
  b = 400.00
  d = 258.00
  d' = 42.00
  v = 0.00010855
    N = 224.0403
  fc = 20.00
   co (5A.5, TBDY) = 0.002
  Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
    The Shear_factor is considered equal to 1 (pure moment strength)
    From (5.4b), TBDY: cu = 0.00583896
      we (5.4c) = 0.0034192
      ase ((5.4d), TBDY) = 0.15672608
        bo = 240.00
        ho = 340.00

```
              bi2 = 346400.00
          psh,min = Min(psh,x , psh,y) = 0.00261799
       Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
   earthquake detailing (90° closed stirrups)
          ----------------------------------------------------------------
          psh,x (5.4d) = 0.00349066
              Ash = Astir*ns = 78.53982
                 No stirups, ns = 2.00
              bk = 300.00
          ----------------------------------------------------------------
          psh,y (5.4d) = 0.00261799
              Ash = Astir*ns = 78.53982
                 No stirups, ns = 2.00
              bk = 400.00
          ----------------------------------------------------------------
             s = 150.00
          fywe = 555.55
          fce = 20.00
      From ((5.A5), TBDY), TBDY:  cc = 0.002
            c  = confinement factor = 1.00
   y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
      su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu1_nominal = 0.08,
     For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
     characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs1 = fs = 555.55
       with Es1 = Es = 200000.00
   y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
      su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
     From table 5A.1, TBDY: esu2_nominal = 0.08,
     For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
     characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
       with fs2 = fs = 555.55
       with Es2 = Es = 200000.00
   yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
      suv = 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  yv, shv,ftv,fyv, it is considered
     characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
      y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
```

with fsv = fs = 555.55
with Esv = Es = 200000.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
b = 340.00
d = 228.00
d' = 12.00
fcc (5A.2, TBDY) = 20.00
cc (5A.5, TBDY) = 0.002
c = confinement factor = 1.00
1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
u = su (4.1) = 0.00015595

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

Calculation of Mu2+

Calculation of ultimate curvature u according to 4.1, Biskinis/Fardis 2013:
u = 0.00015595
Mu = 1.0873E+008
----
with full section properties:
b = 400.00
d = 258.00
d' = 42.00
v = 0.00010855
N = 224.0403
fc = 20.00
co (5A.5, TBDY) = 0.002
Final value of cu: cu* = shear_factor * Max(cu, cc) = 0.00583896
The Shear_factor is considered equal to 1 (pure moment strength)
From (5.4b), TBDY: cu = 0.00583896
we (5.4c) = 0.0034192
ase ((5.4d), TBDY) = 0.15672608
bo = 240.00
ho = 340.00
bi2 = 346400.00
psh,min = Min(psh,x , psh,y) = 0.00261799
Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
----
psh,x (5.4d) = 0.00349066
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00
bk = 300.00
----
psh,y (5.4d) = 0.00261799
Ash = Astir*ns = 78.53982
No stirups, ns = 2.00

```
        bk = 400.00

    -----------------------------------------------------------------
        s = 150.00
      fywe = 555.55
      fce  = 20.00
    From ((5.A5), TBDY), TBDY:  cc = 0.002
        c = confinement factor = 1.00
  y1 = 0.00231479
  sh1 = 0.008
 ft1 = 666.66
 fy1 = 555.55
  su1 = 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
     su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu1_nominal = 0.08,
    For calculation of esu1_nominal and  y1, sh1,ft1,fy1, it is considered
    characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs1 = fs = 555.55
     with Es1 = Es = 200000.00
  y2 = 0.00231479
  sh2 = 0.008
 ft2 = 666.66
 fy2 = 555.55
  su2 = 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
     su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
    From table 5A.1, TBDY: esu2_nominal = 0.08,
    For calculation of esu2_nominal and  y2, sh2,ft2,fy2, it is considered
    characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fs2 = fs = 555.55
     with Es2 = Es = 200000.00
  yv = 0.00231479
  shv = 0.008
 ftv = 666.66
 fyv = 555.55
  suv = 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
     suv = 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  yv, shv,ftv,fyv, it is considered
    characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
     y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
     with fsv = fs = 555.55
     with Esv = Es = 200000.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
    2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
    v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
 and confined core properties:
   b = 340.00
   d = 228.00
   d' = 12.00
  fcc (5A.2, TBDY) = 20.00
   cc (5A.5, TBDY) = 0.002
      c = confinement factor = 1.00
    1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
```

```
        2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
       v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
  ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
  u =    su (4.1) = 0.00015595
-----------------------------------------------------------

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


--------------------------------------------------------------------------
Calculation of ultimate curvature   u according to 4.1, Biskinis/Fardis 2013:
  u = 0.00015595
Mu = 1.0873E+008
--------------------------------------------------------------------------
with full section properties:
  b =  400.00
  d =  258.00
  d' =  42.00
  v = 0.00010855
     N =  224.0403
  fc =  20.00
   co (5A.5, TBDY) = 0.002
  Final value of  cu:  cu* = shear_factor * Max( cu, cc) = 0.00583896
     The Shear_factor is considered equal to 1 (pure moment strength)
     From (5.4b), TBDY:  cu = 0.00583896
       we (5.4c) = 0.0034192
        ase ((5.4d), TBDY) = 0.15672608
           bo =  240.00
           ho =  340.00
            bi2 =  346400.00
       psh,min = Min(psh,x , psh,y) = 0.00261799
     Expression ((5.4d), TBDY) for psh,min has been miltiplied by 0.3 according to 15.7.1.3 for members without
earthquake detailing (90° closed stirrups)
       ----------------------------------------------------------------
       psh,x (5.4d) = 0.00349066
          Ash = Astir*ns =  78.53982
             No stirups, ns =  2.00
          bk =  300.00
       ----------------------------------------------------------------
       psh,y (5.4d) = 0.00261799
          Ash = Astir*ns =  78.53982
             No stirups, ns =  2.00
          bk =  400.00
       ----------------------------------------------------------------
          s =  150.00
        fywe =  555.55
        fce =  20.00
      From ((5.A5), TBDY), TBDY:  cc = 0.002
          c = confinement factor =  1.00
   y1 = 0.00231479
   sh1 = 0.008
  ft1 =  666.66
  fy1 =  555.55
   su1 = 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
    su1 = 0.4*esu1_nominal ((5.5), TBDY) = 0.032
   From table 5A.1, TBDY: esu1_nominal = 0.08,
   For calculation of esu1_nominal and y1, sh1,ft1,fy1, it is considered
   characteristic value fsy1 = fs1/1.2, from table 5.1, TBDY.
    y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
    with fs1 = fs = 555.55
    with Es1 = Es = 200000.00
 y2 = 0.00231479
 sh2 = 0.008
ft2 = 666.66
fy2 = 555.55
 su2 = 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
   su2 = 0.4*esu2_nominal ((5.5), TBDY) = 0.032
  From table 5A.1, TBDY: esu2_nominal = 0.08,
  For calculation of esu2_nominal and y2, sh2,ft2,fy2, it is considered
  characteristic value fsy2 = fs2/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fs2 = fs = 555.55
   with Es2 = Es = 200000.00
 yv = 0.00231479
 shv = 0.008
ftv = 666.66
fyv = 555.55
 suv = 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
   suv = 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 yv, shv,ftv,fyv, it is considered
  characteristic value fsyv = fsv/1.2, from table 5.1, TBDY.
   y1, sh1,ft1,fy1, are also multiplied by Min(1,1.25*(lb/ld)^2/3), from 10.3.5, ASCE 41-17.
   with fsv = fs = 555.55
   with Esv = Es = 200000.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.13698668
 2 = Asl,com/(b*d)*(fs2/fc) = 0.13698668
 v = Asl,mid/(b*d)*(fsv/fc) = 0.13698668
and confined core properties:
 b = 340.00
 d = 228.00
 d' = 12.00
 fcc (5A.2, TBDY) = 20.00
 cc (5A.5, TBDY) = 0.002
  c = confinement factor = 1.00
 1 = Asl,ten/(b*d)*(fs1/fc) = 0.18236617
 2 = Asl,com/(b*d)*(fs2/fc) = 0.18236617
 v = Asl,mid/(b*d)*(fsv/fc) = 0.18236617
Case/Assumption: Unconfinesd full section - Steel rupture
 ' does not satisfy Eq. (4.3)
--->
v < vs,c - RHS eq.(4.5) is satisfied
--->
 su (4.9) = 0.2046582
Mu = MRc (4.14) = 1.0873E+008
 u = su (4.1) = 0.00015595

Calculation of ratio lb/ld

```
-------------------------------------------------------------
Adequate Lap Length: lb/ld >= 1
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
Calculation of Shear Strength Vr = Min(Vr1,Vr2) = 152466.975
-----------------------------------------------------------------------------
Calculation of Shear Strength at edge 1, Vr1 = 152466.975
Vr1 = Vn ((22.5.1.1), ACI 318-14)
-----------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+  f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
-----------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
       = 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 = 1.8491887E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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
-----------------------------------------------------------------------
Calculation of Shear Strength at edge 2, Vr2 = 152466.975
Vr2 = Vn ((22.5.1.1), ACI 318-14)
-----------------------------------------------------------
NOTE: In expression (22.5.1.1) 'Vw' is replaced by 'Vw+  f*Vf'
where Vf is the contribution of FRPs (11.3), ACI 440).
-----------------------------------------------------------
   From Table (22.5.5.1), ACI 318-14: Vc = 68692.008
       = 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 = 1.8491916E-012
        Vu = 8.7724203E-020
   From (11.5.4.8), ACI 318-14: Vs = 83774.966
     Av = 157079.633
     fy = 444.44
     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 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,   = 0.75
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:
Existing material of Secondary Member: Concrete Strength, fc = fcm = 20.00
Existing material of Secondary Member: Steel Strength, fs = fsm = 444.44
Concrete Elasticity, Ec = 21019.039
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
Secondary Member
Smooth Bars
Ductile Steel
Without Detailing for Earthquake Resistance (including stirrups not 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 = -8.9686435E-011
Shear Force, V2 = 5.2893637E-014
Shear Force, V3 = 11865.276
Axial Force, F = -766.5227
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

Existing component: From table 7-7, ASCE 41_17: Final chord rotation Capacity u,R =   * u = 0.01779661
  u =   y +   p = 0.02372882

 - Calculation of   y -
----
  y = (My*Ls/3)/EIeff = 0.00372882 ((4.29),Biskinis Phd))
   My = 6.8632E+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 = 5.6751E+012

Calculation of Yielding Moment My

Calculation of   y and My according to Annex 7   -
----
  y = Min(y_ten, y_com)
  y_ten = 1.2094933E-005
 with fy = 444.44
    d = 258.00
     y = 0.28786888
    A = 0.01481142
    B = 0.00861829

with pt = 0.00493157
           pc = 0.00493157
           pv = 0.00493157
           N = 766.5227
           b = 400.00
            " = 0.1627907
  y_comp = 2.3070920E-005
 with fc = 20.00
     Ec = 21019.039
      y = 0.28774317
      A = 0.01477303
      B = 0.00860158
      with Es = 200000.00

Calculation of ratio lb/ld

Adequate Lap Length: lb/ld >= 1

 - Calculation of p -

From table 10-7: p = 0.02
with:
 - Condition i occured
   Beam controlled by flexure: Vp/Vo <= 1
   shear control ratio Vp/Vo = 0.77093353
 - Transverse Reinforcement: NC
 - Stirrup Spacing > d/3
 - Low ductility demand, / y < 2 (table 10-6, ASCE 41-17)
        = -1.2886169E-021
 - Stirrup Spacing > d/2
  d = 258.00
  s = 150.00
 - Strength provided by hoops Vs < 3/4*design Shear
  Vs = 111699.955,already given in calculation of shear control ratio
  design Shear = 5.2893637E-014
 - (- ')/ bal = -0.15320593
    = Aslt/(bw*d) = 0.00596659
   Tension Reinf Area: Aslt = 615.7522
   ' = Aslc/(bw*d) = 0.00882812
   Compression Reinf Area: Aslc = 911.0619
  From (B-1), ACI 318-11: bal = 0.01867766
    fc = 20.00
    fy = 444.44
    From 10.2.7.3, ACI 318-11: 1 = 0.85
    From fig R10.3.3, ACI 318-11 (Ence 454, too): 87000/(87000+fy) = cb/dt = 0.003/(0.003+ y) = 0.57447053
         y = 0.0022222
 - V/(bw*d*fc^0.5) = 1.3801680E-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)