



## Section Properties:

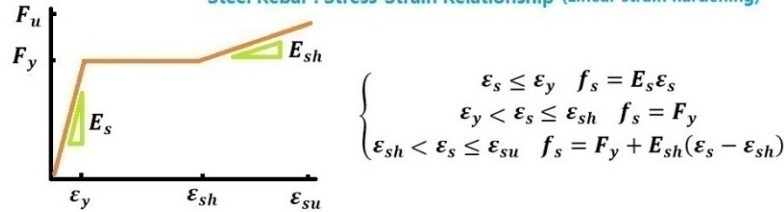
```

b=400;% [mm]
h=400;% [mm]
%As: As1 As2 As3 As4 As5 As6
As=[2454.296 0 0 0 0 2454.296]; % NOTE: As1 & As2 = 5fi25
%d:d1 d2 d3 d4 d5 d6
d=[70.5 0 0 0 0 329.5]; % Distance of rebars - NOTE: d(1)=cover+stirrup
diameter+half longitudinal rebar
cover=50; % Concrete cover - NOTE: Cover must less than d(1)

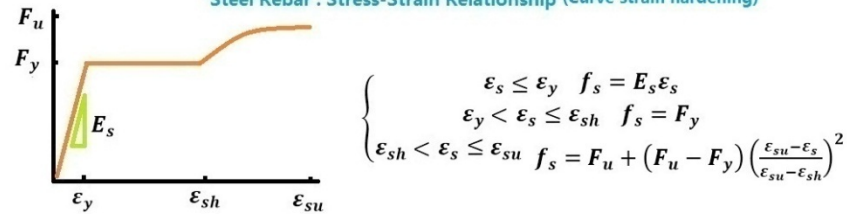
```

## Stress-Strain of materials

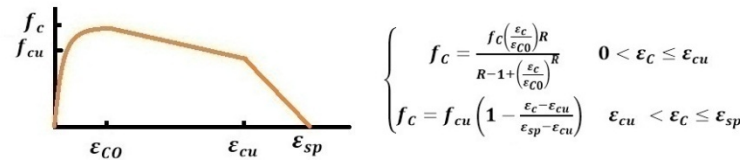
Steel Rebar : Stress-Strain Relationship (Linear strain hardening)



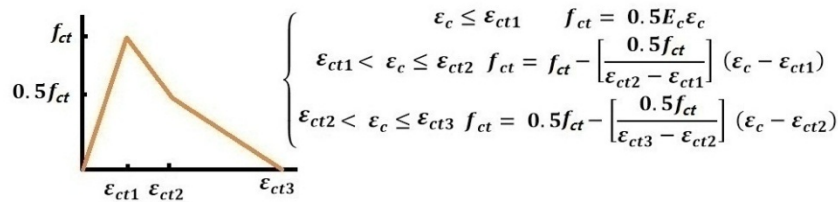
Steel Rebar : Stress-Strain Relationship (Curve strain hardening)



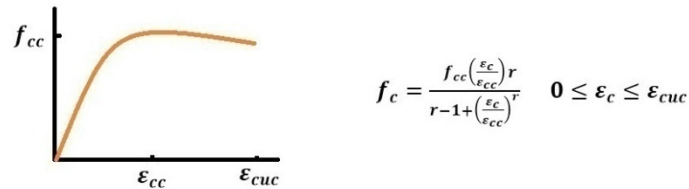
Unconfined Concrete compressive : Stress-Strain Relationship (Mander Model)



Unconfined Concrete Tensile: Stress-Strain Relationship



Confined concrete compressive: Stress-strain Relationship (Mander Model)



## Concrete Properties:

```

fc =30;% [N/mm^2] Unconfined concrete strength
ecu=0.004;% Ultimate concrete strain

```

```
Ec=5000*sqrt(fc);
ec0=(2*fc)/Ec;
fct=-0.7*sqrt(fc);% Concrete tension stress
ect1=(2*fct)/Ec;ect2=(2.625*fct)/Ec;ect3=(9.292*fct)/Ec;% Concrete tension strain
```

#### Steel Reinforcing Properties:

```
fy =400;% [N/mm^2] Yield strength of reinforcing steel
Es =2e5;% [N/mm^2] Modulus of elasticity of steel
fu=1.5*fy;% Ultimate steel stress
ey=fy/Es;% Yeild steel strain
esh=0.01;% Strain at steel strain-hardening
esu=0.09;% Ultimate steel strain
Esh=(fu-fy)/(esu-esh);
```

#### Stirrup Reinforcing Properties:

```
fyh =300;% [MPa] Transverse Reinforcing Bar (stirrup) Yield Stress
Nx=2;% Total of transverse hoop legs in the X
Ny=2;% Total of transverse hoop legs in the Y
diastirrup=8;% [mm] Cross-sectional hoop diameter
wi=360000;% [mm^2] Define total summation of confined reinforcing steel in power.2
s =150;% [mm] Tie Spacing Along Member
```

#### Analysis Report:

```
(+)Increment 1 : It is converged in 20 iterations - strain: 0.000014 - x: 176.87 - Phi: 0.00008 - Moment: 4.53
(+)Increment 2 : It is converged in 17 iterations - strain: 0.000153 - x: 177.02 - Phi: 0.00087 - Moment: 49.70
(+)Increment 3 : It is converged in 17 iterations - strain: 0.000299 - x: 168.30 - Phi: 0.00178 - Moment: 88.41
(+)Increment 4 : It is converged in 18 iterations - strain: 0.000471 - x: 146.54 - Phi: 0.00321 - Moment: 118.98
(+)Increment 5 : It is converged in 18 iterations - strain: 0.000648 - x: 136.30 - Phi: 0.00475 - Moment: 152.60
(+)Increment 6 : It is converged in 20 iterations - strain: 0.000822 - x: 131.73 - Phi: 0.00624 - Moment: 187.19
(+)Increment 7 : It is converged in 21 iterations - strain: 0.000990 - x: 130.28 - Phi: 0.00760 - Moment: 221.23
(+)Increment 8 : It is converged in 21 iterations - strain: 0.001154 - x: 130.04 - Phi: 0.00887 - Moment: 253.53
(+)Increment 9 : It is converged in 16 iterations - strain: 0.001321 - x: 129.32 - Phi: 0.01021 - Moment: 282.96
(+)Increment 10 : It is converged in 20 iterations - strain: 0.001712 - x: 106.71 - Phi: 0.01605 - Moment: 282.79
(+)Increment 11 : It is converged in 22 iterations - strain: 0.002127 - x: 95.22 - Phi: 0.02234 - Moment: 283.31
(+)Increment 12 : It is converged in 22 iterations - strain: 0.002527 - x: 89.16 - Phi: 0.02835 - Moment: 283.55
(+)Increment 13 : It is converged in 18 iterations - strain: 0.002901 - x: 85.78 - Phi: 0.03382 - Moment: 283.55
(+)Increment 14 : It is converged in 14 iterations - strain: 0.003262 - x: 83.55 - Phi: 0.03905 - Moment: 283.27
(+)Increment 15 : It is converged in 9 iterations - strain: 0.003576 - x: 82.55 - Phi: 0.04332 - Moment: 285.16
(+)Increment 16 : It is converged in 11 iterations - strain: 0.003869 - x: 82.01 - Phi: 0.04718 - Moment: 287.84
(+)Increment 17 : It is converged in 10 iterations - strain: 0.004150 - x: 81.69 - Phi: 0.05081 - Moment: 290.21
(+)Increment 18 : It is converged in 12 iterations - strain: 0.004415 - x: 81.61 - Phi: 0.05409 - Moment: 291.94
(+)Increment 19 : It is converged in 13 iterations - strain: 0.004666 - x: 81.69 - Phi: 0.05711 - Moment: 293.22
(+)Increment 20 : It is converged in 15 iterations - strain: 0.004907 - x: 81.87 - Phi: 0.05993 - Moment: 294.15
(+)Increment 21 : It is converged in 21 iterations - strain: 0.005141 - x: 82.10 - Phi: 0.06261 - Moment: 294.84
(+)Increment 22 : It is converged in 21 iterations - strain: 0.005367 - x: 82.39 - Phi: 0.06514 - Moment: 295.28
(+)Increment 23 : It is converged in 23 iterations - strain: 0.005588 - x: 82.71 - Phi: 0.06757 - Moment: 295.56
(+)Increment 24 : It is converged in 22 iterations - strain: 0.005806 - x: 83.04 - Phi: 0.06992 - Moment: 295.73
(+)Increment 25 : It is converged in 24 iterations - strain: 0.006017 - x: 83.41 - Phi: 0.07214 - Moment: 295.73
(+)Increment 26 : It is converged in 20 iterations - strain: 0.006231 - x: 83.73 - Phi: 0.07441 - Moment: 295.83
(+)Increment 27 : It is converged in 21 iterations - strain: 0.006444 - x: 84.04 - Phi: 0.07668 - Moment: 296.00
(+)Increment 28 : It is converged in 17 iterations - strain: 0.006665 - x: 84.26 - Phi: 0.07911 - Moment: 296.48
(+)Increment 29 : It is converged in 16 iterations - strain: 0.006886 - x: 84.47 - Phi: 0.08152 - Moment: 296.98
(+)Increment 30 : It is converged in 15 iterations - strain: 0.007111 - x: 84.63 - Phi: 0.08403 - Moment: 297.67
(+)Increment 31 : It is converged in 14 iterations - strain: 0.007341 - x: 84.75 - Phi: 0.08662 - Moment: 298.50
(+)Increment 32 : It is converged in 14 iterations - strain: 0.007570 - x: 84.87 - Phi: 0.08920 - Moment: 299.35
(+)Increment 33 : It is converged in 11 iterations - strain: 0.007807 - x: 84.92 - Phi: 0.09193 - Moment: 300.43
(+)Increment 34 : It is converged in 12 iterations - strain: 0.008042 - x: 84.97 - Phi: 0.09465 - Moment: 301.49
(+)Increment 35 : It is converged in 9 iterations - strain: 0.008283 - x: 84.99 - Phi: 0.09746 - Moment: 302.71
(+)Increment 36 : It is converged in 8 iterations - strain: 0.008526 - x: 84.99 - Phi: 0.10031 - Moment: 303.97
(+)Increment 37 : It is converged in 8 iterations - strain: 0.008772 - x: 84.97 - Phi: 0.10324 - Moment: 305.33
(+)Increment 38 : It is converged in 8 iterations - strain: 0.009019 - x: 84.94 - Phi: 0.10618 - Moment: 306.72
(+)Increment 39 : It is converged in 7 iterations - strain: 0.009266 - x: 84.92 - Phi: 0.10911 - Moment: 308.09
```

(+)Increment 40 : It is converged in 8 iterations - strain: 0.009522 - x: 84.84 - Phi: 0.11223 - Moment: 309.68  
 (+)Increment 41 : It is converged in 8 iterations - strain: 0.009778 - x: 84.76 - Phi: 0.11536 - Moment: 311.26  
 (+)Increment 42 : It is converged in 10 iterations - strain: 0.010034 - x: 84.69 - Phi: 0.11847 - Moment: 312.79  
 (+)Increment 43 : It is converged in 10 iterations - strain: 0.010298 - x: 84.57 - Phi: 0.12177 - Moment: 314.54  
 (+)Increment 44 : It is converged in 10 iterations - strain: 0.010563 - x: 84.46 - Phi: 0.12507 - Moment: 316.25  
 (+)Increment 45 : It is converged in 11 iterations - strain: 0.010828 - x: 84.35 - Phi: 0.12837 - Moment: 317.94  
 (+)Increment 46 : It is converged in 12 iterations - strain: 0.011099 - x: 84.22 - Phi: 0.13179 - Moment: 319.74  
 (+)Increment 47 : It is converged in 12 iterations - strain: 0.011372 - x: 84.09 - Phi: 0.13525 - Moment: 321.56  
 (+)Increment 48 : It is converged in 13 iterations - strain: 0.011646 - x: 83.95 - Phi: 0.13872 - Moment: 323.36  
 (+)Increment 49 : It is converged in 13 iterations - strain: 0.011924 - x: 83.80 - Phi: 0.14229 - Moment: 325.17  
 (+)Increment 50 : It is converged in 14 iterations - strain: 0.012209 - x: 83.63 - Phi: 0.14598 - Moment: 327.06  
 (+)Increment 51 : It is converged in 14 iterations - strain: 0.012496 - x: 83.46 - Phi: 0.14972 - Moment: 328.98  
 (+)Increment 52 : It is converged in 14 iterations - strain: 0.012781 - x: 83.31 - Phi: 0.15343 - Moment: 330.85  
 (+)Increment 53 : It is converged in 15 iterations - strain: 0.013067 - x: 83.16 - Phi: 0.15714 - Moment: 332.69  
 (+)Increment 54 : It is converged in 15 iterations - strain: 0.013280 - x: 83.31 - Phi: 0.15939 - Moment: 333.68  
 (+)Increment 55 : It is converged in 38 iterations - strain: 0.013435 - x: 83.71 - Phi: 0.16049 - Moment: 334.04  
 (+)Increment 56 : It is converged in 44 iterations - strain: 0.013568 - x: 84.19 - Phi: 0.16117 - Moment: 334.23  
 (+)Increment 57 : It is converged in 22 iterations - strain: 0.013737 - x: 84.52 - Phi: 0.16253 - Moment: 334.75  
 (+)Increment 58 : It is converged in 19 iterations - strain: 0.013910 - x: 84.82 - Phi: 0.16400 - Moment: 335.32  
 (+)Increment 59 : It is converged in 17 iterations - strain: 0.014081 - x: 85.12 - Phi: 0.16542 - Moment: 335.86  
 (+)Increment 60 : It is converged in 15 iterations - strain: 0.014250 - x: 85.43 - Phi: 0.16679 - Moment: 336.37  
 (+)Increment 61 : It is converged in 12 iterations - strain: 0.014417 - x: 85.75 - Phi: 0.16813 - Moment: 336.85  
 (+)Increment 62 : It is converged in 53 iterations - strain: 0.014585 - x: 86.05 - Phi: 0.16950 - Moment: 337.36  
 (+)Increment 63 : It is converged in 49 iterations - strain: 0.014761 - x: 86.31 - Phi: 0.17102 - Moment: 337.93  
 (+)Increment 64 : It is converged in 45 iterations - strain: 0.014935 - x: 86.58 - Phi: 0.17249 - Moment: 338.48  
 (+)Increment 65 : It is converged in 39 iterations - strain: 0.015106 - x: 86.86 - Phi: 0.17391 - Moment: 338.99  
 (+)Increment 66 : It is converged in 34 iterations - strain: 0.015274 - x: 87.14 - Phi: 0.17529 - Moment: 339.48  
 (+)Increment 67 : It is converged in 29 iterations - strain: 0.015441 - x: 87.43 - Phi: 0.17661 - Moment: 339.93  
 (+)Increment 68 : It is converged in 26 iterations - strain: 0.015604 - x: 87.72 - Phi: 0.17788 - Moment: 340.36  
 (+)Increment 69 : It is converged in 28 iterations - strain: 0.015766 - x: 88.02 - Phi: 0.17912 - Moment: 340.79  
 (+)Increment 70 : It is converged in 18 iterations - strain: 0.015897 - x: 88.45 - Phi: 0.17974 - Moment: 340.92  
 (+)Increment 71 : It is converged in 16 iterations - strain: 0.016068 - x: 88.69 - Phi: 0.18116 - Moment: 341.42  
 (+)Increment 72 : It is converged in 13 iterations - strain: 0.016238 - x: 88.95 - Phi: 0.18255 - Moment: 341.89  
 (+)Increment 73 : It is converged in 12 iterations - strain: 0.016405 - x: 89.21 - Phi: 0.18390 - Moment: 342.34  
 (+)Increment 74 : It is converged in 10 iterations - strain: 0.016570 - x: 89.47 - Phi: 0.18521 - Moment: 342.76  
 (+)Increment 75 : It is converged in 6 iterations - strain: 0.016734 - x: 89.74 - Phi: 0.18647 - Moment: 343.17  
 (+)Increment 76 : It is converged in 31 iterations - strain: 0.016896 - x: 90.01 - Phi: 0.18771 - Moment: 343.55  
 (+)Increment 77 : It is converged in 32 iterations - strain: 0.017071 - x: 90.22 - Phi: 0.18923 - Moment: 344.07  
 (+)Increment 78 : It is converged in 29 iterations - strain: 0.017246 - x: 90.43 - Phi: 0.19071 - Moment: 344.57  
 (+)Increment 79 : It is converged in 26 iterations - strain: 0.017418 - x: 90.64 - Phi: 0.19217 - Moment: 345.05  
 (+)Increment 80 : It is converged in 27 iterations - strain: 0.017588 - x: 90.86 - Phi: 0.19357 - Moment: 345.50  
 (+)Increment 81 : It is converged in 24 iterations - strain: 0.017755 - x: 91.10 - Phi: 0.19490 - Moment: 345.91  
 (+)Increment 82 : It is converged in 21 iterations - strain: 0.017920 - x: 91.34 - Phi: 0.19619 - Moment: 346.30  
 (+)Increment 83 : It is converged in 19 iterations - strain: 0.018081 - x: 91.59 - Phi: 0.19741 - Moment: 346.66  
 (+)Increment 84 : It is converged in 16 iterations - strain: 0.018239 - x: 91.85 - Phi: 0.19858 - Moment: 346.99  
 (+)Increment 85 : It is converged in 13 iterations - strain: 0.018396 - x: 92.11 - Phi: 0.19971 - Moment: 347.31  
 (+)Increment 86 : It is converged in 10 iterations - strain: 0.018526 - x: 92.48 - Phi: 0.20031 - Moment: 347.41  
 (+)Increment 87 : It is converged in 8 iterations - strain: 0.018680 - x: 92.75 - Phi: 0.20140 - Moment: 347.72  
 (+)Increment 88 : It is converged in 9 iterations - strain: 0.018848 - x: 92.96 - Phi: 0.20276 - Moment: 348.12  
 (+)Increment 89 : It is converged in 11 iterations - strain: 0.019015 - x: 93.17 - Phi: 0.20409 - Moment: 348.52  
 (+)Increment 90 : It is converged in 13 iterations - strain: 0.019179 - x: 93.38 - Phi: 0.20539 - Moment: 348.89  
 (+)Increment 91 : It is converged in 13 iterations - strain: 0.019340 - x: 93.61 - Phi: 0.20660 - Moment: 349.23  
 (+)Increment 92 : It is converged in 14 iterations - strain: 0.019498 - x: 93.85 - Phi: 0.20776 - Moment: 349.53  
 (+)Increment 93 : It is converged in 26 iterations - strain: 0.019659 - x: 94.07 - Phi: 0.20897 - Moment: 349.86

+=====+

= Confined curve fitted =

Curvature Moment  
 (1/m) (kN.m)

```
-----
      0      0
    0.0074 271.5604
    0.2090 348.0046
```

+=====+

+=====+

= Confined =

Curvature (1/m)	Moment (kN.m)
0.00000	0.000
0.00008	4.532
0.00087	49.722
0.00178	88.753
0.00321	118.426
0.00475	151.645
0.00624	185.772
0.00760	219.536
0.00887	251.608
0.01021	280.841
0.01605	281.522
0.02234	282.475
0.02835	282.948
0.03382	283.062
0.03905	282.863
0.04332	284.776
0.04718	287.457
0.05081	289.823
0.05409	291.544
0.05711	292.794
0.05993	293.700
0.06261	294.354
0.06514	294.755
0.06757	294.996
0.06992	295.125
0.07214	295.074
0.07441	295.132
0.07668	295.261
0.07911	295.709
0.08152	296.177
0.08403	296.829
0.08662	297.638
0.08920	298.460
0.09193	299.524
0.09465	300.563
0.09746	301.764
0.10031	303.012
0.10324	304.361
0.10618	305.742
0.10911	307.100
0.11223	308.686
0.11536	310.257
0.11847	311.792
0.12177	313.534
0.12507	315.249
0.12837	316.938
0.13179	318.738
0.13525	320.568
0.13872	322.372
0.14229	324.184
0.14598	326.081
0.14972	328.011
0.15343	329.892
0.15714	331.742
0.15939	332.714
0.16049	333.032
0.16117	333.170
0.16253	333.659
0.16400	334.195
0.16542	334.702
0.16679	335.179
0.16813	335.636
0.16950	336.114
0.17102	336.662
0.17249	337.180
0.17391	337.667
0.17529	338.127
0.17661	338.560

0.17788	338.963
0.17912	339.359
0.17974	339.462
0.18116	339.935
0.18255	340.385
0.18390	340.813
0.18521	341.217
0.18647	341.598
0.18771	341.965
0.18923	342.465
0.19071	342.949
0.19217	343.415
0.19357	343.847
0.19490	344.243
0.19619	344.619
0.19741	344.960
0.19858	345.275
0.19971	345.573
0.20031	345.654
0.20140	345.940
0.20276	346.336
0.20409	346.716
0.20539	347.078
0.20660	347.400
0.20776	347.693
0.20897	348.005

+=====+

= Confined curve fitted =

Curvature (1/m)	Moment (kN.m)
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0.00000	0.000
0.00736	271.560
0.20897	348.005

+=====+

+=====+

Increment	Top strain	Neutral axis(x)	Curvature	Flexutural Rigidity(EI)
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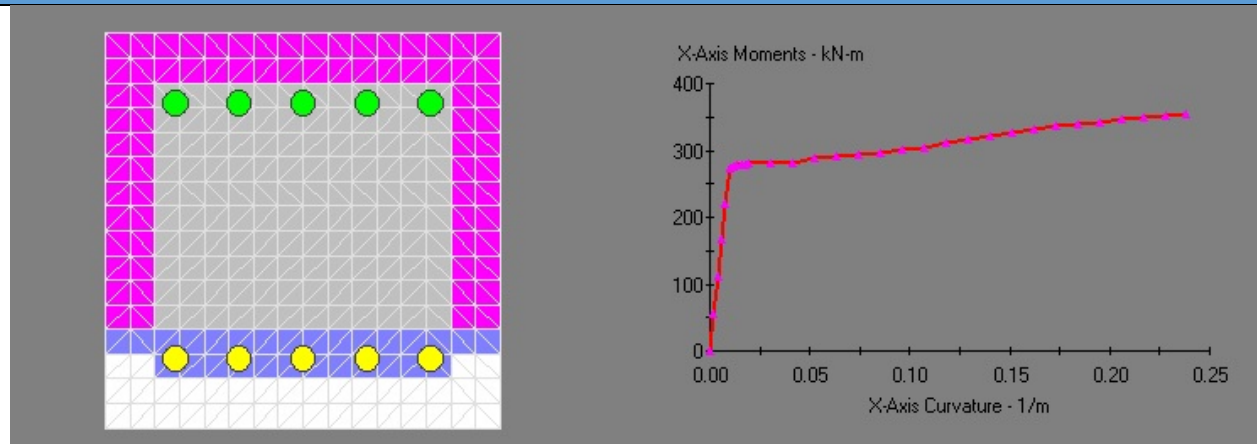
(i)	(1)	(mm)	(1/m)	(kN.m^2)
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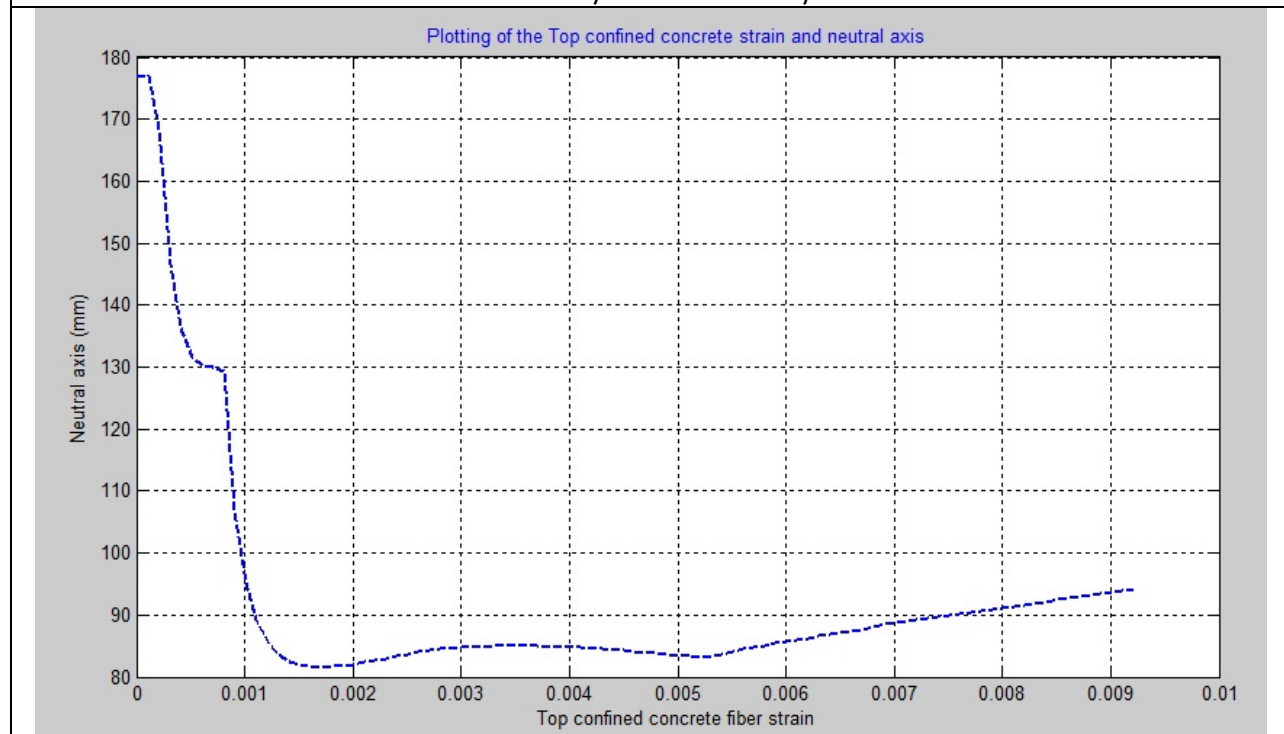
1	0.00001	176.87	0.000079	57491.85
2	0.00011	177.02	0.000866	57406.72
3	0.00021	168.30	0.001775	42929.26
4	0.00031	146.54	0.003211	20663.62
5	0.00041	136.30	0.004751	21579.26
6	0.00051	131.73	0.006240	22908.98
7	0.00061	130.28	0.007598	24861.01
8	0.00071	130.04	0.008871	25203.32
9	0.00081	129.32	0.010212	21794.83
10	0.00091	106.71	0.016046	116.78
11	0.00101	95.22	0.022335	151.57
12	0.00111	89.16	0.028348	78.67
13	0.00121	85.78	0.033818	20.86
14	0.00131	83.55	0.039046	38.18
15	0.00141	82.55	0.043319	447.89
16	0.00151	82.01	0.047179	694.36
17	0.00161	81.69	0.050805	652.47
18	0.00171	81.61	0.054092	523.58
19	0.00181	81.69	0.057111	414.16
20	0.00191	81.87	0.059934	320.86
21	0.00201	82.10	0.062611	244.39
22	0.00211	82.39	0.065141	158.36
23	0.00221	82.71	0.067568	99.22
24	0.00231	83.04	0.069917	55.01
25	0.00241	83.41	0.072145	22.75
26	0.00251	83.73	0.074414	25.41
27	0.00261	84.04	0.076682	56.86
28	0.00271	84.26	0.079108	184.78
29	0.00281	84.47	0.081521	193.96
30	0.00291	84.63	0.084028	260.12

31	0.00301	84.75	0.086617	312.48
32	0.00311	84.87	0.089199	318.14
33	0.00321	84.92	0.091934	389.30
34	0.00331	84.97	0.094645	383.09
35	0.00341	84.99	0.097459	426.99
36	0.00351	84.99	0.100312	437.32
37	0.00361	84.97	0.103236	461.36
38	0.00371	84.94	0.106177	469.66
39	0.00381	84.92	0.109115	461.98
40	0.00391	84.84	0.112235	508.38
41	0.00401	84.76	0.115361	502.65
42	0.00411	84.69	0.118474	493.10
43	0.00421	84.57	0.121770	528.47
44	0.00431	84.46	0.125067	520.21
45	0.00441	84.35	0.128367	511.98
46	0.00451	84.22	0.131785	526.50
47	0.00461	84.09	0.135247	528.62
48	0.00471	83.95	0.138721	519.25
49	0.00481	83.80	0.142289	507.72
50	0.00491	83.63	0.145979	514.01
51	0.00501	83.46	0.149725	515.45
52	0.00511	83.31	0.153428	507.81
53	0.00521	83.16	0.157139	498.53
54	0.00531	83.31	0.159395	430.96
55	0.00541	83.71	0.160493	289.73
56	0.00551	84.19	0.161169	203.65
57	0.00561	84.52	0.162534	358.43
58	0.00571	84.82	0.164000	365.42
59	0.00581	85.12	0.165420	356.84
60	0.00591	85.43	0.166794	347.81
61	0.00601	85.75	0.168132	341.10
62	0.00611	86.05	0.169503	348.76
63	0.00621	86.31	0.171024	360.29
64	0.00631	86.58	0.172494	352.14
65	0.00641	86.86	0.173912	343.63
66	0.00651	87.14	0.175285	335.36
67	0.00661	87.43	0.176610	326.41
68	0.00671	87.72	0.177883	316.62
69	0.00681	88.02	0.179116	321.75
70	0.00691	88.45	0.179737	164.72
71	0.00701	88.69	0.181162	331.71
72	0.00711	88.95	0.182550	324.58
73	0.00721	89.21	0.183900	317.11
74	0.00731	89.47	0.185208	309.23
75	0.00741	89.74	0.186474	300.87
76	0.00751	90.01	0.187713	295.54
77	0.00761	90.22	0.189226	330.92
78	0.00771	90.43	0.190712	325.53
79	0.00781	90.64	0.192170	319.97
80	0.00791	90.86	0.193566	309.06
81	0.00801	91.10	0.194898	297.58
82	0.00811	91.34	0.196191	290.29
83	0.00821	91.59	0.197414	279.37
84	0.00831	91.85	0.198581	269.29
85	0.00841	92.11	0.199713	263.23
86	0.00851	92.48	0.200311	135.31
87	0.00861	92.75	0.201403	262.67
88	0.00871	92.96	0.202762	291.41
89	0.00881	93.17	0.204090	285.61
90	0.00891	93.38	0.205387	279.58
91	0.00901	93.61	0.206603	264.60
92	0.00911	93.85	0.207762	253.24
93	0.00921	94.07	0.208970	257.45
=====				
+-----+ Confined Section Ductility Rito is: 28.38 +-----+				

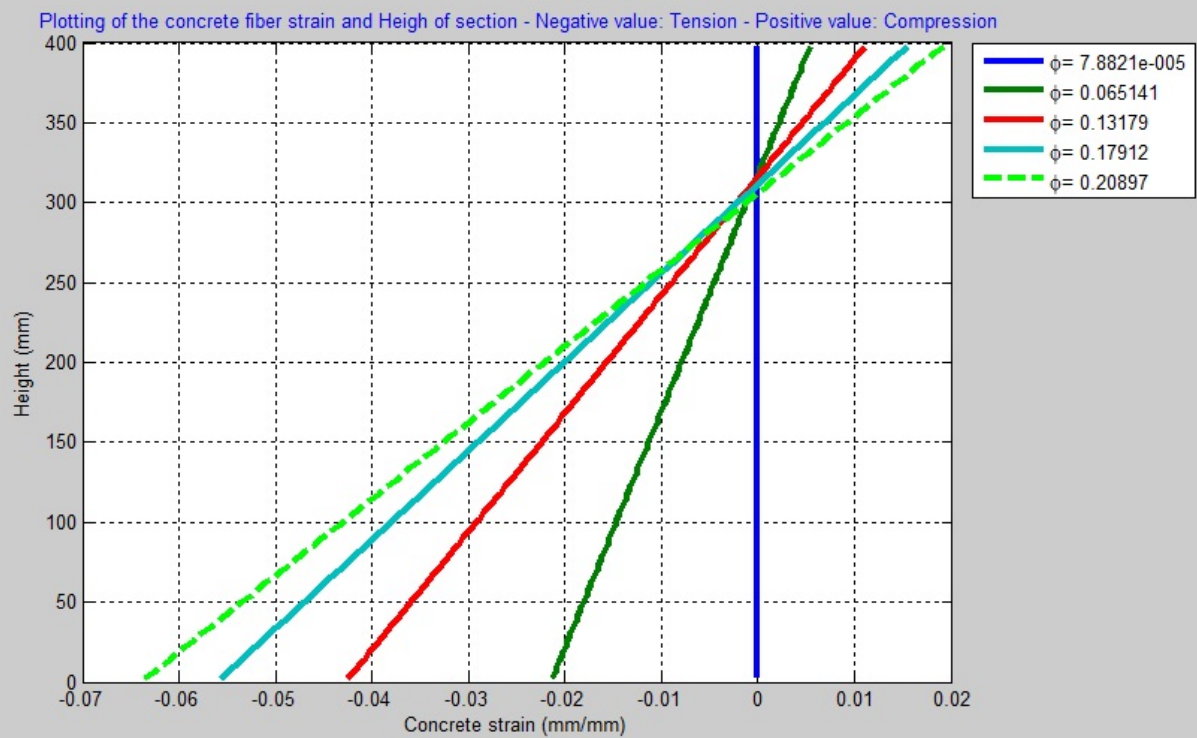
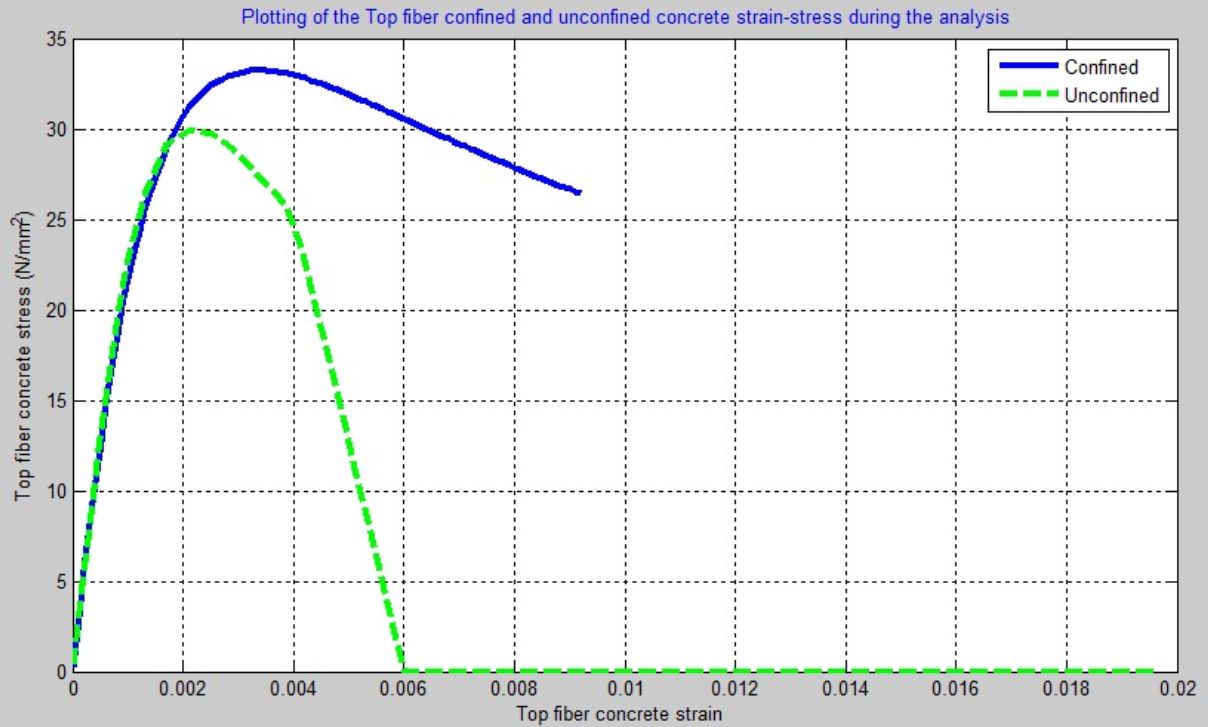
Plot :



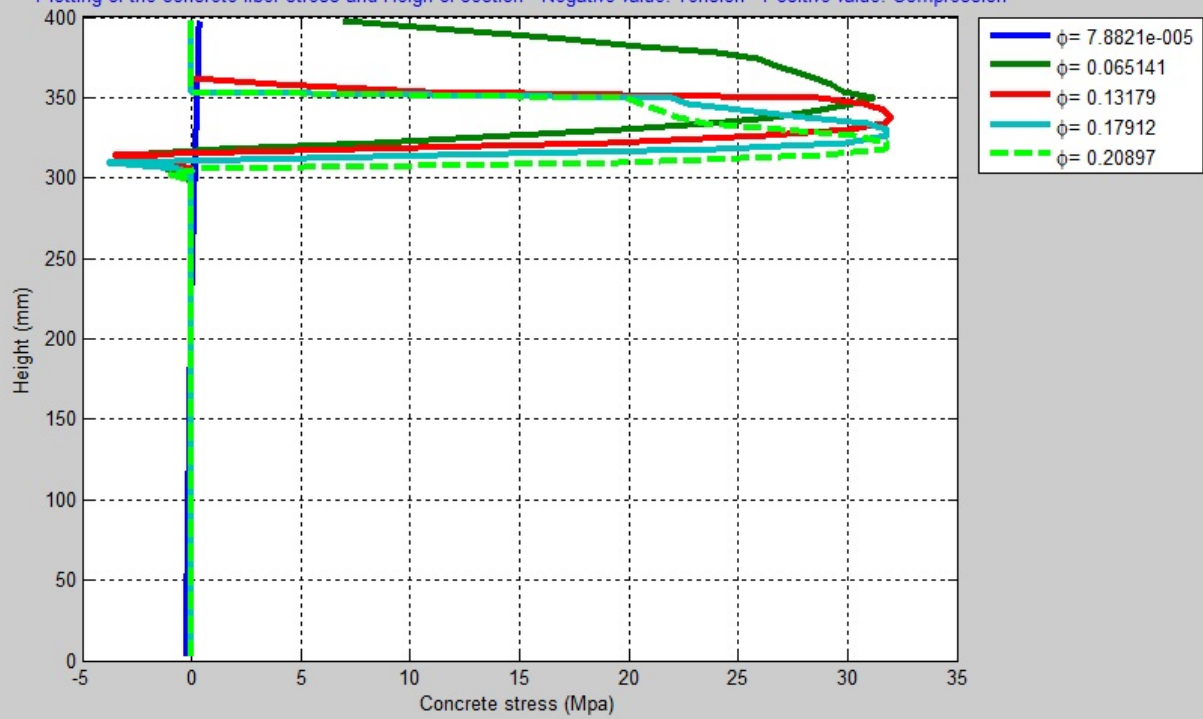
Moment-Curvature Analysis Verification by XTRACT v.3.0.8







Plotting of the concrete fiber stress and Heigh of section - Negative value: Tension - Positive value: Compression



# Flextural Rigidity(EI)-Curvature diagram #

