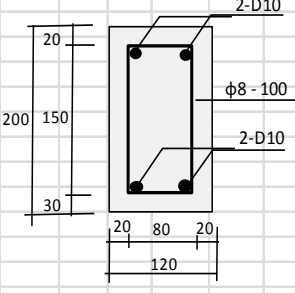
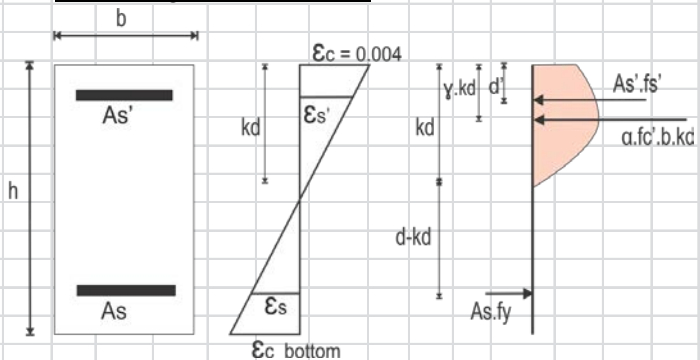


APPENDIX

Appendix 1. Preliminary analysis of beam yield and ultimate strength

Check of Beam Failure State			
	<p>Base Specimens Data</p> <p>Top Reinf. Dia = 10 mm</p> <p>Top Reinf. Dia. = 10 mm</p> <p>Stirrup Dia. = 8 mm</p> <p>Stirrup Space = 100 mm</p> <p>Conc. Cover Top = 20 mm</p> <p>Conc. Cover Bot = 30 mm</p> <p>Conc. Cover Side = 20 mm</p> <p>Breadth (b) = 120 mm</p> <p>Height (h) = 200 mm</p> <p>Depth (d) = 170 mm</p> <p>Beam Span = 1.8 m</p>	<p>As = 157 mm²</p> <p>As' = 157 mm²</p> <p>ρ_s = 0.019258667</p> <p>f_y = 381 Mpa</p> <p>f_c' = 34 Mpa</p> <p>E_s = 200000 Mpa</p> <p>E_c = 27405.47391 Mpa</p> <p>ε_{cm} = 0.004</p> <p>f_r = 3.499 Mpa</p>	
finding whether the beam will fail in overreinforced or underreinforced			
Schematic Diagram of Strain and Stress			
			
finding Z to determine the α and γ of stress function proposed by Kent and Park (1975).			
$Z = \frac{0.5}{3 + \frac{0.29 f_c'}{145 f_c' - 1000}} + \frac{3}{4} \rho_s \left(\frac{b''}{Sh} \right)^{1/2} - 0.002$ $= 35.2326777$		<p>from table Z of Park and Pauley (1975), we have α and γ as,</p> <p>ε_{cm} = 0.004</p> <p>α = 0.8255</p> <p>γ = 0.42775</p>	
C=T			
$As'fs' + \alpha fc' b kd = As fy$ $kd = \frac{As.fy - As'.fs'}{\alpha fc' b}$		<p>with</p> $fs' = \frac{E \cdot \epsilon_{cm} \cdot (kd - d')}{kd}$	
$kd = \frac{As.fy - \frac{As' \cdot E \cdot \epsilon_{cm} \cdot (kd - d')}{kd}}{\alpha fc' b}$			
$3368.04 \quad kd^2 = -65783 \quad kd + 2512000$ $0 = -3368.04 \quad kd^2 - 65783 \quad kd + 2512000$			
$kd_1 = -38.769296 \text{ mm}$ $kd_2 = 19.2377588 \text{ mm}$ $\text{real } kd = 19.2377588 \text{ mm}$			
then,			
$fs' = \frac{E \cdot \epsilon_{cm} \cdot (kd - d')}{kd}$		$fs = \frac{E \cdot \epsilon_{cm} \cdot (d - kd)}{kd}$	
$fs' = -31.697714 \text{ Mpa} \ll fy = 381 \text{ Mpa}$		$= 6269.4306 \text{ Mpa} > fy = 381 \text{ Mpa}$	
underreinforced Ok!			

Calculate Curvature and Ultimate moment of specimens

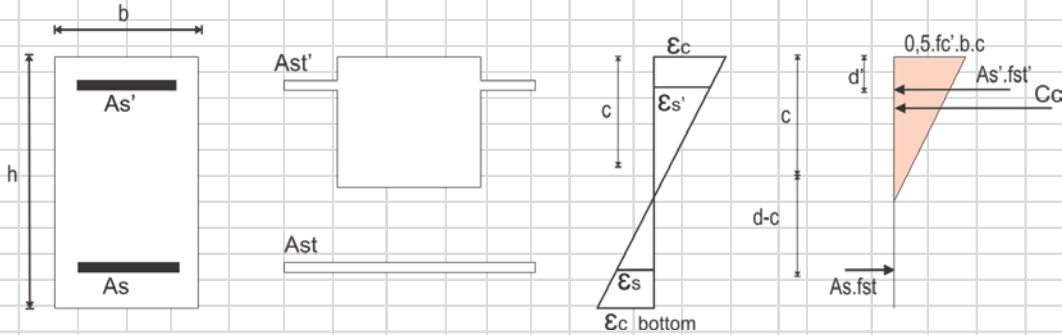
$$\begin{aligned} \text{Mult} &= A_s' f_s' (d-d') + \alpha f_c b k d (d-\gamma k d) \\ &= 9735237.926 \text{ Nmm} \\ &= 9.735237926 \text{ kNm} \end{aligned}$$

$$\begin{aligned} \phi &= \frac{\epsilon_{cm}}{k d} \\ \phi &= 0.000208 \text{ rad/mm} \\ \phi &= 0.20792 \text{ rad/m} \end{aligned}$$

Load Needed at Mid.Span

$$\begin{aligned} M_x &= 9.735237926 \text{ kNm} \\ 9.735237926 &= P/2 * 0.5 L (\text{span}) \\ P &= 21.63386206 \text{ KN} \\ P &= 2.205286652 \text{ Ton} \end{aligned}$$

Calculate Curvature and Moment at first yield



n Modular transformation

$$\begin{aligned} n &= \frac{E_{\text{concrete}}}{E_{\text{steel}}} \\ n &= 7.29781213 \end{aligned}$$

$$k = \left[(\rho + \rho')^2 n^2 + 2\rho + \left(\frac{\rho' d'}{d} \right) n \right]^{1/2} - (\rho + \rho') n$$

with $p = \frac{A_s}{b \cdot h}$
 $p = 0.0065417$
 $p' = 0.0065417$

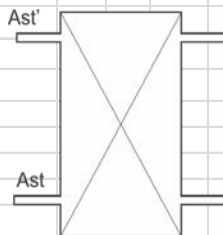
$$\begin{aligned} k &= 0.2448569 \\ k d &= 41.625669 \text{ mm} \end{aligned}$$

$$\epsilon_s = 0.001905$$

$$\begin{aligned} M &= 0.5 f_c k d b (d' - 1/3 k d) + A_s f_y (d - d') \\ M &= 8895652.034 \text{ Nmm} \\ M &= 8.895652 \text{ kNm} \end{aligned}$$

$$\begin{aligned} \phi &= \frac{\epsilon_{cm}}{k d} \\ \phi &= \frac{f_y / E}{(d - k d)} \\ \phi &= 1.484E-05 \text{ rad/mm} \\ \phi &= 0.0148394 \text{ rad/m} \end{aligned}$$

Calculate Curvature and Moment at first Crack (W/O Notch)



$$\begin{aligned} A_{\text{Concrete}} &= 24000 \text{ mm}^2 \\ A_s \text{ Steel Transf.} &= (n-1) A_s = 988.7565 \text{ mm}^2 \\ A_s' \text{ Steel Transf.} &= (n-1) A_s' = 988.7565 \text{ mm}^2 \end{aligned}$$

$$\bar{y} = \frac{\sum \bar{y} \cdot A}{A} = 100.3806202 \text{ mm}^2$$

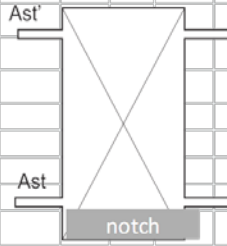
$$I_{\text{total}} = 91177874.84 \text{ mm}^4$$

Moment at first Crack

$$\begin{aligned} M &= \frac{f \cdot I}{y} = 3177827.361 \text{ Nmm} \\ &= 3.177827 \text{ kNm} \end{aligned}$$

$$\begin{aligned} \phi &= \frac{\epsilon_c}{k d} \\ &= 1.27176E-06 \text{ rad/mm} \\ &= 0.001271755 \text{ rad/m} \end{aligned}$$

Calculate Curvature and Moment at first Crack (With Notch)



$$A_{\text{Concrete}} = 20400 \text{ mm}^2$$

$$A_s \text{ Steel Transf.} = (n-1) A_s = 988.7565 \text{ mm}^2$$

$$A_{s'} \text{ Steel Transf.} = (n-1) A_{s'} = 988.7565 \text{ mm}^2$$

$$\bar{y} = \frac{\sum \bar{y}_i A_i}{A} = 84.33722092 \text{ mm}$$

$$I_{\text{total}} = 60434878.8 \text{ mm}^4$$

$$\phi = \frac{\epsilon}{kd}$$

Moment at first Crack

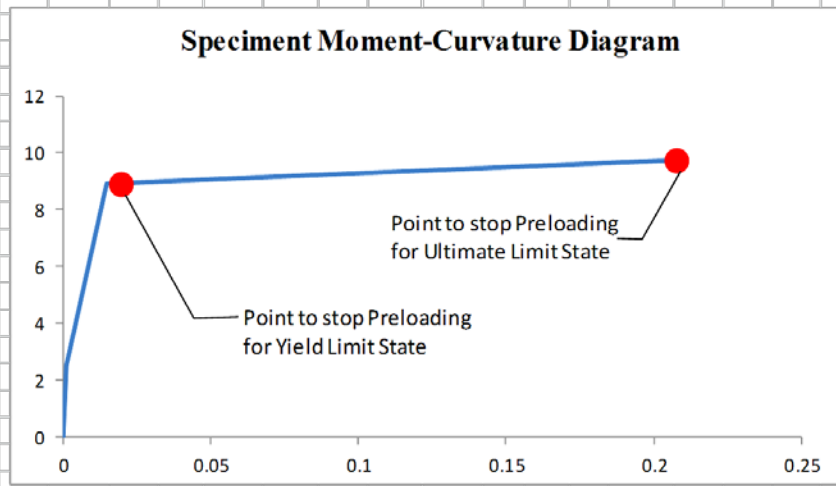
$$M = \frac{f_t I}{y} = 2507027.388 \text{ Nmm}$$

$$= 2.507027 \text{ kNm}$$

$$= 1.51368E-06 \text{ rad/mm}$$

$$= 0.00151368 \text{ rad/m}$$

Moment (kNm)	Curvature (rad/m)	Load kg	
0	0	0	
2.507	0.002	0.567907439	first Crack
8.896	0.015	2.015098433	First Yield
9.735	0.208	2.205286652	Ultimate



Appendix 2. (a) Coarse aggregate mud washing (b) Fine aggregate mud wash
(c) mold preparation for Direct shear and Flexural bond test



(a)



(b)



(b)


Appendix 4. (a) Table of YFLA-5 strain gauge (b) influence of adhesive type on strain limit of YFLA-5

series YF

These gauges are applicable to the measurement of large strain up to 15 to 20%. These are not applicable to the measurement of repeated strain in elastic range as well as in large range.

Single element

- YFLA-2
- YFLA-5
- YFLA-10
- YFLA-20

Operating temperature range
-20°C  +80°C

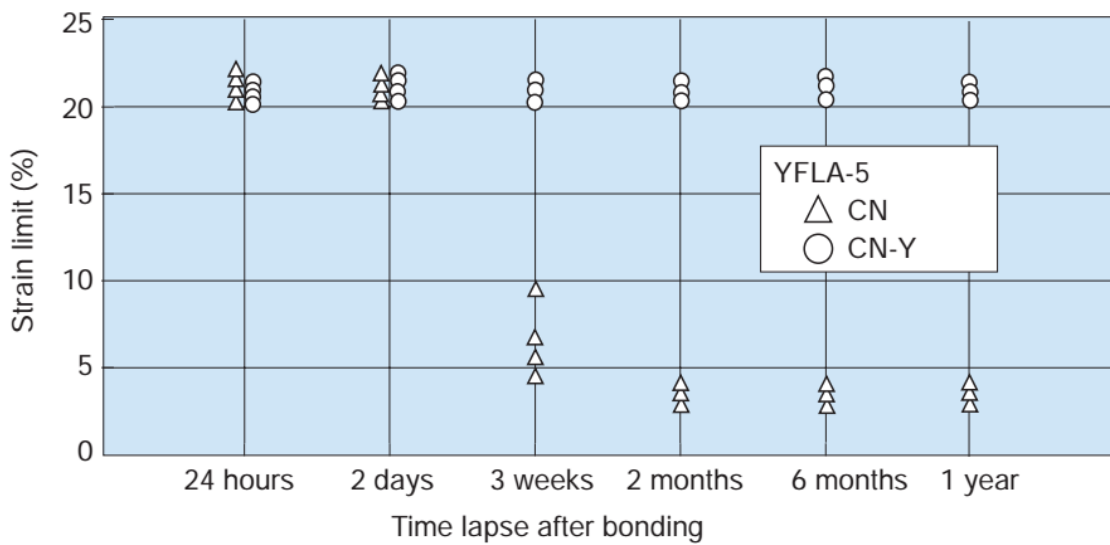
Applicable adhesives	CN	-20 ~ +80°C
	CN-Y	-20 ~ +80°C

Strain limit in room-temperature: 15 ~ 20%

Each package contains 10 gauges.

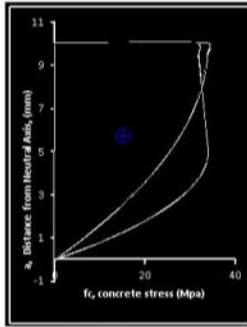
YFLA-2	2	1.8	7.5	4.0	120
YFLA-5	5	1.9	12.0	4.0	120
YFLA-10	10	2.6	16.6	4.9	120
YFLA-20	20	1.8	26.0	3.7	120

(a)

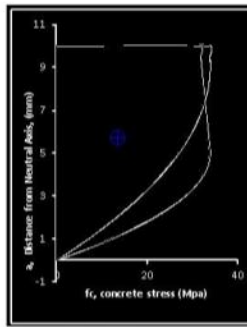


(b)

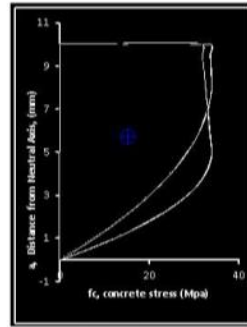
Appendix 5. Stress Block of Repeated loading with constant $0.004\epsilon_c$ and increments of ϵ_{un}



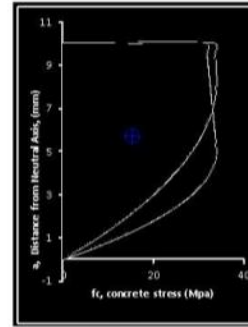
Sun = 0.002
 Preload Area = 1950.18
 Reload Area = 2403.08
 Reload CoG
 CoG Y = 27.55



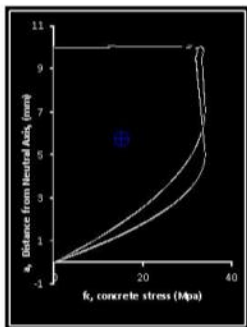
Sun = 0.0022
 Preload Area = 2045.12
 Reload Area = 2393.00
 Reload CoG
 CoG Y = 27.43



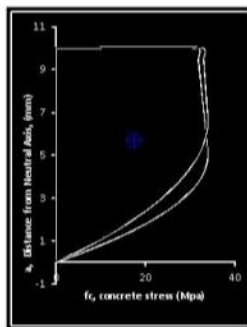
Sun = 0.0024
 Preload Area = 2095.30
 Reload Area = 2396.08
 Reload CoG
 CoG Y = 27.96



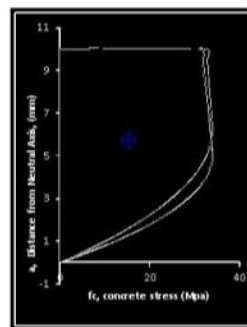
Sun = 0.0026
 Preload Area = 2128.11
 Reload Area = 2400.87
 Reload CoG
 CoG Y = 27.63



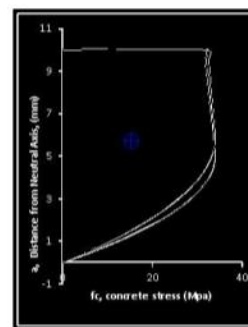
Sun = 0.0028
 Preload Area = 2187.53
 Reload Area = 2352.99
 Reload CoG
 CoG Y = 27.43



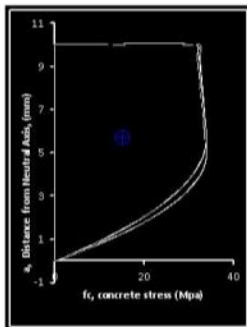
Sun = 0.0030
 Preload Area = 2231.43
 Reload Area = 2355.94
 Reload CoG
 CoG Y = 27.35



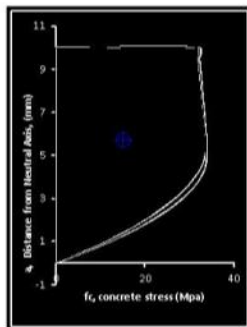
Sun = 0.0032
 Preload Area = 2268.9
 Reload Area = 2301.85
 Reload CoG
 CoG Y = 27.28



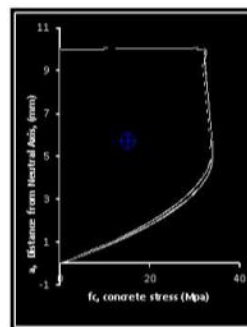
Sun = 0.0034
 Preload Area = 2294.17
 Reload Area = 2290.60
 Reload CoG
 CoG Y = 27.23



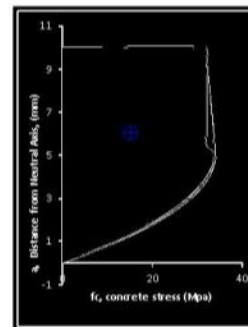
Sun = 0.0035
 Preload Area = 2332.4
 Reload Area = 2382.95
 Reload CoG
 CoG Y = 27.61



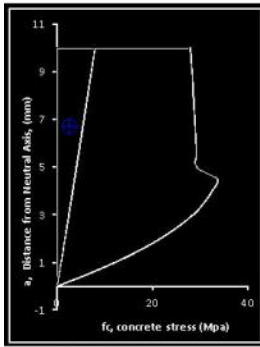
Sun = 0.0036
 Preload Area = 2320.07
 Reload Area = 2300
 Reload CoG
 CoG Y = 27.51



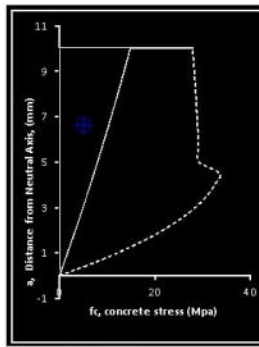
Sun = 0.0037
 Preload Area = 2339.01
 Reload Area = 2367.55
 Reload CoG
 CoG Y = 27.40



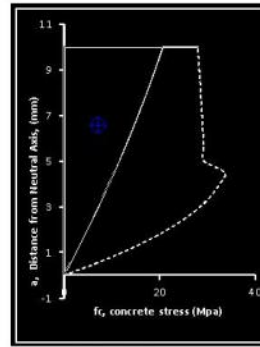
Sun = 0.0038
 Preload Area = 2389.26
 Reload Area = 2201.51
 Reload CoG
 CoG Y = 27.96



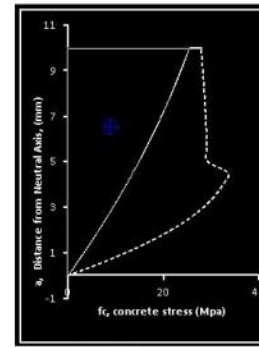
$\epsilon_{un} = 0.0025$
Increment Stress Block Area = 394.53
Block CoG Y = 22.51



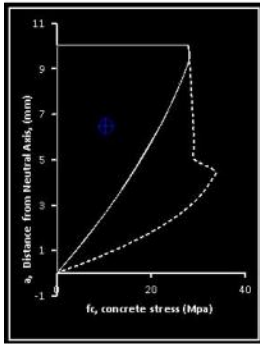
$\epsilon_{un} = 0.005$
Increment Stress Block Area = 693.4
Block CoG Y = 21.67



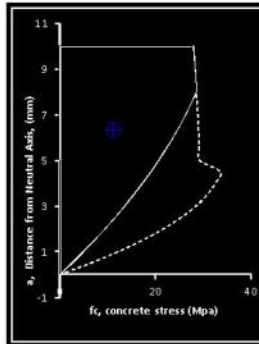
$\epsilon_{un} = 0.0075$
Increment Stress Block Area = 934.8
Block CoG Y = 22.68



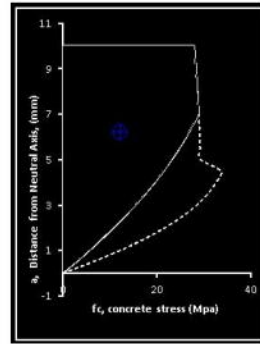
$\epsilon_{un} = 0.01$
Increment Stress Block Area = 1203.94
Block CoG Y = 22.33



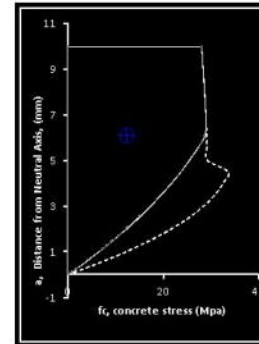
$\epsilon_{un} = 0.0125$
Increment Stress Block Area = 1409.98
Block CoG Y = 22.67



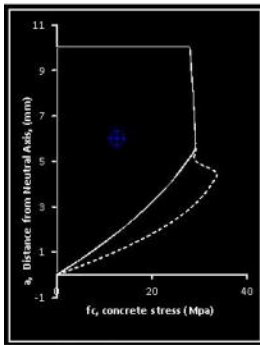
$\epsilon_{un} = 0.015$
Increment Stress Block Area = 1606.02
Block CoG Y = 23.53



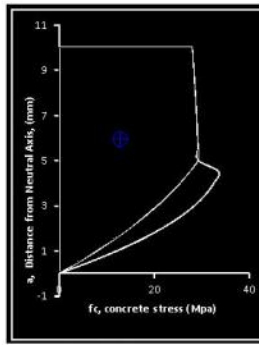
$\epsilon_{un} = 0.0175$
Increment Stress Block Area = 1696.67
Block CoG Y = 24.15



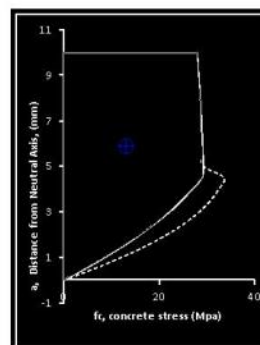
$\epsilon_{un} = 0.02$
Increment Stress Block Area = 1801.47
Block CoG Y = 25.05



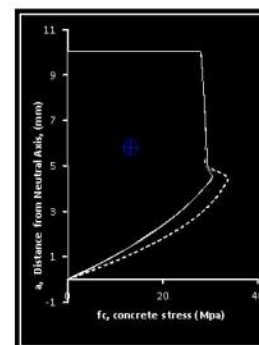
$\epsilon_{un} = 0.0225$
Increment Stress Block Area = 1868.96
Block CoG Y = 25.49



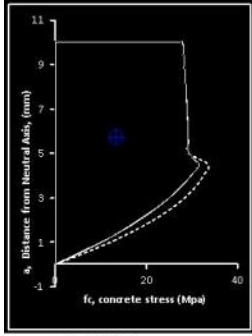
$\epsilon_{un} = 0.025$
Increment Stress Block Area = 1923.74
Block CoG Y = 25.93



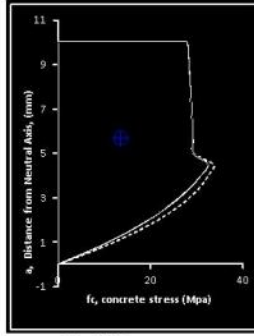
$\epsilon_{un} = 0.0275$
Increment Stress Block Area = 1984.95
Block CoG Y = 26.6



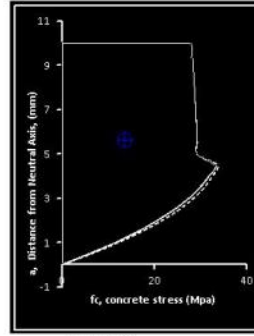
$\epsilon_{un} = 0.03$
Increment Stress Block Area = 2021.96
Block CoG Y = 26.92



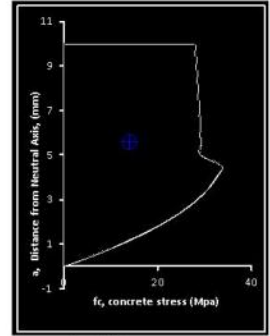
$\epsilon_{un} = 0.00325$
 Inclinomnt Strass Block Area = 2039.48
 Block CoG Y = 27.38



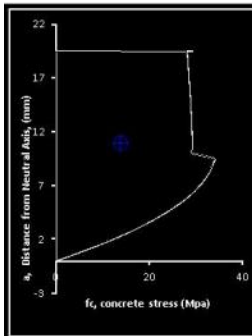
$\epsilon_{un} = 0.0035$
 Inclinomnt Strass Block Area = 2096.95
 Block CoG Y = 27.71



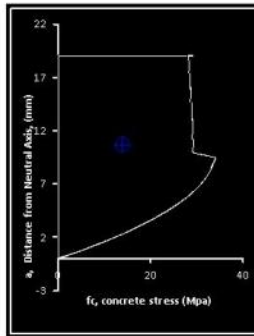
$\epsilon_{un} = 0.00375$
 Inclinomnt Strass Block Area = 2127.2
 Block CoG Y = 27.96



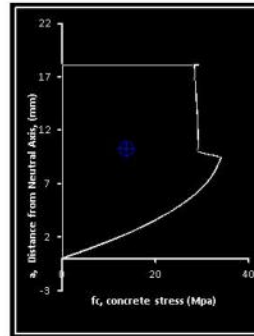
$\epsilon_{un} = 0.004$
 Inclinomnt Strass Block Area = 2195.43
 Block CoG Y = 28.41



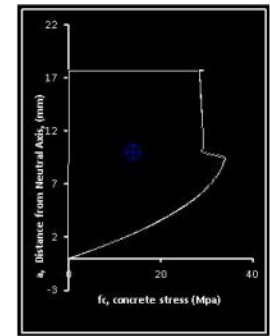
$\epsilon_{un} = 0.0041$
 Inclinomnt Strass Block Area = 2081.48
 Block CoG Y = 26.53



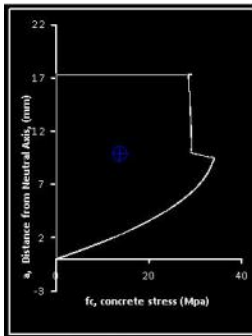
$\epsilon_{un} = 0.0042$
 Inclinomnt Strass Block Area = 1998.20
 Block CoG Y = 25.58



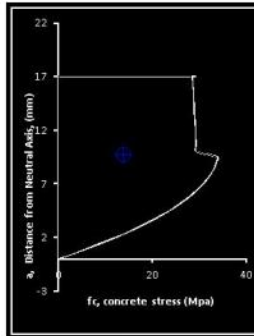
$\epsilon_{un} = 0.0044$
 Inclinomnt Strass Block Area = 1882
 Block CoG Y = 24.25



$\epsilon_{un} = 0.0045$
 Inclinomnt Strass Block Area = 1795
 Block CoG Y = 23.47



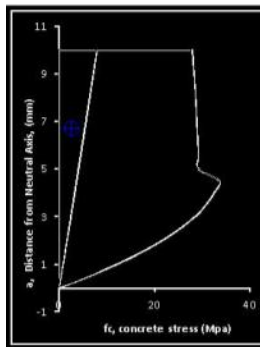
$\epsilon_{un} = 0.0046$
 Inclinomnt Strass Block Area = 1780
 Block CoG Y = 22.92



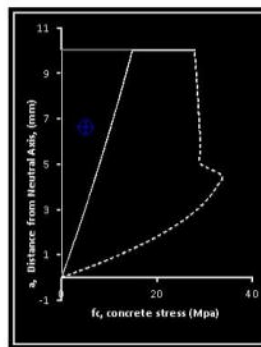
$\epsilon_{un} = 0.0047$
 Inclinomnt Strass Block Area = 1765
 Block CoG Y = 22.54

Appendix 6. Stress block plot area and center of gravity of ϵ_c increments of 0.0038

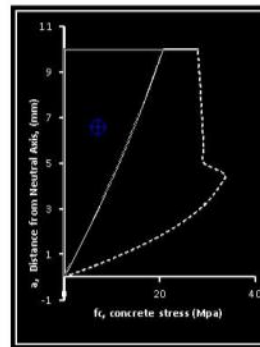
ϵ_{un}



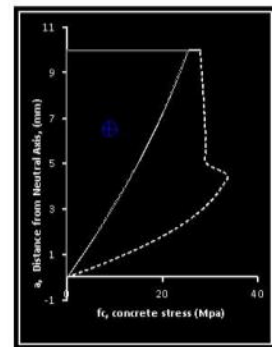
$\epsilon_{un} = 0.00025$
Increment Stress Block Area = 394.53
Block CoG Y = 22.31



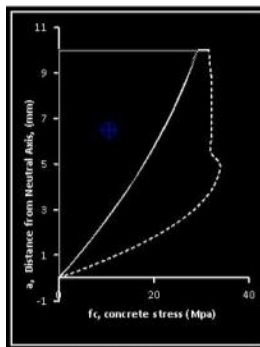
$\epsilon_{un} = 0.0005$
Increment Stress Block Area = 659.4
Block CoG Y = 21.07



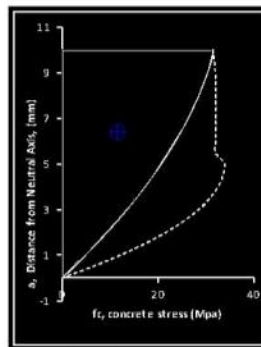
$\epsilon_{un} = 0.00075$
Increment Stress Block Area = 934.8
Block CoG Y = 20.08



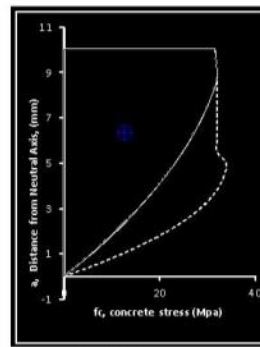
$\epsilon_{un} = 0.001$
Increment Stress Block Area = 1203.94
Block CoG Y = 22.39



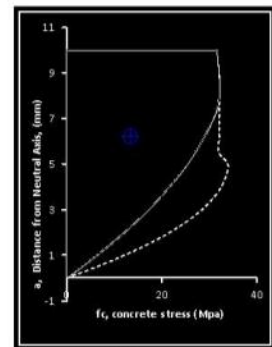
$\epsilon_{un} = 0.00125$
Increment Stress Block Area = 1430
Block CoG Y = 22.73



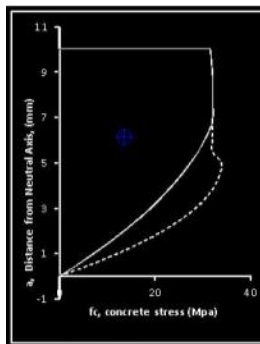
$\epsilon_{un} = 0.0015$
Increment Stress Block Area = 1640
Block CoG Y = 23.14



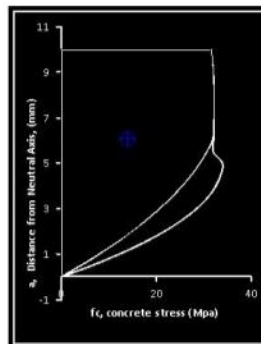
$\epsilon_{un} = 0.00175$
Increment Stress Block Area = 1790
Block CoG Y = 23.55



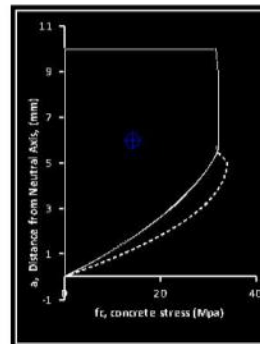
$\epsilon_{un} = 0.002$
Increment Stress Block Area = 1901.7
Block CoG Y = 24.31



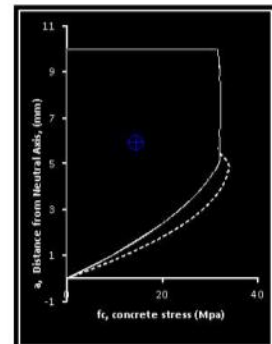
$\epsilon_{un} = 0.00225$
Increment Stress Block Area = 1997.36
Block CoG Y = 24.74



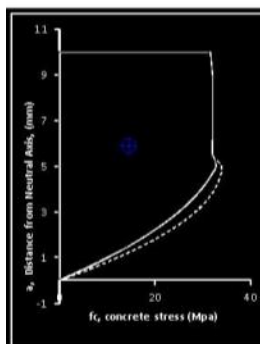
$\epsilon_{un} = 0.0025$
Increment Stress Block Area = 2063
Block CoG Y = 25.34



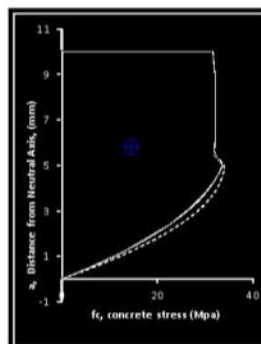
$\epsilon_{un} = 0.00275$
Increment Stress Block Area = 2146.98
Block CoG Y = 25.88



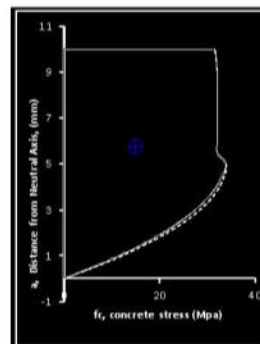
$\epsilon_{un} = 0.003$
Increment Stress Block Area = 2192.67
Block CoG Y = 26.41



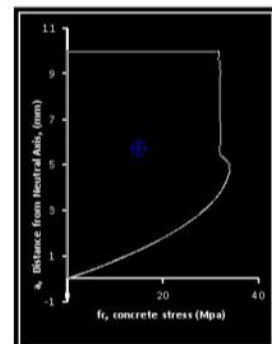
$\epsilon_{un} = 0.00325$
Increment Stress Block Area = 2230
Block CoG Y = 26.70



$\epsilon_{un} = 0.0035$
Increment Stress Block Area = 2271.43
Block CoG Y = 26.95



$\epsilon_{un} = 0.00375$
Increment Stress Block Area = 2318.81
Block CoG Y = 27.41



$\epsilon_{un} = 0.004$
Increment Stress Block Area = 2346.98
Block CoG Y = 27.95

Appendix 7. Iteration table for Control empirical analysis

kd	ϵ_c Increment	es	fs	es r	fs r	Ld	es'	fs'	α_{re}	γ_{re}	C	T	C-T	M (KNm)	Load (KN)	ϕ
-1.8E-15	0	0	0			0	0	0	-0.01	0.34	7.97229E-14	0	7.97E-14	-9.3E-35	-2.1E-34	0
47.85568	0.00004	0.000102	20.41877685			0	2.328E-05	4.656614488	0.01	0.34	2233.38022	2233.38	2.93E-05	0.441942	0.982094	8.36E-07
43.09149	0.000065	0.000191	38.28622904			0	3.483E-05	6.966325995	0.03	0.34	4437.795361	4437.795	-2.3E-06	0.836879	1.859732	1.51E-06
41.48509	0.00009	0.000279	55.76144595			0	4.661E-05	9.32218283	0.04	0.34	6580.095283	6580.095	-5.9E-06	1.223177	2.718172	2.17E-06
40.70682	0.000115	0.000365	73.05269466			0	5.85E-05	11.69968298	0.05	0.34	8693.261608	8693.262	-2.7E-07	1.60531	3.567356	2.83E-06
40.26828	0.00014	0.000451	90.20718114			0	7.047E-05	14.09327281	0.07	0.34	10784.77091	10784.77	0.000955	1.9843	4.409556	3.48E-06
40.00235	0.000165	0.000536	107.2417682			0	8.25E-05	16.50096845	0.08	0.34	12857.29103	12857.29	0.00027	2.360511	5.24558	4.12E-06
39.8362	0.00019	0.000621	124.1640723			0	9.461E-05	18.92187384	0.09	0.34	14912.0303	14912.03	8.66E-05	2.734105	6.075788	4.77E-06
39.73298	0.000215	0.000705	140.9781246			0	0.0001068	21.35551475	0.10	0.34	16949.62668	16949.63	3E-05	3.105163	6.900363	5.41E-06
39.67206	0.00024	0.000788	157.6863146			0	0.000119	23.80161005	0.12	0.34	18970.45851	18970.46	0.00027	3.473734	7.71941	6.05E-06
39.64095	0.000265	0.000871	174.2901961			0	0.0001313	26.25997692	0.13	0.34	20974.77184	20974.77	4.08E-06	3.839846	8.532991	6.69E-06
39.63168	0.00029	0.000954	190.7908618			0	0.0001437	28.73048685	0.14	0.34	22962.73968	22962.74	1.53E-06	4.203517	9.341149	7.32E-06
39.6389	0.000315	0.001036	207.1891328			0	0.0001561	31.21304321	0.15	0.34	24934.49207	24934.49	5.68E-07	4.56476	10.14919	7.95E-06
39.6589	0.00034	0.001117	223.4856627			0	0.0001685	33.70756909	0.17	0.34	26890.13253	26890.13	2.02E-07	4.923585	10.9413	8.57E-06
39.68901	0.000365	0.001198	239.6809979			0	0.0001811	36.21400024	0.18	0.34	28829.74757	28829.75	6.63E-08	5.279998	11.73333	9.2E-06
39.72729	0.00039	0.001279	255.7756135			0	0.0001937	38.73228076	0.19	0.34	30753.41242	30753.41	1.9E-08	5.634005	12.52001	9.82E-06
39.77225	0.000415	0.001359	271.7699335			0	0.0002063	41.26236076	0.20	0.34	32661.19495	32661.19	0.0007	5.98561	13.30136	1.04E-05
39.82278	0.00044	0.001438	287.6643593			0	0.000219	43.80419303	0.21	0.34	34553.15679	34553.16	0.00018	6.334819	14.07738	1.1E-05
39.87799	0.000465	0.001517	303.4592548			0	0.0002318	46.35773473	0.22	0.34	36429.35715	36429.36	9.09E-06	6.681634	14.84808	1.17E-05
39.9372	0.00049	0.001596	319.1549749			0	0.0002446	48.92294413	0.23	0.34	38289.85204	38289.85	2.72E-05	7.026059	15.61346	1.23E-05
39.9983	0.000515	0.001674	334.7518624			0	0.0002575	51.4997809	0.25	0.34	40134.69569	40134.7	0.000136	7.368098	16.37355	1.29E-05
40.06544	0.00054	0.001751	350.2502522			0	0.0002704	54.08820563	0.26	0.34	41963.94106	41963.94	0.000276	7.707754	17.12834	1.35E-05
40.13367	0.000565	0.001828	365.6504737			0	0.0002834	56.68817957	0.27	0.34	43777.64027	43777.64	0.000412	8.04503	17.87784	1.41E-05
40.2042	0.00059	0.001905	380.9528527			0	0.0002965	59.29966438	0.28	0.34	45575.84491	45575.84	0.000524	8.379931	18.62207	1.47E-05
40.27678	0.000615	0.001981	396.1577132			0	0.0003096	61.92262198	0.29	0.34	47358.60626	47358.61	0.000598	8.71246	19.36102	1.53E-05
38.49377	0.00064	0.002186	392.2446685			0	0.0003075	61.49573678	0.30	0.34	46864.643	46864.64	2.49E-08	8.654371	19.23194	1.66E-05
37.27937	0.000665	0.002368	392.7608086			0	0.0003082	61.64685707	0.31	0.34	46916.36358	46916.36	2.95E-08	8.684692	19.29932	1.78E-05
36.17037	0.00069	0.002553	393.288617			0	0.0003085	61.6944849	0.32	0.34	46984.40673	46984.41	3.55E-08	8.713722	19.36383	1.91E-05
35.15482	0.000715	0.002743	393.8271784			0	0.0003082	61.64557697	0.33	0.34	47067.64156	47067.64	4.34E-08	8.741635	19.42586	2.03E-05
34.22243	0.00074	0.002936	394.3756168			0	0.0003075	61.50701771	0.34	0.34	47164.98398	47164.98	5.37E-08	8.768578	19.48573	2.16E-05
33.36431	0.000765	0.003133	394.9330975			0	0.0003064	61.2852438	0.35	0.35	47275.39851	47275.4	6.71E-08	8.794672	19.54372	2.29E-05
31.16326	0.00084	0.003742	396.6520668			0	0.0003009	60.18073556	0.37	0.35	47675.46409	47675.46	1.36E-07	8.868811	19.70847	2.7E-05
27.17212	0.00104	0.005467	401.4640131			0	0.0002745	54.90187504	0.44	0.35	49105.25574	49105.26	8.87E-07	9.0462	20.10267	3.83E-05
24.769	0.00124	0.007271	406.4163651			0	0.0002387	47.7497074	0.50	0.36	50820.3754	50820.38	4.48E-06	9.205291	20.4562	5.01E-05
23.22331	0.00144	0.009101	411.3560784			0	0.0001999	39.97333736	0.56	0.36	52622.14906	52622.15	1.68E-05	9.35155	20.78122	6.2E-05
22.18462	0.00164	0.010927	416.1982362			0	0.0001615	32.29961581	0.60	0.37	54395.55532	54395.56	4.9E-05	9.48691	21.08202	7.39E-05
21.46681	0.00184	0.012731	420.8977425			0	0.0001257	25.14516472	0.64	0.38	56075.17224	56075.17	0.000117	9.612341	21.36076	8.57E-05
20.96284	0.00204	0.014504	425.4328965			0	9.37E-05	18.73978897	0.67	0.39	57625.36338	57625.36	0.000236	9.728598	21.61911	9.73E-05
20.607	0.00224	0.016239	429.796093			0	6.598E-05	13.19637774	0.70	0.39	59029.05557	59029.06	0.000414	9.836438	21.85875	0.000109
20.3567	0.00244	0.017937	433.9884938			0	4.275E-05	8.550868189	0.73	0.40	60281.32141	60281.32	0.00064	9.936682	22.08152	0.00012
20.18293	0.00264	0.019597	438.0168961			0	2.393E-05	4.78561025	0.75	0.41	61385.62485	61385.62	0.000876	10.03023	22.28939	0.000131
20.06512	0.00284	0.021222	441.8918337			0	9.217E-06	1.843396066	0.76	0.42	62351.56325	62351.56	-9.4E-09	10.11803	22.48452	0.000142
19.98804	0.00304	0.022815	445.6263811			0	1.819E-06	0.363837707	0.77	0.42	63193.46908	63193.47	-1E-08	10.20112	22.66915	0.000152
19.94001	0.00324	0.024383	449.2353727			0	9.747E-06	1.949453318	0.79	0.43	63929.50596	63929.51	-9E-09	10.28052	22.84559	0.000162
19.91178	0.00344	0.02593	452.7348557			0	1.524E-05	3.048323398	0.79	0.43	64581.05893	64581.06	0.000832	10.35734	23.01632	0.000173
19.89576	0.00364	0.027462	456.1416849			0	1.907E-05	3.814099719	0.80	0.44	65172.28554	65172.29	0.000528	10.43274	23.18387	0.000183
19.88563	0.00384	0.028988	459.4731863			0	2.208E-05	4.416970881	0.81	0.44	65729.75634	65729.76	0.000249	10.50785	23.35077	0.000193
19.87598	0.00404	0.030514	462.7468578			0	2.521E-05	5.041672544	0.82	0.44	66282.12636	66282.13	3E-05	10.5838	23.51956	0.000203
19.86215	0.00424	0.03205	465.9800756			0	2.943E-05	5.885479785	0.83	0.44	66859.81021	66859.81	-1.4E-07	10.66175	23.69278	0.000213
19.84012	0.00444	0.033604	469.1897933			0	3.578E-05	7.156078159	0.83	0.43	67494.63738	67494.64	-6.4E-06	10.74284	23.87299	0.000224
19.80643	0.00464	0.035185	472.3922237			0	4.535E-05	9.069231611	0.84	0.43	68219.47719	68219.48	-6.8E-05	10.82821	24.06268	0.000234
19.7582	0.00484	0.036803	475.6025038			0	5.923E-05	11.8462296	0.86	0.42	69067.82965	69067.83	1.56E-07	10.91896	24.26436	0.000245
19.69306	0.00504	0.038468	478.8343449			0	7.856E-05	15.71113975	0.87	0.41	70073.38608	70073.39	-4.4E-08	11.01619	24.48043	0.000256
19.60917	0.00524	0.040188	482.0996742			0	0.0001044	20.88791919	0.89	0.39	71269.56989	71269.57	-1.2E-06	11.12096	24.71324	0.000267
19.50524	0.00544	0.041973	485.4082942			0	0.000138	27.59748949	0.91	0.38	72689.07199	72689.07	-7.9E-06	11.23426	24.96501	0.000279

Appendix 8. Iteration table for Repaired Empirical Analysis

Kd (mm)	ϵ_c Increment	ϵ_s	f_s (Mpa)	ϵ_{sr}	f_{sr} (Mpa)	I_d	ϵ'_s	f'_s (Mpa)	α_{re}	γ_{re}	C (kN)	T (kN)	C-T	M (KNm)	Load (kN)	Φ
1E-07	0	0	0	0	0	0	0	0	0.00	0.34	0	0	0	0	0	0
117.7902	0.00004	1.77E-05	3.545955	2.11E-05	4.225129	11.6815	3.3E-05	6.641652	0.0	0.34	0	-2.5E-05	1.0455472	0.3234383	3.4E-07	
65.66463	0.00065	0.000103	20.65587	0.00113	22.63562	19.1364	4.5E-05	9.040486	0.01	0.34	3995.75747	3995.758	-0.00054	0.8049066	1.7886813	9.9E-07
58.82222	0.00009	0.00017	34.02115	0.000185	37.08122	26.3107	5.9E-05	11.87986	0.03	0.34	6986.88825	6986.888	3.6E-05	1.3378824	2.973072	1.53E-06
55.95873	0.000115	0.000234	46.87292	0.000255	50.98309	33.3503	7.4E-05	14.77966	0.04	0.34	9840.24787	9840.248	-2.1E-05	1.8512899	4.1139775	2.06E-06
54.41366	0.00014	0.000297	59.47804	0.000323	64.6238	40.298	8.9E-05	17.70847	0.06	0.34	12627.4357	12627.44	-0.00049	2.3549442	5.2332093	2.57E-06
53.47177	0.000165	0.00036	71.91517	0.00039	78.08665	47.1714	0.0001	20.65704	0.07	0.34	15369.5548	15369.55	7.92E-08	2.8518011	6.3373357	3.09E-06
52.8571	0.00019	0.000421	84.21631	0.000457	91.4055	53.9791	0.00012	23.62161	0.08	0.34	18075.1907	18075.19	5.39E-07	3.3430718	7.4290485	3.59E-06
52.44011	0.000215	0.000482	96.3971	0.000523	104.5969	60.7258	0.00013	26.60034	0.10	0.34	20748.5394	20748.54	2.33E-06	3.829348	8.5096622	4.1E-06
52.15184	0.00024	0.000542	108.4662	0.000588	117.6701	67.4142	0.00015	29.59221	0.11	0.34	23391.9209	23391.92	2.92E-06	4.3109544	9.5798987	4.6E-06
51.95214	0.000265	0.000602	120.4288	0.000653	130.6305	74.0464	0.00016	32.59661	0.12	0.34	26006.7413	26006.74	2.19E-07	4.7880855	10.64019	5.1E-06
51.81607	0.00029	0.000661	132.2884	0.000717	143.4819	80.6235	0.00018	35.61312	0.14	0.34	28593.918	28593.92	-0.00017	5.2608656	11.690813	5.6E-06
51.72729	0.000315	0.00072	144.0474	0.000781	156.2266	87.1466	0.00019	38.64149	0.15	0.34	31154.0879	31154.09	0.000864	5.7293791	12.731954	6.09E-06
51.67465	0.00034	0.000779	155.7078	0.000844	168.8666	93.6164	0.00021	41.68148	0.16	0.34	33687.7159	33687.72	-7E-07	6.193686	13.763747	6.58E-06
51.65027	0.000365	0.000836	167.2698	0.000907	181.4033	100.033	0.00022	44.73297	0.17	0.34	36195.1606	36195.16	-8.5E-06	6.6538306	14.78629	7.07E-06
51.64845	0.00039	0.000894	178.7357	0.000969	193.8378	106.398	0.00024	47.7958	0.18	0.34	38676.7079	38676.71	-4.7E-05	7.1098477	15.799662	7.55E-06
51.66494	0.000415	0.000951	190.1505	0.001031	206.171	112.711	0.00025	50.86989	0.20	0.34	41132.5959	41132.6	-0.00017	7.561765	16.803922	8.03E-06
51.6965	0.00044	0.001007	201.3813	0.001092	218.4037	118.973	0.00027	53.95514	0.21	0.34	43563.029	43563.03	-0.00049	8.0096059	17.799124	8.51E-06
51.74066	0.000465	0.001063	212.5624	0.001153	230.5367	125.183	0.00029	57.05148	0.22	0.34	45968.1883	45968.19	1.04E-08	8.4533902	18.785311	8.99E-06
51.79543	0.00049	0.001118	223.65	0.001213	242.5706	131.342	0.0003	60.15883	0.23	0.34	48348.2369	48348.24	3.49E-08	8.893136	19.762524	9.46E-06
51.85928	0.000515	0.001173	234.6445	0.001273	254.5059	137.451	0.00032	63.27712	0.24	0.34	50703.3263	50703.33	1.01E-07	9.3288596	20.730799	9.93E-06
51.93093	0.00054	0.001228	245.5465	0.001332	266.3434	143.51	0.00033	66.40629	0.25	0.34	53033.5985	53033.6	6.19E-09	9.7605765	21.69017	1.04E-05
52.00937	0.000565	0.001282	256.3565	0.00139	278.0834	149.519	0.00035	69.54629	0.26	0.34	55339.1889	55339.19	-6.3E-06	10.188301	22.640669	1.09E-05
52.09374	0.00059	0.001335	267.0751	0.001449	289.7265	155.477	0.00036	72.69705	0.27	0.34	57620.2281	57620.23	-0.00013	10.612048	23.582329	1.13E-05
52.18335	0.000615	0.001389	277.7025	0.001506	301.2733	161.387	0.00038	75.85853	0.28	0.34	59876.8429	59876.84	-0.00073	11.031831	24.51518	1.18E-05
52.2776	0.00064	0.001441	288.2394	0.001564	312.7241	167.247	0.0004	79.03066	0.29	0.34	62109.1585	62109.16	-1.7E-07	11.447664	25.439253	1.22E-05
52.37601	0.000665	0.001493	298.6862	0.00162	324.0795	173.058	0.00041	82.21339	0.30	0.34	64317.2967	64317.3	8.66E-05	11.859561	26.35458	1.27E-05
52.47813	0.00069	0.001545	309.0433	0.001677	335.34	178.821	0.00043	85.40667	0.31	0.34	66501.3795	66501.38	4.94E-05	12.267536	27.261191	1.31E-05
52.58362	0.000715	0.001597	319.3112	0.001733	346.506	184.535	0.00044	88.61044	0.32	0.34	68661.5278	68661.53	0.000333	12.671603	28.159118	1.36E-05
52.69216	0.00074	0.001647	329.4904	0.001788	357.5781	188.881	0.00046	91.82466	0.33	0.34	70797.8621	70797.86	-0.00028	13.071777	29.048394	1.4E-05
53.06358	0.000765	0.001686	337.1667	0.00183	366	202.93	0.00048	95.33333	0.34	0.35	73269.6582	73269.66	1006.941	13.401634	29.78141	1.44E-05
53.34035	0.00079	0.001728	345.5587	0.001876	391.3576	203.045	0.00049	98.37578	0.35	0.35	75599.1184	75599.12	-2.5E-08	13.962837	31.028527	1.48E-05
53.07939	0.000815	0.001795	359.0482	0.001949	391.566	203.16	0.00051	101.5826	0.36	0.35	77131.8564	77131.86	-3.6E-08	14.260486	31.689968	1.54E-05
52.84486	0.00084	0.001862	372.4499	0.002021	391.773	203.234	0.00052	104.4177	0.36	0.35	78650.5663	78650.57	-3.5E-08	14.55641	32.345869	1.59E-05
53.08664	0.000865	0.001905	381	0.002068	391.9065	203.441	0.00054	107.8235	0.37	0.35	80844.0149	79393.92	14.782362	32.849693	3.16E-05	1.63E-05
51.86583	0.00089	0.002027	391.7899	0.002199	392.2798	203.653	0.00055	109.3614	0.38	0.35	80743.0254	80743.03	1.97E-07	15.001803	33.337341	1.72E-05
50.70761	0.000915	0.002153	392.1481	0.002333	392.6626	203.869	0.00056	110.8215	0.39	0.35	80626.632	80626.63	2.07E-05	15.045836	33.435191	1.8E-05
49.62178	0.00094	0.00228	392.5125	0.00247	393.052	204.088	0.00058	112.2268	0.40	0.35	80519.5633	80519.56	2.43E-05	15.08804	33.528977	1.89E-05
48.60235	0.000965	0.00241	392.8828	0.002609	393.4476	204.31	0.00057	113.58	0.41	0.35	80421.3676	80421.37	2.81E-05	15.128583	33.619073	1.99E-05
47.64395	0.00099	0.002542	393.2587	0.00275	393.849	204.536	0.00057	114.8835	0.41	0.35	80331.6037	80331.6	3.24E-05	15.167614	33.70581	2.08E-05
46.74175	0.001015	0.002677	393.6398	0.002894	394.2559	204.764	0.00058	116.1398	0.42	0.35	80249.8411	80249.84	-2.3E-05	15.205266	33.789481	2.17E-05
45.89144	0.00104	0.002813	394.0258	0.003039	394.668	204.995	0.00059	117.3513	0.43	0.35	80175.6607	80175.66	-2.5E-05	15.241656	33.870347	2.27E-05
45.08908	0.001065	0.00295	394.4165	0.003187	395.085	205.228	0.00059	118.5204	0.44	0.35	80108.6547	80108.65	-2.8E-05	15.276887	33.948638	2.36E-05
44.33114	0.00109	0.00309	394.8115	0.003336	395.5065	205.464	0.0006	119.6493	0.44	0.35	80048.4273	80048.43	-3E-05	15.311053	34.024562	2.46E-05
43.61441	0.001115	0.003231	395.2106	0.003487	395.9322	205.702	0.0006	120.7402	0.45	0.35	79994.5946	79994.59	-3.3E-05	15.344236	34.098302	2.56E-05
42.93597	0.00114	0.003374	395.613	0.003639	396.3619	205.942	0.00061	121.7953	0.46	0.35	79946.7852	79946.79	-3.5E-05	15.37651	34.170023	2.66E-05
42.29316	0.001165	0.003518	396.0199	0.003793	396.7953	206.184	0.00061	122.8167	0.46	0.35	79904.6397	79904.64	-3.7E-05	15.407943	34.239873	2.75E-05
41.68356	0.00119	0.003663	396.4295	0.003949	397.2321	206.428	0.00062	123.8063	0.47	0.36	79867.8111	79867.81	-3.9E-05	15.438592	34.307983	2.85E-05
41.10495	0.001215	0.00381	396.8422	0.004106	397.672	206.673	0.00062	124.7661	0.48	0.36	79835.9647	79835.96	-4.1E-05	15.468513	34.374474	2.96E-05
40.55229	0.00124	0.003958	397.2577	0.004264	398.1148	206.92	0.00063	125.6978	0.48	0.36	79808.778	79808.78	-4.3E-05	15.497754	34.439453	3.06E-05
40.03273	0.001265	0.004107	397.6757	0.004423	398.5603	207.168	0.00063	126.6034	0.49	0.36	79785.9407	79785.94	-4.3E-05	15.526357	34.503017	3.16E-05
39.53554	0.00129	0.004257	398.0961	0.004583	399.0081	207.418	0.00064	127.4845	0.49	0.36	79767.1544	79767.15	-4.4E-05	15.554364	34.565253	3.26E-05
39.06216	0.001315	0.004408	398.5186	0.004745	399.4582	207.668	0.00064	128.3428	0.50	0.36	79752.1327	79752.13	-4.3E-05	15.581808	34.626241	3.37E-05
38.61112	0.00134	0.00456	398.943	0.004907	399.9103	207.92	0.00065	129.1799	0.51	0.36	79740.6007	79740.6	-4.6E-05	15.608724	34.686053	3.47E-05
38.18107	0.001365	0.004713	399.3692	0.00507	400.3642	208.172	0.00065	129.9972	0.51	0.36	79732.2951	79732.3	-4.6E-05	15.63514	34.744755	3.58E-05
37.77078	0.00139	0.004866	399.7969	0.005234	400.8197	208.425	0.00065	130.7963	0.52	0.36	79726.9638	79726.96	-4.7E-05	15.661083	34.802406	3.68E-05
37.3791	0.001415	0.00502														

31.90434	0.001965	0.008505	409.7578	0.009121	411.4099	214.342	0.00073	146.6385	0.61	0.38	79993.0622	79993.06	-2E-05	16.165645	35.923655	6.16E-05
31.72024	0.001995	0.008697	410.2727	0.009326	411.9566	214.644	0.00074	147.4256	0.62	0.38	80011.247	80011.25	-1.9E-05	16.188426	35.974281	6.29E-05
31.54387	0.002025	0.008888	410.7864	0.00953	412.5018	214.946	0.00074	148.2148	0.62	0.39	80028.8197	80028.82	-1.7E-05	16.210945	36.024323	6.42E-05
31.37483	0.002055	0.00908	411.2988	0.009735	413.0458	215.246	0.00075	149.0066	0.63	0.39	80045.7014	80045.7	-1.6E-05	16.233211	36.073802	6.55E-05
31.21274	0.002085	0.009271	411.8099	0.009939	413.5882	215.546	0.00075	149.8014	0.63	0.39	80061.8238	80061.82	-1.5E-05	16.255233	36.12274	6.68E-05
31.05723	0.002115	0.009462	412.3198	0.010143	414.1292	215.845	0.00075	150.5996	0.63	0.39	80077.1282	80077.13	-1.3E-05	16.27702	36.171156	6.81E-05
30.90795	0.002145	0.009653	412.8283	0.010347	414.6687	216.143	0.00076	151.4015	0.64	0.39	80091.5655	80091.57	-1.2E-05	16.298581	36.219069	6.94E-05
30.76458	0.002175	0.009844	413.3354	0.010551	415.2067	216.44	0.00076	152.2073	0.64	0.39	80105.0958	80105.1	-1.1E-05	16.319924	36.266498	7.07E-05
30.62682	0.002205	0.010034	413.8411	0.010754	415.7431	216.736	0.00077	153.0171	0.64	0.39	80117.6879	80117.69	-1E-05	16.341058	36.313463	7.2E-05
30.49438	0.002235	0.010225	414.3454	0.010958	416.2779	217.032	0.00077	153.8312	0.64	0.39	80129.3191	80129.32	-9.2E-06	16.361991	36.359981	7.33E-05
30.36698	0.002265	0.010415	414.8483	0.011161	416.8112	217.326	0.00077	154.6496	0.65	0.39	80139.975	80139.98	-8.3E-06	16.382732	36.406071	7.46E-05
30.24436	0.002295	0.010605	415.3497	0.011364	417.3429	217.62	0.00078	155.4724	0.65	0.40	80149.6491	80149.65	-7.5E-06	16.403288	36.451751	7.59E-05
30.12629	0.002325	0.010795	415.8498	0.011567	417.873	217.913	0.00078	156.2995	0.65	0.40	80158.3423	80158.34	-6.7E-06	16.423667	36.497038	7.72E-05
30.01251	0.002355	0.010984	416.3484	0.011769	418.4016	218.205	0.00079	157.1309	0.65	0.40	80166.0631	80166.06	-6E-06	16.443878	36.541951	7.85E-05
29.90282	0.002385	0.011174	416.8457	0.011972	418.9286	218.496	0.00079	157.9666	0.66	0.40	80172.8271	80172.83	-5.4E-06	16.463928	36.586507	7.98E-05
29.797	0.002415	0.011363	417.3416	0.012174	419.4541	218.786	0.00079	158.8063	0.66	0.40	80178.6567	80178.66	-4.8E-06	16.483825	36.630723	8.1E-05
29.69485	0.002445	0.011552	417.8361	0.012376	419.9781	219.076	0.0008	159.65	0.66	0.40	80183.5811	80183.58	-4.3E-06	16.503577	36.674616	8.23E-05
29.59618	0.002475	0.011741	418.3293	0.012578	420.5006	219.365	0.0008	160.4974	0.66	0.40	80187.6358	80187.64	-3.8E-06	16.523192	36.718205	8.36E-05
29.50081	0.002505	0.01193	418.8212	0.012779	421.0216	219.652	0.00081	161.3483	0.67	0.40	80190.8626	80190.86	-3.4E-06	16.542678	36.761506	8.49E-05
29.40855	0.002535	0.012119	419.3118	0.012981	421.5413	219.94	0.00081	162.2023	0.67	0.41	80193.3092	80193.31	-3E-06	16.562042	36.804537	8.62E-05
29.31925	0.002565	0.012307	419.8011	0.013182	422.0595	220.226	0.00082	163.0593	0.67	0.41	80195.0295	80195.03	-2.6E-06	16.581292	36.847315	8.75E-05
29.23275	0.002595	0.012496	420.2893	0.013384	422.5764	220.512	0.00082	163.9188	0.67	0.41	80196.0826	80196.08	-2.3E-06	16.600436	36.889857	8.88E-05
29.14889	0.002625	0.012684	420.7764	0.013585	423.0921	220.797	0.00082	164.7804	0.67	0.41	80196.5333	80196.53	-2E-06	16.619481	36.93218	9.01E-05
29.06753	0.002655	0.012873	421.2623	0.013786	423.6064	221.081	0.00083	165.6438	0.68	0.41	80196.4519	80196.45	-1.7E-06	16.638436	36.974303	9.13E-05
28.98852	0.002685	0.013061	421.7472	0.013987	424.1196	221.365	0.00083	166.5085	0.68	0.41	80195.9136	80195.91	-1.5E-06	16.657309	37.016241	9.26E-05
28.91174	0.002715	0.013249	422.2311	0.014188	424.6317	221.648	0.00084	167.3741	0.68	0.41	80194.9987	80194.99	-1.3E-06	16.676106	37.058013	9.39E-05
28.83706	0.002745	0.013437	422.714	0.014389	425.1427	221.93	0.00084	168.2399	0.68	0.41	80193.7924	80193.79	-1.1E-06	16.694836	37.099636	9.52E-05
28.76434	0.002775	0.013626	423.1961	0.01459	425.6527	222.212	0.00085	169.1055	0.68	0.41	80192.3843	80192.38	-9.6E-07	16.713507	37.141127	9.65E-05
28.69348	0.002805	0.013814	423.6773	0.014791	426.1617	222.494	0.00085	169.9704	0.68	0.42	80190.8691	80190.87	-8.2E-07	16.732126	37.182503	9.78E-05
28.62436	0.002835	0.014002	424.1577	0.014992	426.6698	222.775	0.00085	170.8339	0.69	0.42	80189.3454	80189.35	-6.9E-07	16.750702	37.223783	9.9E-05
28.55687	0.002865	0.01419	424.6375	0.015194	427.1772	223.056	0.00086	171.6955	0.69	0.42	80187.9164	80187.92	-5.8E-07	16.769242	37.264983	0.0001
28.4909	0.002895	0.014379	425.1166	0.015395	427.6837	223.336	0.00086	172.5544	0.69	0.42	80186.6894	80186.69	-4.9E-07	16.787754	37.306121	0.000102
28.42635	0.002925	0.014568	425.5952	0.015597	428.1896	223.616	0.00087	173.4101	0.69	0.42	80185.7756	80185.78	-4.1E-07	16.806246	37.347214	0.000103
28.36313	0.002955	0.014756	426.0733	0.015798	428.6949	223.896	0.00087	174.2618	0.69	0.42	80185.2903	80185.29	-3.4E-07	16.824726	37.388281	0.000104
28.30114	0.002985	0.014945	426.5509	0.016	429.1997	224.175	0.00088	175.1089	0.69	0.42	80185.3524	80185.35	-2.8E-07	16.843202	37.429338	0.000105
28.24029	0.003015	0.015135	427.0283	0.016202	429.7041	224.454	0.00088	175.9506	0.70	0.42	80186.0847	80186.08	-2.3E-07	16.861682	37.470404	0.000107
28.18049	0.003045	0.015324	427.5053	0.016405	430.208	224.733	0.00088	176.7861	0.70	0.42	80187.6132	80187.61	-1.8E-07	16.880173	37.511496	0.000108
28.12166	0.003075	0.015514	427.9822	0.016607	430.7117	225.012	0.00089	177.6147	0.70	0.42	80190.0676	80190.07	-1.5E-07	16.898684	37.552631	0.000109
28.06371	0.003105	0.015704	428.459	0.01681	431.2152	225.291	0.00089	178.4356	0.70	0.42	80193.5808	80193.58	-1.2E-07	16.917222	37.593828	0.000111
28.00657	0.003135	0.015894	428.9357	0.017014	431.7186	225.57	0.0009	179.248	0.70	0.43	80198.2889	80198.29	-9.1E-08	16.935796	37.635103	0.000112
27.95016	0.003165	0.016085	429.4125	0.017218	432.222	225.849	0.0009	180.051	0.70	0.43	80204.3312	80204.33	-7.5E-08	16.954414	37.676475	0.000113
27.89441	0.003195	0.016277	429.8995	0.017422	432.7254	226.128	0.0009	180.8437	0.70	0.43	80211.8498	80211.85	-7.3E-08	16.973083	37.717962	0.000115
27.83925	0.003225	0.016468	430.3667	0.017627	433.229	226.407	0.00091	181.6254	0.71	0.43	80220.9896	80220.99	-7.2E-08	16.991811	37.759581	0.000116
27.7846	0.003255	0.016661	430.8442	0.017832	433.7329	226.686	0.00091	182.395	0.71	0.43	80231.8986	80231.9	-7E-08	17.010607	37.801349	0.000117
27.7304	0.003285	0.016854	431.3221	0.018038	434.237	226.966	0.00092	183.1518	0.71	0.43	80244.727	80244.73	-6.8E-08	17.029478	37.843285	0.000118
27.67659	0.003315	0.017047	431.8005	0.018245	434.7416	227.246	0.00092	183.8948	0.71	0.43	80259.6277	80259.63	-6.7E-08	17.048433	37.885406	0.00012
27.62311	0.003345	0.017241	432.2795	0.018452	435.2467	227.526	0.00092	184.623	0.71	0.43	80276.756	80276.76	-6.5E-08	17.067479	37.92773	0.000121
27.5699	0.003375	0.017436	432.7592	0.01866	435.7525	227.807	0.00093	185.3355	0.71	0.43	80296.2695	80296.27	-6.3E-08	17.086624	37.970275	0.000122
27.51689	0.003405	0.017631	433.2396	0.018869	436.2589	228.088	0.00093	186.0313	0.72	0.43	80318.328	80318.33	-6.1E-08	17.105876	38.013057	0.000124
27.46404	0.003435	0.017827	433.7209	0.019078	436.7662	228.369	0.00093	186.7095	0.72	0.43	80343.0933	80343.09	-6E-08	17.125243	38.056095	0.000125
27.41129	0.003465	0.018024	434.2032	0.019288	437.2743	228.651	0.00094	187.369	0.72	0.43	80370.7291	80370.73	-0.00015	17.144733	38.099407	0.000126
27.35859	0.003495	0.018222	434.6865	0.0195	437.7834	228.934	0.00094	188.0088	0.72	0.43	80401.4012	80401.4	-5.6E-08	17.164354	38.143009	0.000128
27.3059	0.003525	0.018421	435.1709	0.019712	438.2937	229.217	0.00094	188.628	0.72	0.43	80435.2766	80435.28	-5.5E-08	17.184114	38.18692	0.000129
27.25315	0.003555	0.01862	435.6565	0.019925	438.8051	229.501	0.00095	189.2255	0.72	0.43	80472.5245	80472.52	-5.3E-08	17.20402	38.231156	0.00013
27.20032	0.003585	0.018821	436.1435	0.020139	439.3177	229.786	0.00095	189.8002	0.73	0.44	80513.3151	80513.32	-5.1E-08	17.224081	38.275736	0.000132
27.14734	0.003615	0.019023	436.6319	0.020354	439.8318	230.072	0.00095	190.3512	0.73	0.44	80557.8202	80557.82	-4.9E-08	17.244304	38.320676	0.000133
27.09419	0.003645	0.019225	437.1218	0.020571	440.3473	230.358	0.00095	190.8772	0.73	0.44	80606.2129	80606.21				

26.8244	0.003795	0.020256	439.5971	0.021671	442.9504	231.805	0.00097	193.0973	0.74	0.44	80912.6179	80912.62	-4E-08	17.56948	38.598844	0.000141
26.76939	0.003825	0.020466	440.0979	0.021895	443.4768	232.098	0.00097	193.4517	0.74	0.44	80988.0243	80988.02	-3.8E-08	17.391053	38.646785	0.000143
26.71395	0.003855	0.020677	440.601	0.02212	444.0053	232.392	0.00097	193.7735	0.74	0.44	81068.5545	81068.55	-3.6E-08	17.41285	38.695223	0.000144
26.65806	0.003885	0.02089	441.1062	0.022347	444.536	232.688	0.00097	194.0619	0.75	0.44	81154.3871	81154.39	-3.5E-08	17.434878	38.744173	0.000146
26.60169	0.003915	0.021104	441.6138	0.022576	445.069	232.984	0.00097	194.3155	0.75	0.44	81245.701	81245.7	-3.3E-08	17.457144	38.793653	0.000147
26.5448	0.003945	0.02132	442.1238	0.022806	445.6044	233.282	0.00097	194.5334	0.75	0.44	81342.6752	81342.68	-3.2E-08	17.479655	38.843678	0.000149
26.48739	0.003975	0.021537	442.6362	0.023038	446.1423	234.001	0.00097	194.7144	0.75	0.44	81445.4886	81445.49	-3E-08	17.502419	38.894266	0.00015
26.11511	0.004005	0.022066	443.8787	0.0236	447.44	234.057	0.00094	187.5621	0.78	0.44	82769.6826	82769.68	-2.4E-08	17.575115	39.055811	0.000153
26.24082	0.004035	0.022106	443.9711	0.023643	447.5403	234.113	0.00096	191.9277	0.77	0.44	82174.6056	82174.61	-2.5E-08	17.569328	39.04295	0.000154
26.36506	0.004065	0.022146	444.0653	0.023688	447.6424	234.171	0.00098	196.2747	0.76	0.44	81582.6263	81582.63	-2.7E-08	17.563843	39.030762	0.000154
26.48778	0.004095	0.022187	444.1614	0.023733	447.7466	234.23	0.001	200.6016	0.75	0.44	80993.9726	80993.97	-2.9E-08	17.558669	39.019264	0.000155
26.60892	0.004125	0.022229	444.2597	0.023779	447.8529	234.29	0.00102	204.9071	0.74	0.44	80408.8733	80408.87	-3.1E-08	17.553813	39.008474	0.000155
26.72841	0.004155	0.022272	444.3601	0.023826	447.9615	234.352	0.00105	209.1898	0.73	0.44	79827.5585	79827.56	-3.4E-08	17.549284	38.99841	0.000155
26.84621	0.004185	0.022316	444.463	0.023875	448.0725	234.415	0.00107	213.4483	0.72	0.44	79250.259	79250.26	-3.6E-08	17.54509	38.989088	0.000156
26.96225	0.004215	0.022361	444.5683	0.023924	448.1862	234.479	0.00109	217.6812	0.72	0.44	78677.2069	78677.21	-3.9E-08	17.541237	38.980527	0.000156
27.07646	0.004245	0.022407	444.6762	0.023975	448.3025	234.545	0.00111	221.8871	0.71	0.44	78108.6348	78108.63	-4.1E-08	17.537734	38.972743	0.000157
27.1888	0.004275	0.022455	444.7869	0.024027	448.4218	234.613	0.00113	226.0646	0.70	0.44	77544.7761	77544.78	-4.4E-08	17.534589	38.965752	0.000157
27.2992	0.004305	0.022503	444.9005	0.02408	448.544	234.682	0.00115	230.2123	0.69	0.44	76985.865	76985.86	-4.7E-08	17.531807	38.959571	0.000158
27.4076	0.004335	0.022554	445.0171	0.024135	448.6694	234.754	0.00117	234.3287	0.68	0.43	76432.1358	76432.14	-5E-08	17.529397	38.954217	0.000158
27.51394	0.004365	0.022605	445.1369	0.024191	448.798	234.827	0.00119	238.4125	0.68	0.43	75883.8235	75883.82	-5.3E-08	17.527366	38.949703	0.000159
27.61816	0.004395	0.022658	445.26	0.024249	448.9301	234.902	0.00121	242.4622	0.67	0.43	75341.163	75341.16	-5.7E-08	17.525721	38.946047	0.000159
27.7202	0.004425	0.022712	445.3865	0.024309	449.0657	234.979	0.00123	246.4764	0.66	0.43	74804.3895	74804.39	-6E-08	17.524468	38.943263	0.00016
27.82	0.004455	0.022768	445.5166	0.02437	449.2051	235.058	0.00125	250.4537	0.65	0.43	74273.738	74273.74	-6.4E-08	17.523615	38.941366	0.00016
27.91751	0.004485	0.022826	445.6504	0.024432	449.3483	235.14	0.00127	254.3927	0.65	0.43	73749.4433	73749.44	-6.8E-08	17.523167	38.94037	0.000161
28.01267	0.004515	0.022885	445.7881	0.024497	449.4954	235.224	0.00129	258.2918	0.64	0.43	73231.7397	73231.74	-7.1E-08	17.523131	38.94029	0.000161
28.10543	0.004545	0.022946	445.9297	0.024563	449.6467	235.31	0.00131	262.1498	0.63	0.43	72720.8611	72720.86	-7.5E-08	17.523513	38.94114	0.000162
28.19572	0.004575	0.023009	446.0754	0.024632	449.8022	235.399	0.00133	265.9652	0.63	0.43	72217.0405	72217.04	-8E-08	17.52432	38.942933	0.000162
28.28349	0.004605	0.023074	446.2253	0.024702	449.9622	235.49	0.00135	269.7366	0.62	0.43	71720.51	71720.51	-8.4E-08	17.525557	38.945683	0.000163
28.36869	0.004635	0.02314	446.3796	0.024774	450.1266	0	0.00137	273.4626	0.62	0.43	71231.5005	71231.5	-8.8E-08	17.527231	38.949403	0.000163

