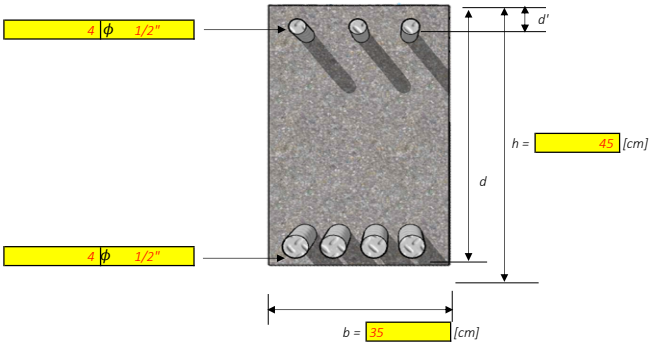
DISEÑO DE VIGA DOBLEMENTE REFORZADA

CÁLCULO DEL MOMENTO ÚLTIMO MÁXIMO

Daniel Bravo

*Modificar las celdas en : X

Seleccionar aceros



Datos

f'c =	210	[kg/cm2]	
fy =	4200	[kg/cm2]	
Es =	2100000	[kg/cm2]	(Modulo de eslasticidad del acero)
Ø =	0.72	"Vigas y losas controladas por tensión"	

Cálculo del area de acero

As'=	5.16	[cm2]
As =	5.16	[cm2]

Peralte efectivo

Superior	acero 1 capa	→	5 [cm]
Inferior	acero 1 capa	→	5 [cm]
d' =	5	[cm]	
d =	40.00	[cm]	

Hipotesis 1: Acero en compresion fluye

f´s = fy

$$c = \frac{(As - As') * fy}{0.85 * f'c * \beta_1 * b}$$

β1 =	0.85	para concreto ≤ 280 kg/cm2
c =	0	[cm]
a =	0	[cm]

Deformacion del fluencia del acero

Ey = 0.0020

Deformacion unitaria del acero en compresion

E's = #¡DIV/0!

E's	<	Ey	
#¡DIV/0!	<	0.0020	#¡DIV/0!

Cálculo de Momento ultimo

Mu = Ø * Mn

Mu = 780192 [kg.cm]

Mu = 7801.92 7.80192 **[ton.m]**

Hipotesis 2: Acero en compresión no fluye

f´s ≠ fy

Ecuación

$$As * fy = As' * (Es * \varepsilon_s') + 0.85 * f'c * (\beta_1 * c) * b$$

Calculo de c

21672 = 32508 * (c-d')/c + 5310.375 c

21672 = 5310.375 c + 32508 − 162540 /c

-10836 c = 5310.375 c² − 162540

-5310.375 c² + -10836 c + 162540 = 0

Ec. cuadratica

a =	-5310.375
b =	-10836
c =	162540
x 1=	-6.65
x 2=	4.605473245

Cálculo de parametros

c =	*4.605*	*[cm]*
a =	*3.9147*	*[cm]*

Cálculo de deformacion en la zona de compresion

E's = -0.000256994

Cálculo del esfuerzo en las barras de compresion

*f 's = Es * E's*

f 's = -540 [kg/cm2]

f 's	<	*fy*	
-540	<	*4200*	***HIPOTESIS CORRECTA***

Cálculo de As2

As2 = -0.67000 [cm2]

Cálculo de As1

As1 = 5.8300 [cm2]

Verificacion del fluencia del acero

Et =	*0.0231*	>	*0.005*	***EL ACERO FLUYE***

Cálculo de Momento ultimo

*Mu = Ø * Mn*

Mu = 594711.2969 [kg.cm] ***594711.297***

Mu = *5.947112969* ***[ton.m]***

TABLE: Element Forces - Frames							
VIGA	Station	OutputCase	CaseType	StepType	P(Kgf)	V2(kgf)	M3(kgf.m)
V1	0.175	Envolvente	Combination	Max	0	-815.08	541.98
V1	0.7636	Envolvente	Combination	Max	0	-592.7	977.1
V1	1.3523	Envolvente	Combination	Max	0	-369.94	1348.51
V1	1.9409	Envolvente	Combination	Max	0	-147.18	1562.57
V1	2.5295	Envolvente	Combination	Max	0	75.58	1619.27
V1	3.1182	Envolvente	Combination	Max	0	304.63	1518.64
V1	3.7068	Envolvente	Combination	Max	0	571.95	1260.66
V1	4.2955	Envolvente	Combination	Max	0	839.26	1024.48
V1	4.8841	Envolvente	Combination	Max	0	1106.57	766
V1	5.4727	Envolvente	Combination	Max	0	1373.89	359.12
V1	6.0614	Envolvente	Combination	Max	0	1641.2	-92.33
V1	6.65	Envolvente	Combination	Max	0	1908.51	-674.91
V1	6.65	Envolvente	Combination	Max	0	33.93	-187.57
V1	7.1975	Envolvente	Combination	Max	0	241.12	-262.87
V1	7.745	Envolvente	Combination	Max	0	448.31	-405.44
V1	8.2925	Envolvente	Combination	Max	0	655.51	171.03
V1	8.84	Envolvente	Combination	Max	0	865.65	683.94
V1	8.84	Envolvente	Combination	Max	0	-463.51	278.22
V1	9.4013	Envolvente	Combination	Max	0	-251.11	479.77
V1	9.9625	Envolvente	Combination	Max	0	-38.72	611.69
V1	10.5238	Envolvente	Combination	Max	0	173.68	600.57
V1	11.085	Envolvente	Combination	Max	0	402.15	528.51
V1	11.6463	Envolvente	Combination	Max	0	657.03	574.39
V1	12.2075	Envolvente	Combination	Max	0	911.91	477.26
V1	12.7688	Envolvente	Combination	Max	0	1166.78	290.2
V1	13.33	Envolvente	Combination	Max	0	1421.66	-0.56
V1	13.33	Envolvente	Combination	Max	0	-550.88	67.13
V1	13.8975	Envolvente	Combination	Max	0	-336.12	318.82
V1	14.465	Envolvente	Combination	Max	0	-121.36	461.14
V1	15.0325	Envolvente	Combination	Max	0	93.4	508.14
V1	15.6	Envolvente	Combination	Max	0	308.17	408.88
V1	16.1675	Envolvente	Combination	Max	0	561.48	515.51
V1	16.735	Envolvente	Combination	Max	0	819.2	498.49
V1	17.3025	Envolvente	Combination	Max	0	1076.91	371.16
V1	17.87	Envolvente	Combination	Max	0	1334.63	144.45
V1	17.87	Envolvente	Combination	Max	0	-409.76	224.92
V1	18.4288	Envolvente	Combination	Max	0	-198.31	394.8
V1	18.9875	Envolvente	Combination	Max	0	13.14	461.1
V1	19.5463	Envolvente	Combination	Max	0	224.59	421.59
V1	20.105	Envolvente	Combination	Max	0	451.33	296.59
V1	20.6638	Envolvente	Combination	Max	0	705.07	375.34
V1	21.2225	Envolvente	Combination	Max	0	958.82	331.93
V1	21.7813	Envolvente	Combination	Max	0	1212.56	194.74
V1	22.34	Envolvente	Combination	Max	0	1466.3	-60.59
V1	22.34	Envolvente	Combination	Max	0	-901.16	-392.64
V1	22.946	Envolvente	Combination	Max	0	-694.76	104.78
V1	23.552	Envolvente	Combination	Max	0	-476.84	479.02

V1	24.158	Envolvente	Combination	Max	0	-247.51	766.33
V1	24.764	Envolvente	Combination	Max	0	-18.17	886.86
V1	25.37	Envolvente	Combination	Max	0	213.89	840.63
V1	25.976	Envolvente	Combination	Max	0	489.09	816.47
V1	26.582	Envolvente	Combination	Max	0	764.29	676.06
V1	27.188	Envolvente	Combination	Max	0	1039.49	368.87
V1	27.794	Envolvente	Combination	Max	0	1314.69	-11.99
V1	28.4	Envolvente	Combination	Max	0	1589.89	-525.98
V1	28.4	Envolvente	Combination	Max	0	-518.88	-20.61
V1	29.0079	Envolvente	Combination	Max	0	-288.84	224.88
V1	29.6157	Envolvente	Combination	Max	0	-58.81	330.54
V1	30.2236	Envolvente	Combination	Max	0	171.23	345.81
V1	30.8314	Envolvente	Combination	Max	0	401.26	699.57
V1	31.4393	Envolvente	Combination	Max	0	658.69	984.05
V1	32.0471	Envolvente	Combination	Max	0	934.73	1100.73
V1	32.655	Envolvente	Combination	Max	0	1210.77	1066.8
V1	0.175	Envolvente	Combination	Min	0	-1565.76	-1572.1
V1	0.7636	Envolvente	Combination	Min	0	-1298.45	-749.78
V1	1.3523	Envolvente	Combination	Min	0	-1031.13	-152.23
V1	1.9409	Envolvente	Combination	Min	0	-763.82	314.2
V1	2.5295	Envolvente	Combination	Min	0	-496.51	649.5
V1	3.1182	Envolvente	Combination	Min	0	-235.48	836.2
V1	3.7068	Envolvente	Combination	Min	0	-12.72	854.13
V1	4.2955	Envolvente	Combination	Min	0	210.04	648.13
V1	4.8841	Envolvente	Combination	Min	0	432.8	186.04
V1	5.4727	Envolvente	Combination	Min	0	655.57	-457.45
V1	6.0614	Envolvente	Combination	Min	0	871.66	-1344.84
V1	6.65	Envolvente	Combination	Min	0	1072.14	-2389.59
V1	6.65	Envolvente	Combination	Min	0	-1824.82	-2271.96
V1	7.1975	Envolvente	Combination	Min	0	-1576.19	-1340.93
V1	7.745	Envolvente	Combination	Min	0	-1327.56	-570.22
V1	8.2925	Envolvente	Combination	Min	0	-1078.93	-812.05
V1	8.84	Envolvente	Combination	Min	0	-833.24	-1217.93
V1	8.84	Envolvente	Combination	Min	0	-1228.77	-1085.73
V1	9.4013	Envolvente	Combination	Min	0	-973.89	-468.62
V1	9.9625	Envolvente	Combination	Min	0	-719.01	-44.13
V1	10.5238	Envolvente	Combination	Min	0	-464.14	261.14
V1	11.085	Envolvente	Combination	Min	0	-225.33	340.67
V1	11.6463	Envolvente	Combination	Min	0	-12.94	88.83
V1	12.2075	Envolvente	Combination	Min	0	199.46	-306.66
V1	12.7688	Envolvente	Combination	Min	0	411.86	-874.48
V1	13.33	Envolvente	Combination	Min	0	624.26	-1600.86
V1	13.33	Envolvente	Combination	Min	0	-1387.44	-1593.19
V1	13.8975	Envolvente	Combination	Min	0	-1129.73	-878.95
V1	14.465	Envolvente	Combination	Min	0	-872.01	-323.47
V1	15.0325	Envolvente	Combination	Min	0	-614.3	59.21
V1	15.6	Envolvente	Combination	Min	0	-356.58	291.36

V1	16.1675	Envolvente	Combination	Min	0	-137.42	106.79
V1	16.735	Envolvente	Combination	Min	0	77.34	-250.91
V1	17.3025	Envolvente	Combination	Min	0	292.11	-766.43
V1	17.87	Envolvente	Combination	Min	0	506.87	-1450.7
V1	17.87	Envolvente	Combination	Min	0	-1282.79	-1436.22
V1	18.4288	Envolvente	Combination	Min	0	-1029.04	-790.35
V1	18.9875	Envolvente	Combination	Min	0	-775.3	-300.83
V1	19.5463	Envolvente	Combination	Min	0	-521.56	34.58
V1	20.105	Envolvente	Combination	Min	0	-283.11	184.57
V1	20.6638	Envolvente	Combination	Min	0	-71.66	-107.16
V1	21.2225	Envolvente	Combination	Min	0	139.79	-547.63
V1	21.7813	Envolvente	Combination	Min	0	351.24	-1154.25
V1	22.34	Envolvente	Combination	Min	0	562.69	-1902.66
V1	22.34	Envolvente	Combination	Min	0	-1557.09	-1843.22
V1	22.946	Envolvente	Combination	Min	0	-1281.89	-983.01
V1	23.552	Envolvente	Combination	Min	0	-1006.69	-305.36
V1	24.158	Envolvente	Combination	Min	0	-731.49	153.47
V1	24.764	Envolvente	Combination	Min	0	-456.29	469.75
V1	25.37	Envolvente	Combination	Min	0	-183.83	596.67
V1	25.976	Envolvente	Combination	Min	0	45.51	484.56
V1	26.582	Envolvente	Combination	Min	0	274.84	170.86
V1	27.188	Envolvente	Combination	Min	0	504.17	-304.54
V1	27.794	Envolvente	Combination	Min	0	719.36	-1012.01
V1	28.4	Envolvente	Combination	Min	0	925.76	-1892.1
V1	28.4	Envolvente	Combination	Min	0	-1710.19	-2116.3
V1	29.0079	Envolvente	Combination	Min	0	-1434.15	-1160.64
V1	29.6157	Envolvente	Combination	Min	0	-1158.11	-372.78
V1	30.2236	Envolvente	Combination	Min	0	-882.07	191.94
V1	30.8314	Envolvente	Combination	Min	0	-606.03	122.38
V1	31.4393	Envolvente	Combination	Min	0	-357.38	-191.44
V1	32.0471	Envolvente	Combination	Min	0	-127.34	-645.1
V1	32.655	Envolvente	Combination	Min	0	102.69	-1255.75
V2	0.175	Envolvente	Combination	Max	0	-406.1	908.58
V2	0.7688	Envolvente	Combination	Max	0	-181.4	1125.46
V2	1.3625	Envolvente	Combination	Max	0	43.29	1232.02
V2	1.9563	Envolvente	Combination	Max	0	267.99	1178.48
V2	2.55	Envolvente	Combination	Max	0	494.63	999.38
V2	3.1438	Envolvente	Combination	Max	0	764.26	1144
V2	3.7375	Envolvente	Combination	Max	0	1033.9	1183.72
V2	4.3313	Envolvente	Combination	Max	0	1303.53	1063.36
V2	4.925	Envolvente	Combination	Max	0	1573.17	841.87
V2	0.175	Envolvente	Combination	Min	0	-1549.91	-1456.08
V2	0.7688	Envolvente	Combination	Min	0	-1280.27	-658.34
V2	1.3625	Envolvente	Combination	Min	0	-1010.63	-43.78
V2	1.9563	Envolvente	Combination	Min	0	-741	437.36
V2	2.55	Envolvente	Combination	Min	0	-473.3	710.48
V2	3.1438	Envolvente	Combination	Min	0	-248.6	446.52
V2	3.7375	Envolvente	Combination	Min	0	-23.91	-46.13

V2	4.3313	Envolvente	Combination	Min	0	200.79	-672.2
V2	4.925	Envolvente	Combination	Min	0	425.49	-1490.66
V3	0.175	Envolvente	Combination	Max	0	-847.63	466.54
V3	0.7477	Envolvente	Combination	Max	0	-630.89	894.09
V3	1.3205	Envolvente	Combination	Max	0	-414.15	1290.21
V3	1.8932	Envolvente	Combination	Max	0	-197.41	1537.38
V3	2.4659	Envolvente	Combination	Max	0	19.33	1635.58
V3	3.0386	Envolvente	Combination	Max	0	236.07	1584.83
V3	3.6114	Envolvente	Combination	Max	0	478.76	1497.21
V3	4.1841	Envolvente	Combination	Max	0	738.85	1518.53
V3	4.7568	Envolvente	Combination	Max	0	998.94	1390.96
V3	5.3295	Envolvente	Combination	Max	0	1259.03	1114.44
V3	5.9023	Envolvente	Combination	Max	0	1519.12	706.82
V3	6.475	Envolvente	Combination	Max	0	1779.2	258.96
V3	0.175	Envolvente	Combination	Min	0	-1727.94	-1759.43
V3	0.7477	Envolvente	Combination	Min	0	-1467.85	-848.43
V3	1.3205	Envolvente	Combination	Min	0	-1207.76	-179.09
V3	1.8932	Envolvente	Combination	Min	0	-947.67	366.11
V3	2.4659	Envolvente	Combination	Min	0	-687.58	787.18
V3	3.0386	Envolvente	Combination	Min	0	-427.49	1023.33
V3	3.6114	Envolvente	Combination	Min	0	-193.35	1055.02
V3	4.1841	Envolvente	Combination	Min	0	23.39	823.49
V3	4.7568	Envolvente	Combination	Min	0	240.13	377.96
V3	5.3295	Envolvente	Combination	Min	0	456.87	-191.71
V3	5.9023	Envolvente	Combination	Min	0	673.61	-903.39
V3	6.475	Envolvente	Combination	Min	0	890.35	-1847.91
V4	0.175	Envolvente	Combination	Max	0	-417.68	855.8
V4	0.7781	Envolvente	Combination	Max	0	-189.43	1086.69
V4	1.3813	Envolvente	Combination	Max	0	38.81	1186.04
V4	1.9844	Envolvente	Combination	Max	0	267.06	1120.22
V4	2.5875	Envolvente	Combination	Max	0	520.05	889.31
V4	3.1906	Envolvente	Combination	Max	0	793.94	686.72
V4	3.7937	Envolvente	Combination	Max	0	1067.84	572.81
V4	4.3969	Envolvente	Combination	Max	0	1341.73	336.02
V4	5	Envolvente	Combination	Max	0	1615.62	3.64
V4	5	Envolvente	Combination	Max	0	2141.37	3.13
V4	5.1	Envolvente	Combination	Max	0	2186.78	-96.26
V4	5.1	Envolvente	Combination	Max	0	-854.13	-201.42
V4	5.2	Envolvente	Combination	Max	0	-816.29	-113.88
V4	5.2	Envolvente	Combination	Max	0	-586.03	-113.35
V4	5.8088	Envolvente	Combination	Max	0	-355.65	173.29
V4	6.4175	Envolvente	Combination	Max	0	-125.28	326.99
V4	7.0262	Envolvente	Combination	Max	0	105.09	367.9
V4	7.635	Envolvente	Combination	Max	0	347.88	339.41
V4	8.2437	Envolvente	Combination	Max	0	624.33	376.24
V4	8.8525	Envolvente	Combination	Max	0	900.78	267.8
V4	9.4613	Envolvente	Combination	Max	0	1177.23	45.81

V4	10.07	Envolvente	Combination	Max	0	1453.67	-316.41
V4	10.07	Envolvente	Combination	Max	0	1884.01	-316.79
V4	10.17	Envolvente	Combination	Max	0	1929.42	-416.15
V4	10.17	Envolvente	Combination	Max	0	-1352.67	-714.57
V4	10.27	Envolvente	Combination	Max	0	-1318.61	-568.47
V4	10.27	Envolvente	Combination	Max	0	-1033.09	-568.09
V4	10.8564	Envolvente	Combination	Max	0	-833.37	-7.7
V4	11.4427	Envolvente	Combination	Max	0	-622.76	432.38
V4	12.0291	Envolvente	Combination	Max	0	-400.86	811.99
V4	12.6155	Envolvente	Combination	Max	0	-178.96	1035.61
V4	13.2018	Envolvente	Combination	Max	0	42.95	1103.5
V4	13.7882	Envolvente	Combination	Max	0	284.82	1042.14
V4	14.3745	Envolvente	Combination	Max	0	551.1	989.47
V4	14.9609	Envolvente	Combination	Max	0	817.38	781.53
V4	15.5473	Envolvente	Combination	Max	0	1083.66	417.55
V4	16.1336	Envolvente	Combination	Max	0	1349.94	-18.61
V4	16.72	Envolvente	Combination	Max	0	1616.23	-565.99
V4	16.72	Envolvente	Combination	Max	0	2704.31	-566.47
V4	16.82	Envolvente	Combination	Max	0	2749.73	-706.49
V4	16.82	Envolvente	Combination	Max	0	-195.86	-92.84
V4	16.92	Envolvente	Combination	Max	0	-158.02	-74.82
V4	16.92	Envolvente	Combination	Max	0	45.89	-74.38
V4	17.4175	Envolvente	Combination	Max	0	234.16	-143.94
V4	17.915	Envolvente	Combination	Max	0	422.43	-290.64
V4	18.4125	Envolvente	Combination	Max	0	610.71	214.12
V4	18.91	Envolvente	Combination	Max	0	798.98	719.97
V4	18.91	Envolvente	Combination	Max	0	1095.78	719.48
V4	19.01	Envolvente	Combination	Max	0	1141.2	783.47
V4	19.01	Envolvente	Combination	Max	0	-812.99	152.2
V4	19.11	Envolvente	Combination	Max	0	-775.15	234.97
V4	19.11	Envolvente	Combination	Max	0	-461.72	235.53
V4	19.6463	Envolvente	Combination	Max	0	-258.78	430.84
V4	20.1825	Envolvente	Combination	Max	0	-55.85	562.21
V4	20.7188	Envolvente	Combination	Max	0	147.09	563.09
V4	21.255	Envolvente	Combination	Max	0	363.95	500.52
V4	21.7913	Envolvente	Combination	Max	0	607.48	539.49
V4	22.3275	Envolvente	Combination	Max	0	851	448.88
V4	22.8638	Envolvente	Combination	Max	0	1094.52	270.58
V4	23.4	Envolvente	Combination	Max	0	1338.05	2.66
V4	23.4	Envolvente	Combination	Max	0	2077.19	2.05
V4	23.5	Envolvente	Combination	Max	0	2122.6	-101.93
V4	23.5	Envolvente	Combination	Max	0	-967.31	-27.76
V4	23.6	Envolvente	Combination	Max	0	-929.47	69.67
V4	23.6	Envolvente	Combination	Max	0	-541.01	70.28
V4	24.1425	Envolvente	Combination	Max	0	-335.71	308.1
V4	24.685	Envolvente	Combination	Max	0	-130.41	454.36
V4	25.2275	Envolvente	Combination	Max	0	74.89	506.08
V4	25.77	Envolvente	Combination	Max	0	280.19	439.48
V4	26.3125	Envolvente	Combination	Max	0	520.67	545.41

V4	26.855	Envolvente	Combination	Max	0	767.03	532.04
V4	27.3975	Envolvente	Combination	Max	0	1013.39	404.95
V4	27.94	Envolvente	Combination	Max	0	1259.75	199.07
V4	27.94	Envolvente	Combination	Max	0	1881.67	198.49
V4	28.04	Envolvente	Combination	Max	0	1927.08	109.56
V4	28.04	Envolvente	Combination	Max	0	-759.17	144.39
V4	28.14	Envolvente	Combination	Max	0	-721.33	221.15
V4	28.14	Envolvente	Combination	Max	0	-392.78	221.71
V4	28.6862	Envolvente	Combination	Max	0	-186.06	379.81
V4	29.2325	Envolvente	Combination	Max	0	20.67	442.36
V4	29.7787	Envolvente	Combination	Max	0	227.39	398.27
V4	30.325	Envolvente	Combination	Max	0	452.89	286.89
V4	30.8713	Envolvente	Combination	Max	0	700.95	342.33
V4	31.4175	Envolvente	Combination	Max	0	949.02	286.97
V4	31.9638	Envolvente	Combination	Max	0	1197.08	139.2
V4	32.51	Envolvente	Combination	Max	0	1445.15	-121.48
V4	32.51	Envolvente	Combination	Max	0	-942.83	-461.34
V4	33.116	Envolvente	Combination	Max	0	-726.85	48.63
V4	33.722	Envolvente	Combination	Max	0	-497.52	433.26
V4	34.328	Envolvente	Combination	Max	0	-268.19	733.66
V4	34.934	Envolvente	Combination	Max	0	-38.86	867.31
V4	35.54	Envolvente	Combination	Max	0	192.32	834.52
V4	36.146	Envolvente	Combination	Max	0	467.52	810.1
V4	36.752	Envolvente	Combination	Max	0	742.72	663.02
V4	37.358	Envolvente	Combination	Max	0	1017.92	349.19
V4	37.964	Envolvente	Combination	Max	0	1293.12	-39.93
V4	38.57	Envolvente	Combination	Max	0	1568.32	-561.09
V4	38.57	Envolvente	Combination	Max	0	-561.84	-102.02
V4	39.1779	Envolvente	Combination	Max	0	-331.81	169.59
V4	39.7857	Envolvente	Combination	Max	0	-101.77	301.39
V4	40.3936	Envolvente	Combination	Max	0	128.26	343
V4	41.0014	Envolvente	Combination	Max	0	358.3	684.32
V4	41.6093	Envolvente	Combination	Max	0	614.71	949.42
V4	42.2171	Envolvente	Combination	Max	0	890.75	1046.77
V4	42.825	Envolvente	Combination	Max	0	1166.79	990.95
V4	0.175	Envolvente	Combination	Min	0	-1318.64	-1225.86
V4	0.7781	Envolvente	Combination	Min	0	-1044.75	-560.96
V4	1.3813	Envolvente	Combination	Min	0	-770.85	-67.37
V4	1.9844	Envolvente	Combination	Min	0	-496.96	288.54
V4	2.5875	Envolvente	Combination	Min	0	-247.82	506.69
V4	3.1906	Envolvente	Combination	Min	0	-19.57	393.66
V4	3.7937	Envolvente	Combination	Min	0	208.67	-110.89
V4	4.3969	Envolvente	Combination	Min	0	436.92	-795.43
V4	5	Envolvente	Combination	Min	0	665.16	-1687.21
V4	5	Envolvente	Combination	Min	0	956.53	-1687.17
V4	5.1	Envolvente	Combination	Min	0	994.37	-1887.41
V4	5.1	Envolvente	Combination	Min	0	-1675.66	-1652.29
V4	5.2	Envolvente	Combination	Min	0	-1630.25	-1491.24
V4	5.2	Envolvente	Combination	Min	0	-1304.66	-1491.31
V4	5.8088	Envolvente	Combination	Min	0	-1028.21	-781.25

V4	6.4175	Envolvente	Combination	Min	0	-751.77	-246.79
V4	7.0262	Envolvente	Combination	Min	0	-475.32	91.94
V4	7.635	Envolvente	Combination	Min	0	-211.29	190.98
V4	8.2437	Envolvente	Combination	Min	0	19.08	-82.71
V4	8.8525	Envolvente	Combination	Min	0	249.46	-520.21
V4	9.4613	Envolvente	Combination	Min	0	479.83	-1152.69
V4	10.07	Envolvente	Combination	Min	0	710.2	-1953.47
V4	10.07	Envolvente	Combination	Min	0	948.58	-1953.15
V4	10.17	Envolvente	Combination	Min	0	986.42	-2135.18
V4	10.17	Envolvente	Combination	Min	0	-2739.17	-2141.08
V4	10.27	Envolvente	Combination	Min	0	-2693.76	-1928.87
V4	10.27	Envolvente	Combination	Min	0	-1642.85	-1929.2
V4	10.8564	Envolvente	Combination	Min	0	-1376.57	-1044.01
V4	11.4427	Envolvente	Combination	Min	0	-1110.29	-324.77
V4	12.0291	Envolvente	Combination	Min	0	-844.01	168.68
V4	12.6155	Envolvente	Combination	Min	0	-577.72	531.88
V4	13.2018	Envolvente	Combination	Min	0	-311.44	724.26
V4	13.7882	Envolvente	Combination	Min	0	-65.13	759.7
V4	14.3745	Envolvente	Combination	Min	0	156.77	605.47
V4	14.9609	Envolvente	Combination	Min	0	378.67	270.7
V4	15.5473	Envolvente	Combination	Min	0	600.57	-209.77
V4	16.1336	Envolvente	Combination	Min	0	813.41	-904.3
V4	16.72	Envolvente	Combination	Min	0	1013.12	-1773.88
V4	16.72	Envolvente	Combination	Min	0	1259.38	-1773.7
V4	16.82	Envolvente	Combination	Min	0	1293.44	-1973.68
V4	16.82	Envolvente	Combination	Min	0	-2153.5	-2272.53
V4	16.92	Envolvente	Combination	Min	0	-2108.09	-2059.78
V4	16.92	Envolvente	Combination	Min	0	-1838.87	-2059.9
V4	17.4175	Envolvente	Combination	Min	0	-1612.94	-1201.36
V4	17.915	Envolvente	Combination	Min	0	-1387.02	-457.88
V4	18.4125	Envolvente	Combination	Min	0	-1161.09	-599.66
V4	18.91	Envolvente	Combination	Min	0	-935.17	-934.72
V4	18.91	Envolvente	Combination	Min	0	-661.67	-934.69
V4	19.01	Envolvente	Combination	Min	0	-623.83	-1046.26
V4	19.01	Envolvente	Combination	Min	0	-1746.46	-1125.7
V4	19.11	Envolvente	Combination	Min	0	-1701.05	-968.28
V4	19.11	Envolvente	Combination	Min	0	-1170.92	-968.34
V4	19.6463	Envolvente	Combination	Min	0	-927.39	-407.86
V4	20.1825	Envolvente	Combination	Min	0	-683.87	-22.85
V4	20.7188	Envolvente	Combination	Min	0	-440.35	253.24
V4	21.255	Envolvente	Combination	Min	0	-210.75	331.78
V4	21.7913	Envolvente	Combination	Min	0	-7.81	112.53
V4	22.3275	Envolvente	Combination	Min	0	195.12	-238.13
V4	22.8638	Envolvente	Combination	Min	0	398.06	-740.52
V4	23.4	Envolvente	Combination	Min	0	600.99	-1392.71
V4	23.4	Envolvente	Combination	Min	0	988.79	-1392.75
V4	23.5	Envolvente	Combination	Min	0	1026.63	-1576.92
V4	23.5	Envolvente	Combination	Min	0	-2094.58	-1575.95
V4	23.6	Envolvente	Combination	Min	0	-2049.17	-1392.8
V4	23.6	Envolvente	Combination	Min	0	-1330.4	-1392.73

V4	24.1425	Envolvente	Combination	Min	0	-1084.04	-737.82
V4	24.685	Envolvente	Combination	Min	0	-837.68	-236.38
V4	25.2275	Envolvente	Combination	Min	0	-591.31	114.58
V4	25.77	Envolvente	Combination	Min	0	-344.95	316.09
V4	26.3125	Envolvente	Combination	Min	0	-133.76	145.51
V4	26.855	Envolvente	Combination	Min	0	71.54	-173.54
V4	27.3975	Envolvente	Combination	Min	0	276.84	-623.87
V4	27.94	Envolvente	Combination	Min	0	482.14	-1240.46
V4	27.94	Envolvente	Combination	Min	0	842.98	-1240.47
V4	28.04	Envolvente	Combination	Min	0	880.83	-1413.46
V4	28.04	Envolvente	Combination	Min	0	-1691.89	-1459.69
V4	28.14	Envolvente	Combination	Min	0	-1646.48	-1295.51
V4	28.14	Envolvente	Combination	Min	0	-1219.79	-1295.52
V4	28.6862	Envolvente	Combination	Min	0	-971.73	-696.97
V4	29.2325	Envolvente	Combination	Min	0	-723.66	-251.3
V4	29.7787	Envolvente	Combination	Min	0	-475.6	52.59
V4	30.325	Envolvente	Combination	Min	0	-246.31	172.9
V4	30.8713	Envolvente	Combination	Min	0	-39.59	-117.15
V4	31.4175	Envolvente	Combination	Min	0	167.13	-547.28
V4	31.9638	Envolvente	Combination	Min	0	373.85	-1133.42
V4	32.51	Envolvente	Combination	Min	0	580.57	-1855.07
V4	32.51	Envolvente	Combination	Min	0	-1546.15	-1809.93
V4	33.116	Envolvente	Combination	Min	0	-1270.95	-956.36
V4	33.722	Envolvente	Combination	Min	0	-995.75	-283.2
V4	34.328	Envolvente	Combination	Min	0	-720.55	168.46
V4	34.934	Envolvente	Combination	Min	0	-445.35	481.11
V4	35.54	Envolvente	Combination	Min	0	-172	598.73
V4	36.146	Envolvente	Combination	Min	0	57.33	501.68
V4	36.752	Envolvente	Combination	Min	0	286.66	189.84
V4	37.358	Envolvente	Combination	Min	0	516	-273.01
V4	37.964	Envolvente	Combination	Min	0	745.33	-966.32
V4	38.57	Envolvente	Combination	Min	0	959.46	-1833.33
V4	38.57	Envolvente	Combination	Min	0	-1678.39	-2054.3
V4	39.1779	Envolvente	Combination	Min	0	-1402.35	-1117.99
V4	39.7857	Envolvente	Combination	Min	0	-1126.31	-349.47
V4	40.3936	Envolvente	Combination	Min	0	-850.26	201.23
V4	41.0014	Envolvente	Combination	Min	0	-574.22	145.34
V4	41.6093	Envolvente	Combination	Min	0	-324.56	-142.32
V4	42.2171	Envolvente	Combination	Min	0	-94.52	-569.85
V4	42.825	Envolvente	Combination	Min	0	135.51	-1151.83
V5	0.175	Envolvente	Combination	Max	0	-420.68	872.25
V5	0.7781	Envolvente	Combination	Max	0	-192.44	1099.07
V5	1.3813	Envolvente	Combination	Max	0	35.8	1202.81
V5	1.9844	Envolvente	Combination	Max	0	264.05	1141.36
V5	2.5875	Envolvente	Combination	Max	0	512.73	914.72
V5	3.1906	Envolvente	Combination	Max	0	786.62	710.1
V5	3.7937	Envolvente	Combination	Max	0	1060.51	623.65
V5	4.3969	Envolvente	Combination	Max	0	1334.41	404.03
V5	5	Envolvente	Combination	Max	0	1608.3	95.89
V5	5	Envolvente	Combination	Max	0	1638.75	95.56

V5	5.1	Envolvente	Combination	Max	0	1684.17	28.55
V5	5.1	Envolvente	Combination	Max	0	-499.13	12.78
V5	5.2	Envolvente	Combination	Max	0	-461.29	60.81
V5	5.2	Envolvente	Combination	Max	0	-441.7	61.08
V5	5.8088	Envolvente	Combination	Max	0	-211.33	259.84
V5	6.4175	Envolvente	Combination	Max	0	19.05	324.2
V5	7.0262	Envolvente	Combination	Max	0	249.42	261.41
V5	7.635	Envolvente	Combination	Max	0	517.82	157.35
V5	8.2437	Envolvente	Combination	Max	0	794.26	132.2
V5	8.8525	Envolvente	Combination	Max	0	1070.71	-17.56
V5	9.4613	Envolvente	Combination	Max	0	1347.16	-307.55
V5	10.07	Envolvente	Combination	Max	0	1623.61	-737.78
V5	10.07	Envolvente	Combination	Max	0	1648.59	-738.06
V5	10.17	Envolvente	Combination	Max	0	1694	-824.26
V5	10.17	Envolvente	Combination	Max	0	-1482.17	-1682.63
V5	10.27	Envolvente	Combination	Max	0	-1448.11	-1524.74
V5	10.27	Envolvente	Combination	Max	0	-1420.02	-1524.39
V5	10.8564	Envolvente	Combination	Max	0	-1220.31	-693.11
V5	11.4427	Envolvente	Combination	Max	0	-1020.6	8.05
V5	12.0291	Envolvente	Combination	Max	0	-820.89	631.92
V5	12.6155	Envolvente	Combination	Max	0	-621.18	1175.64
V5	13.2018	Envolvente	Combination	Max	0	-419.11	1563.23
V5	13.7882	Envolvente	Combination	Max	0	-197.21	1855.61
V5	14.3745	Envolvente	Combination	Max	0	24.69	2067.27
V5	14.9609	Envolvente	Combination	Max	0	271.04	2122.79
V5	15.5473	Envolvente	Combination	Max	0	537.32	2022.17
V5	16.1336	Envolvente	Combination	Max	0	803.6	1765.42
V5	16.72	Envolvente	Combination	Max	0	1069.88	1352.52
V5	16.72	Envolvente	Combination	Max	0	1198.49	1352.35
V5	16.92	Envolvente	Combination	Max	0	1289.32	1103.57
V5	16.92	Envolvente	Combination	Max	0	1578.68	1103.4
V5	17.4175	Envolvente	Combination	Max	0	1804.61	416.76
V5	17.915	Envolvente	Combination	Max	0	2030.53	-133.16
V5	18.4125	Envolvente	Combination	Max	0	2256.46	-765.97
V5	18.91	Envolvente	Combination	Max	0	2482.38	-1492.37
V5	18.91	Envolvente	Combination	Max	0	2506.02	-1492.49
V5	19.01	Envolvente	Combination	Max	0	2551.43	-1650.29
V5	19.01	Envolvente	Combination	Max	0	-784.71	-773.5
V5	19.11	Envolvente	Combination	Max	0	-746.87	-696.92
V5	19.11	Envolvente	Combination	Max	0	-739.02	-696.76
V5	19.6463	Envolvente	Combination	Max	0	-536.09	-354.87
V5	20.1825	Envolvente	Combination	Max	0	-333.15	-121.8
V5	20.7188	Envolvente	Combination	Max	0	-130.21	2.45
V5	21.255	Envolvente	Combination	Max	0	72.72	17.91
V5	21.7913	Envolvente	Combination	Max	0	275.66	137.38
V5	22.3275	Envolvente	Combination	Max	0	502.83	316.33
V5	22.8638	Envolvente	Combination	Max	0	746.35	385.11
V5	23.4	Envolvente	Combination	Max	0	989.88	348.57
V5	23.4	Envolvente	Combination	Max	0	995.27	348.27
V5	23.5	Envolvente	Combination	Max	0	1040.68	328.11

V5	23.5	Envolvente	Combination	Max	0	-491.88	247.29
V5	23.6	Envolvente	Combination	Max	0	-454.04	294.6
V5	23.6	Envolvente	Combination	Max	0	-446.41	294.87
V5	24.2093	Envolvente	Combination	Max	0	-215.83	496.62
V5	24.8186	Envolvente	Combination	Max	0	14.74	617.94
V5	25.4279	Envolvente	Combination	Max	0	245.32	623.32
V5	26.0371	Envolvente	Combination	Max	0	483.83	913.13
V5	26.6464	Envolvente	Combination	Max	0	760.53	1065.56
V5	27.2557	Envolvente	Combination	Max	0	1037.22	1049.42
V5	27.865	Envolvente	Combination	Max	0	1313.91	899.1
V5	0.175	Envolvente	Combination	Min	0	-1363.08	-1335.53
V5	0.7781	Envolvente	Combination	Min	0	-1089.18	-637.94
V5	1.3813	Envolvente	Combination	Min	0	-815.29	-120.13
V5	1.9844	Envolvente	Combination	Min	0	-541.4	260.02
V5	2.5875	Envolvente	Combination	Min	0	-287.94	502.51
V5	3.1906	Envolvente	Combination	Min	0	-59.69	411.77
V5	3.7937	Envolvente	Combination	Min	0	168.55	-83.27
V5	4.3969	Envolvente	Combination	Min	0	396.79	-756.37
V5	5	Envolvente	Combination	Min	0	625.04	-1643.78
V5	5	Envolvente	Combination	Min	0	651.16	-1643.94
V5	5.1	Envolvente	Combination	Min	0	689	-1810.09
V5	5.1	Envolvente	Combination	Min	0	-1235.72	-1460.2
V5	5.2	Envolvente	Combination	Min	0	-1190.31	-1338.9
V5	5.2	Envolvente	Combination	Min	0	-1167.33	-1338.8
V5	5.8088	Envolvente	Combination	Min	0	-890.88	-712.33
V5	6.4175	Envolvente	Combination	Min	0	-614.43	-259.99
V5	7.0262	Envolvente	Combination	Min	0	-337.99	10.98
V5	7.635	Envolvente	Combination	Min	0	-99.56	1.91
V5	8.2437	Envolvente	Combination	Min	0	130.81	-369.03
V5	8.8525	Envolvente	Combination	Min	0	361.18	-936.68
V5	9.4613	Envolvente	Combination	Min	0	591.56	-1672.62
V5	10.07	Envolvente	Combination	Min	0	821.93	-2576.85
V5	10.07	Envolvente	Combination	Min	0	843.08	-2576.98
V5	10.17	Envolvente	Combination	Min	0	880.92	-2744.1
V5	10.17	Envolvente	Combination	Min	0	-2260.75	-3220.48
V5	10.27	Envolvente	Combination	Min	0	-2215.34	-3003.65
V5	10.27	Envolvente	Combination	Min	0	-2107.94	-3003.44
V5	10.8564	Envolvente	Combination	Min	0	-1841.66	-1845.49
V5	11.4427	Envolvente	Combination	Min	0	-1575.38	-843.69
V5	12.0291	Envolvente	Combination	Min	0	-1309.09	-50.86
V5	12.6155	Envolvente	Combination	Min	0	-1042.81	535.89
V5	13.2018	Envolvente	Combination	Min	0	-776.53	954.47
V5	13.7882	Envolvente	Combination	Min	0	-510.25	1222.33
V5	14.3745	Envolvente	Combination	Min	0	-243.97	1372.59
V5	14.9609	Envolvente	Combination	Min	0	-20.08	1350.67
V5	15.5473	Envolvente	Combination	Min	0	201.82	1188.09
V5	16.1336	Envolvente	Combination	Min	0	423.72	908.3
V5	16.72	Envolvente	Combination	Min	0	641.48	463.12
V5	16.72	Envolvente	Combination	Min	0	675.16	463.24
V5	16.92	Envolvente	Combination	Min	0	743.28	266.89

V5	16.92	Envolvente	Combination	Min	0	764.45	267.01
V5	17.4175	Envolvente	Combination	Min	0	933.89	-299.23
V5	17.915	Envolvente	Combination	Min	0	1103.34	-1068.54
V5	18.4125	Envolvente	Combination	Min	0	1272.78	-1961.04
V5	18.91	Envolvente	Combination	Min	0	1442.23	-2966
V5	18.91	Envolvente	Combination	Min	0	1446.92	-2965.94
V5	19.01	Envolvente	Combination	Min	0	1480.97	-3190.43
V5	19.01	Envolvente	Combination	Min	0	-1728.27	-2887.06
V5	19.11	Envolvente	Combination	Min	0	-1682.85	-2716.51
V5	19.11	Envolvente	Combination	Min	0	-1673.18	-2716.53
V5	19.6463	Envolvente	Combination	Min	0	-1429.65	-1884.59
V5	20.1825	Envolvente	Combination	Min	0	-1186.13	-1183.23
V5	20.7188	Envolvente	Combination	Min	0	-942.61	-612.47
V5	21.255	Envolvente	Combination	Min	0	-699.08	-216.75
V5	21.7913	Envolvente	Combination	Min	0	-455.56	-81.84
V5	22.3275	Envolvente	Combination	Min	0	-236.27	-277.83
V5	22.8638	Envolvente	Combination	Min	0	-33.33	-609.25
V5	23.4	Envolvente	Combination	Min	0	169.61	-1074.78
V5	23.4	Envolvente	Combination	Min	0	182.35	-1074.57
V5	23.5	Envolvente	Combination	Min	0	220.19	-1176.34
V5	23.5	Envolvente	Combination	Min	0	-1553.91	-1535.43
V5	23.6	Envolvente	Combination	Min	0	-1508.5	-1382.33
V5	23.6	Envolvente	Combination	Min	0	-1495.31	-1382.54
V5	24.2093	Envolvente	Combination	Min	0	-1218.62	-555.77
V5	24.8186	Envolvente	Combination	Min	0	-941.93	42.38
V5	25.4279	Envolvente	Combination	Min	0	-665.24	432
V5	26.0371	Envolvente	Combination	Min	0	-396.49	258.89
V5	26.6464	Envolvente	Combination	Min	0	-165.91	-101.29
V5	27.2557	Envolvente	Combination	Min	0	64.66	-601.97
V5	27.865	Envolvente	Combination	Min	0	295.24	-1277.54
V6	0.175	Envolvente	Combination	Max	0	-413.9	901.86
V6	0.7781	Envolvente	Combination	Max	0	-185.65	1122.88
V6	1.3813	Envolvente	Combination	Max	0	42.59	1223.83
V6	1.9844	Envolvente	Combination	Max	0	270.84	1159.6
V6	2.5875	Envolvente	Combination	Max	0	517.35	930.17
V6	3.1906	Envolvente	Combination	Max	0	791.24	739.77
V6	3.7937	Envolvente	Combination	Max	0	1065.13	671.81
V6	4.3969	Envolvente	Combination	Max	0	1339.03	464.55
V6	5	Envolvente	Combination	Max	0	1612.92	173.59
V6	5	Envolvente	Combination	Max	0	1748.29	173.49
V6	5.1	Envolvente	Combination	Max	0	1793.7	103.89
V6	5.1	Envolvente	Combination	Max	0	-469.11	79.63
V6	5.2	Envolvente	Combination	Max	0	-431.26	124.67
V6	5.2	Envolvente	Combination	Max	0	-396.26	124.73
V6	5.8088	Envolvente	Combination	Max	0	-165.88	295.84
V6	6.4175	Envolvente	Combination	Max	0	64.49	331.85
V6	7.0262	Envolvente	Combination	Max	0	296.93	235.24
V6	7.635	Envolvente	Combination	Max	0	573.37	61.4
V6	8.2437	Envolvente	Combination	Max	0	849.82	15.32
V6	8.8525	Envolvente	Combination	Max	0	1126.27	-168.34

V6	9.4613	Envolvente	Combination	Max	0	1402.72	-492.24
V6	10.07	Envolvente	Combination	Max	0	1679.16	-956.38
V6	10.07	Envolvente	Combination	Max	0	1789.25	-956.57
V6	10.17	Envolvente	Combination	Max	0	1834.67	-1049.52
V6	10.17	Envolvente	Combination	Max	0	-1619.63	-1860.22
V6	10.27	Envolvente	Combination	Max	0	-1585.57	-1688.94
V6	10.27	Envolvente	Combination	Max	0	-1500.82	-1689
V6	10.8564	Envolvente	Combination	Max	0	-1301.1	-812.06
V6	11.4427	Envolvente	Combination	Max	0	-1101.39	-65.23
V6	12.0291	Envolvente	Combination	Max	0	-901.68	589.36
V6	12.6155	Envolvente	Combination	Max	0	-701.97	1194.53
V6	13.2018	Envolvente	Combination	Max	0	-497	1643.58
V6	13.7882	Envolvente	Combination	Max	0	-275.1	2139.66
V6	14.3745	Envolvente	Combination	Max	0	-53.2	2490.43
V6	14.9609	Envolvente	Combination	Max	0	168.7	2685.06
V6	15.5473	Envolvente	Combination	Max	0	432.48	2723.55
V6	16.1336	Envolvente	Combination	Max	0	698.76	2605.9
V6	16.72	Envolvente	Combination	Max	0	965.04	2332.12
V6	16.72	Envolvente	Combination	Max	0	1313.59	2332.34
V6	16.92	Envolvente	Combination	Max	0	1404.42	2060.54
V6	16.92	Envolvente	Combination	Max	0	1730.31	2060.77
V6	17.3988	Envolvente	Combination	Max	0	1947.72	1375.01
V6	17.8775	Envolvente	Combination	Max	0	2165.13	774.53
V6	18.3563	Envolvente	Combination	Max	0	2382.55	191.28
V6	18.835	Envolvente	Combination	Max	0	2599.96	-467.21
V6	0.175	Envolvente	Combination	Min	0	-1393.74	-1398.33
V6	0.7781	Envolvente	Combination	Min	0	-1119.85	-680.54
V6	1.3813	Envolvente	Combination	Min	0	-845.95	-145.54
V6	1.9844	Envolvente	Combination	Min	0	-572.06	251.8
V6	2.5875	Envolvente	Combination	Min	0	-316.43	504.95
V6	3.1906	Envolvente	Combination	Min	0	-88.19	416.17
V6	3.7937	Envolvente	Combination	Min	0	140.06	-78.23
V6	4.3969	Envolvente	Combination	Min	0	368.3	-749.27
V6	5	Envolvente	Combination	Min	0	596.55	-1639.47
V6	5	Envolvente	Combination	Min	0	676.85	-1639.47
V6	5.1	Envolvente	Combination	Min	0	714.69	-1816.55
V6	5.1	Envolvente	Combination	Min	0	-1238.28	-1395.97
V6	5.2	Envolvente	Combination	Min	0	-1192.87	-1274.44
V6	5.2	Envolvente	Combination	Min	0	-1101.51	-1274.49
V6	5.8088	Envolvente	Combination	Min	0	-825.06	-688.09
V6	6.4175	Envolvente	Combination	Min	0	-548.62	-275.14
V6	7.0262	Envolvente	Combination	Min	0	-274.23	-38.08
V6	7.635	Envolvente	Combination	Min	0	-43.86	-76.36
V6	8.2437	Envolvente	Combination	Min	0	186.51	-462.84
V6	8.8525	Envolvente	Combination	Min	0	416.89	-1064.31
V6	9.4613	Envolvente	Combination	Min	0	647.26	-1834.07
V6	10.07	Envolvente	Combination	Min	0	875.27	-2772.12
V6	10.07	Envolvente	Combination	Min	0	910.27	-2772.26
V6	10.17	Envolvente	Combination	Min	0	948.12	-2953.42
V6	10.17	Envolvente	Combination	Min	0	-2834.7	-3778.38

V6	10.27	Envolvente	Combination	Min	0	-2789.29	-3524.62
V6	10.27	Envolvente	Combination	Min	0	-2329.04	-3524.79
V6	10.8564	Envolvente	Combination	Min	0	-2062.76	-2238.68
V6	11.4427	Envolvente	Combination	Min	0	-1796.47	-1108.71
V6	12.0291	Envolvente	Combination	Min	0	-1530.19	-172.76
V6	12.6155	Envolvente	Combination	Min	0	-1263.91	526.36
V6	13.2018	Envolvente	Combination	Min	0	-997.63	1030.97
V6	13.7882	Envolvente	Combination	Min	0	-731.35	1393.68
V6	14.3745	Envolvente	Combination	Min	0	-465.07	1564.69
V6	14.9609	Envolvente	Combination	Min	0	-230.98	1566.48
V6	15.5473	Envolvente	Combination	Min	0	-9.08	1451.13
V6	16.1336	Envolvente	Combination	Min	0	212.82	1218.68
V6	16.72	Envolvente	Combination	Min	0	434.72	801
V6	16.72	Envolvente	Combination	Min	0	604.64	801.21
V6	16.92	Envolvente	Combination	Min	0	672.76	603.08
V6	16.92	Envolvente	Combination	Min	0	724.14	603.3
V6	17.3988	Envolvente	Combination	Min	0	887.2	20.9
V6	17.8775	Envolvente	Combination	Min	0	1050.26	-648.27
V6	18.3563	Envolvente	Combination	Min	0	1213.31	-1525.49
V6	18.835	Envolvente	Combination	Min	0	1376.37	-2518.3
VA	0.175	Envolvente	Combination	Max	0	-920.51	739.34
VA	0.4	Envolvente	Combination	Max	0	-843.88	939.14
VA	0.4	Envolvente	Combination	Max	0	-577.14	939.16
VA	0.9	Envolvente	Combination	Max	0	-406.85	1254.83
VA	1.4	Envolvente	Combination	Max	0	-236.55	1536.34
VA	1.4	Envolvente	Combination	Max	0	-209.96	1536.29
VA	1.9	Envolvente	Combination	Max	0	-39.66	1677.45
VA	2.4	Envolvente	Combination	Max	0	130.64	1706.36
VA	2.4	Envolvente	Combination	Max	0	28	1706.35
VA	2.9	Envolvente	Combination	Max	0	198.3	1766.18
VA	3.4	Envolvente	Combination	Max	0	401.6	1756.69
VA	3.4	Envolvente	Combination	Max	0	230.24	1756.68
VA	3.9	Envolvente	Combination	Max	0	456.18	1648.81
VA	4.4	Envolvente	Combination	Max	0	683.24	1427.41
VA	4.4	Envolvente	Combination	Max	0	557.96	1427.42
VA	4.9	Envolvente	Combination	Max	0	785.02	1116.47
VA	5.4	Envolvente	Combination	Max	0	1012.08	831.78
VA	5.4	Envolvente	Combination	Max	0	987.21	831.79
VA	5.9	Envolvente	Combination	Max	0	1214.27	552.05
VA	6.4	Envolvente	Combination	Max	0	1441.34	259.64
VA	6.4	Envolvente	Combination	Max	0	1566.63	259.67
VA	6.9	Envolvente	Combination	Max	0	1793.7	-67.59
VA	7.4	Envolvente	Combination	Max	0	2020.76	-477.65
VA	7.4	Envolvente	Combination	Max	0	2369.91	-477.7
VA	7.53	Envolvente	Combination	Max	0	2428.95	-613.16
VA	7.53	Envolvente	Combination	Max	0	-659.87	-291.8
VA	7.965	Envolvente	Combination	Max	0	-511.71	-35.6
VA	8.4	Envolvente	Combination	Max	0	-363.55	158.25
VA	8.4	Envolvente	Combination	Max	0	-309.34	158.26
VA	8.9	Envolvente	Combination	Max	0	-139.04	272.83

VA	9.4	Envolvente	Combination	Max	0	31.25	350.65
VA	9.4	Envolvente	Combination	Max	0	91.24	350.64
VA	9.9	Envolvente	Combination	Max	0	261.53	386.73
VA	10.4	Envolvente	Combination	Max	0	457.88	489.17
VA	10.4	Envolvente	Combination	Max	0	558.27	489.17
VA	10.9	Envolvente	Combination	Max	0	785.33	511.8
VA	11.4	Envolvente	Combination	Max	0	1012.39	454.62
VA	11.4	Envolvente	Combination	Max	0	1155.49	454.61
VA	11.98	Envolvente	Combination	Max	0	1418.88	285.56
VA	11.98	Envolvente	Combination	Max	0	89.88	751.33
VA	12.4	Envolvente	Combination	Max	0	232.93	683.66
VA	12.4	Envolvente	Combination	Max	0	289.81	683.67
VA	12.9	Envolvente	Combination	Max	0	460.1	525.37
VA	13.4	Envolvente	Combination	Max	0	630.4	413.43
VA	13.4	Envolvente	Combination	Max	0	703.15	413.41
VA	13.9	Envolvente	Combination	Max	0	884.82	765.13
VA	14.4	Envolvente	Combination	Max	0	1111.88	1104.27
VA	14.4	Envolvente	Combination	Max	0	1221.74	1104.26
VA	14.7575	Envolvente	Combination	Max	0	1384.09	1270.64
VA	15.115	Envolvente	Combination	Max	0	1546.44	1403.82
VA	0.175	Envolvente	Combination	Min	0	-2356.36	-1934.94
VA	0.4	Envolvente	Combination	Min	0	-2254.19	-1483.8
VA	0.4	Envolvente	Combination	Min	0	-1662.16	-1483.75
VA	0.9	Envolvente	Combination	Min	0	-1435.1	-779.68
VA	1.4	Envolvente	Combination	Min	0	-1208.03	-239.44
VA	1.4	Envolvente	Combination	Min	0	-1049.01	-239.47
VA	1.9	Envolvente	Combination	Min	0	-821.95	149.61
VA	2.4	Envolvente	Combination	Min	0	-594.89	452.25
VA	2.4	Envolvente	Combination	Min	0	-591.07	452.24
VA	2.9	Envolvente	Combination	Min	0	-364.01	661.5
VA	3.4	Envolvente	Combination	Min	0	-170.1	784.78
VA	3.4	Envolvente	Combination	Min	0	-237.56	784.77
VA	3.9	Envolvente	Combination	Min	0	-66.28	858.12
VA	4.4	Envolvente	Combination	Min	0	104.02	776.77
VA	4.4	Envolvente	Combination	Min	0	5.85	776.78
VA	4.9	Envolvente	Combination	Min	0	176.15	502.13
VA	5.4	Envolvente	Combination	Min	0	346.45	141.44
VA	5.4	Envolvente	Combination	Min	0	245.49	141.46
VA	5.9	Envolvente	Combination	Min	0	415.78	-294.57
VA	6.4	Envolvente	Combination	Min	0	586.08	-916.29
VA	6.4	Envolvente	Combination	Min	0	562.61	-916.25
VA	6.9	Envolvente	Combination	Min	0	732.91	-1746.14
VA	7.4	Envolvente	Combination	Min	0	903.2	-2691.91
VA	7.4	Envolvente	Combination	Min	0	1014.62	-2691.99
VA	7.53	Envolvente	Combination	Min	0	1058.89	-2992.95
VA	7.53	Envolvente	Combination	Min	0	-1916.44	-2575.04
VA	7.965	Envolvente	Combination	Min	0	-1718.89	-1785.73
VA	8.4	Envolvente	Combination	Min	0	-1521.35	-1084.47
VA	8.4	Envolvente	Combination	Min	0	-1326.31	-1084.45
VA	8.9	Envolvente	Combination	Min	0	-1099.25	-480.53

VA	9.4	Envolvente	Combination	Min	0	-872.19	-38.64
VA	9.4	Envolvente	Combination	Min	0	-702.79	-38.65
VA	9.9	Envolvente	Combination	Min	0	-475.73	206.03
VA	10.4	Envolvente	Combination	Min	0	-274.92	37.11
VA	10.4	Envolvente	Combination	Min	0	-217.45	37.12
VA	10.9	Envolvente	Combination	Min	0	-47.15	-255.36
VA	11.4	Envolvente	Combination	Min	0	123.14	-666.4
VA	11.4	Envolvente	Combination	Min	0	189.38	-666.42
VA	11.98	Envolvente	Combination	Min	0	386.92	-1411.07
VA	11.98	Envolvente	Combination	Min	0	-1855.67	-1747.67
VA	12.4	Envolvente	Combination	Min	0	-1664.94	-1008.46
VA	12.4	Envolvente	Combination	Min	0	-1547.9	-1008.43
VA	12.9	Envolvente	Combination	Min	0	-1320.84	-320.65
VA	13.4	Envolvente	Combination	Min	0	-1093.78	222.88
VA	13.4	Envolvente	Combination	Min	0	-1018.91	222.88
VA	13.9	Envolvente	Combination	Min	0	-803.72	-170.62
VA	14.4	Envolvente	Combination	Min	0	-633.42	-649.89
VA	14.4	Envolvente	Combination	Min	0	-631.24	-649.89
VA	14.7575	Envolvente	Combination	Min	0	-509.48	-1078.34
VA	15.115	Envolvente	Combination	Min	0	-387.71	-1574.31
VB	0.175	Envolvente	Combination	Max	0	-984.88	635.64
VB	0.4	Envolvente	Combination	Max	0	-908.24	849.82
VB	0.4	Envolvente	Combination	Max	0	-636.8	849.84
VB	0.9	Envolvente	Combination	Max	0	-466.51	1194.85
VB	1.4	Envolvente	Combination	Max	0	-296.21	1512.82
VB	1.4	Envolvente	Combination	Max	0	-247.72	1512.77
VB	1.9	Envolvente	Combination	Max	0	-77.43	1676
VB	2.4	Envolvente	Combination	Max	0	92.87	1772.01
VB	2.4	Envolvente	Combination	Max	0	4.19	1772
VB	2.9	Envolvente	Combination	Max	0	174.49	1893.68
VB	3.4	Envolvente	Combination	Max	0	374.46	1901.83
VB	3.4	Envolvente	Combination	Max	0	229.45	1901.82
VB	3.9	Envolvente	Combination	Max	0	456.51	1787.25
VB	4.4	Envolvente	Combination	Max	0	683.58	1559.14
VB	4.4	Envolvente	Combination	Max	0	575.22	1559.15
VB	4.9	Envolvente	Combination	Max	0	802.29	1219.42
VB	5.4	Envolvente	Combination	Max	0	1029.35	844.1
VB	5.4	Envolvente	Combination	Max	0	1129.28	844.11
VB	5.9	Envolvente	Combination	Max	0	1356.34	526.92
VB	6.4	Envolvente	Combination	Max	0	1583.4	203.31
VB	6.4	Envolvente	Combination	Max	0	1825.24	203.34
VB	6.9	Envolvente	Combination	Max	0	2052.3	-173.76
VB	7.4	Envolvente	Combination	Max	0	2279.37	-634.59
VB	7.4	Envolvente	Combination	Max	0	2790.7	-634.68
VB	7.53	Envolvente	Combination	Max	0	2849.73	-788.01
VB	7.53	Envolvente	Combination	Max	0	-743.06	-367.06
VB	7.965	Envolvente	Combination	Max	0	-594.9	-76.01
VB	8.4	Envolvente	Combination	Max	0	-446.74	150.62
VB	8.4	Envolvente	Combination	Max	0	-361.83	150.63
VB	8.9	Envolvente	Combination	Max	0	-191.53	289

VB	9.4	Envolvente	Combination	Max	0	-21.23	452.54
VB	9.4	Envolvente	Combination	Max	0	80.49	452.52
VB	9.9	Envolvente	Combination	Max	0	250.78	574.02
VB	10.4	Envolvente	Combination	Max	0	449.41	581.98
VB	10.4	Envolvente	Combination	Max	0	618.84	582.02
VB	10.9	Envolvente	Combination	Max	0	825.91	489.02
VB	11.4	Envolvente	Combination	Max	0	1052.97	399.59
VB	11.4	Envolvente	Combination	Max	0	1641.03	399.57
VB	11.98	Envolvente	Combination	Max	0	1904.42	162.66
VB	11.98	Envolvente	Combination	Max	0	-74.01	593.59
VB	12.4	Envolvente	Combination	Max	0	69.04	594.66
VB	12.4	Envolvente	Combination	Max	0	178.24	594.7
VB	12.9	Envolvente	Combination	Max	0	348.54	493.8
VB	13.4	Envolvente	Combination	Max	0	518.83	575.06
VB	13.4	Envolvente	Combination	Max	0	648.2	575.02
VB	13.9	Envolvente	Combination	Max	0	832.63	779.33
VB	14.4	Envolvente	Combination	Max	0	1059.69	1081.44
VB	14.4	Envolvente	Combination	Max	0	1229.08	1081.43
VB	14.7575	Envolvente	Combination	Max	0	1391.43	1192.74
VB	15.115	Envolvente	Combination	Max	0	1553.78	1277.45
VB	0.175	Envolvente	Combination	Min	0	-2489.86	-1907.6
VB	0.4	Envolvente	Combination	Min	0	-2387.68	-1444.85
VB	0.4	Envolvente	Combination	Min	0	-1734.77	-1444.8
VB	0.9	Envolvente	Combination	Min	0	-1507.71	-721.43
VB	1.4	Envolvente	Combination	Min	0	-1280.65	-169.07
VB	1.4	Envolvente	Combination	Min	0	-1061.92	-169.1
VB	1.9	Envolvente	Combination	Min	0	-834.85	223.24
VB	2.4	Envolvente	Combination	Min	0	-607.79	528.96
VB	2.4	Envolvente	Combination	Min	0	-590.6	528.95
VB	2.9	Envolvente	Combination	Min	0	-363.54	736.47
VB	3.4	Envolvente	Combination	Min	0	-166.3	857.72
VB	3.4	Envolvente	Combination	Min	0	-213.51	857.71
VB	3.9	Envolvente	Combination	Min	0	-43.21	919.63
VB	4.4	Envolvente	Combination	Min	0	127.09	819.64
VB	4.4	Envolvente	Combination	Min	0	43.66	819.65
VB	4.9	Envolvente	Combination	Min	0	213.96	538.62
VB	5.4	Envolvente	Combination	Min	0	384.25	171.51
VB	5.4	Envolvente	Combination	Min	0	314.7	171.52
VB	5.9	Envolvente	Combination	Min	0	484.99	-283.6
VB	6.4	Envolvente	Combination	Min	0	655.29	-930.68
VB	6.4	Envolvente	Combination	Min	0	663.93	-930.63
VB	6.9	Envolvente	Combination	Min	0	834.22	-1790.43
VB	7.4	Envolvente	Combination	Min	0	1004.52	-2765.18
VB	7.4	Envolvente	Combination	Min	0	1154.49	-2765.34
VB	7.53	Envolvente	Combination	Min	0	1198.77	-3069.54
VB	7.53	Envolvente	Combination	Min	0	-2145.59	-2544.91
VB	7.965	Envolvente	Combination	Min	0	-1948.05	-1752.42
VB	8.4	Envolvente	Combination	Min	0	-1750.5	-1045.89
VB	8.4	Envolvente	Combination	Min	0	-1340.61	-1045.86
VB	8.9	Envolvente	Combination	Min	0	-1113.54	-440.32

VB	9.4	Envolvente	Combination	Min	0	-886.48	-4.69
VB	9.4	Envolvente	Combination	Min	0	-676.14	-4.7
VB	9.9	Envolvente	Combination	Min	0	-449.07	247.51
VB	10.4	Envolvente	Combination	Min	0	-250.53	91.3
VB	10.4	Envolvente	Combination	Min	0	-153.66	91.32
VB	10.9	Envolvente	Combination	Min	0	16.63	-218.86
VB	11.4	Envolvente	Combination	Min	0	186.93	-649.85
VB	11.4	Envolvente	Combination	Min	0	309.48	-649.9
VB	11.98	Envolvente	Combination	Min	0	507.03	-1458.03
VB	11.98	Envolvente	Combination	Min	0	-1937.71	-1744.51
VB	12.4	Envolvente	Combination	Min	0	-1746.98	-970.75
VB	12.4	Envolvente	Combination	Min	0	-1561.43	-970.69
VB	12.9	Envolvente	Combination	Min	0	-1334.37	-277.75
VB	13.4	Envolvente	Combination	Min	0	-1107.31	245.5
VB	13.4	Envolvente	Combination	Min	0	-944.84	245.49
VB	13.9	Envolvente	Combination	Min	0	-732.36	-120.53
VB	14.4	Envolvente	Combination	Min	0	-562.06	-572.33
VB	14.4	Envolvente	Combination	Min	0	-497.39	-572.35
VB	14.7575	Envolvente	Combination	Min	0	-375.63	-996.2
VB	15.115	Envolvente	Combination	Min	0	-253.87	-1494.21
VC(1-3)	0.175	Envolvente	Combination	Max	0	-254.85	1092.34
VC(1-3)	0.6375	Envolvente	Combination	Max	0	-97.33	1232.69
VC(1-3)	1.1	Envolvente	Combination	Max	0	60.2	1331.86
VC(1-3)	1.1	Envolvente	Combination	Max	0	76.19	1331.86
VC(1-3)	1.6	Envolvente	Combination	Max	0	246.48	1312.24
VC(1-3)	2.1	Envolvente	Combination	Max	0	416.78	1338.12
VC(1-3)	2.1	Envolvente	Combination	Max	0	418.33	1338.11
VC(1-3)	2.6	Envolvente	Combination	Max	0	615.51	1308.22
VC(1-3)	3.1	Envolvente	Combination	Max	0	842.57	1164.8
VC(1-3)	3.1	Envolvente	Combination	Max	0	919.33	1164.82
VC(1-3)	3.6	Envolvente	Combination	Max	0	1146.4	1179.82
VC(1-3)	4.1	Envolvente	Combination	Max	0	1373.46	1091.79
VC(1-3)	4.1	Envolvente	Combination	Max	0	1522.83	1091.79
VC(1-3)	4.4325	Envolvente	Combination	Max	0	1673.83	975.59
VC(1-3)	4.765	Envolvente	Combination	Max	0	1824.83	885.59
VC(1-3)	0.175	Envolvente	Combination	Min	0	-1660.76	-1479.97
VC(1-3)	0.6375	Envolvente	Combination	Min	0	-1450.73	-819.92
VC(1-3)	1.1	Envolvente	Combination	Min	0	-1240.7	-287.96
VC(1-3)	1.1	Envolvente	Combination	Min	0	-1119.69	-287.96
VC(1-3)	1.6	Envolvente	Combination	Min	0	-892.62	154.22
VC(1-3)	2.1	Envolvente	Combination	Min	0	-665.56	510.06
VC(1-3)	2.1	Envolvente	Combination	Min	0	-626.35	510.05
VC(1-3)	2.6	Envolvente	Combination	Min	0	-426.47	681.67
VC(1-3)	3.1	Envolvente	Combination	Min	0	-256.17	346.08
VC(1-3)	3.1	Envolvente	Combination	Min	0	-260.24	346.1
VC(1-3)	3.6	Envolvente	Combination	Min	0	-89.94	-107.72
VC(1-3)	4.1	Envolvente	Combination	Min	0	80.35	-647.41
VC(1-3)	4.1	Envolvente	Combination	Min	0	97.82	-647.42
VC(1-3)	4.4325	Envolvente	Combination	Min	0	211.06	-1113.54
VC(1-3)	4.765	Envolvente	Combination	Min	0	324.31	-1694.19

VC(4-6)	0.175	Envolvente	Combination	Max	0	-212.98	946.52
VC(4-6)	0.5225	Envolvente	Combination	Max	0	-94.62	1004.24
VC(4-6)	0.87	Envolvente	Combination	Max	0	23.74	1082.89
VC(4-6)	0.87	Envolvente	Combination	Max	0	40.69	1082.89
VC(4-6)	1.37	Envolvente	Combination	Max	0	210.99	1078.9
VC(4-6)	1.87	Envolvente	Combination	Max	0	381.28	1072.88
VC(4-6)	1.87	Envolvente	Combination	Max	0	397.89	1072.86
VC(4-6)	2.37	Envolvente	Combination	Max	0	614.5	982.66
VC(4-6)	2.87	Envolvente	Combination	Max	0	841.57	778.91
VC(4-6)	2.87	Envolvente	Combination	Max	0	1008.46	778.97
VC(4-6)	3.37	Envolvente	Combination	Max	0	1235.52	454.69
VC(4-6)	3.87	Envolvente	Combination	Max	0	1462.59	308.71
VC(4-6)	3.87	Envolvente	Combination	Max	0	2157.18	308.69
VC(4-6)	4.45	Envolvente	Combination	Max	0	2420.57	-6.25
VC(4-6)	4.45	Envolvente	Combination	Max	0	-253.42	304.37
VC(4-6)	4.87	Envolvente	Combination	Max	0	-110.37	380.76
VC(4-6)	4.87	Envolvente	Combination	Max	0	32.26	380.81
VC(4-6)	5.37	Envolvente	Combination	Max	0	202.56	329.44
VC(4-6)	5.87	Envolvente	Combination	Max	0	372.85	537.37
VC(4-6)	5.87	Envolvente	Combination	Max	0	535.25	537.32
VC(4-6)	6.37	Envolvente	Combination	Max	0	707.7	745.54
VC(4-6)	6.87	Envolvente	Combination	Max	0	934.76	1033.21
VC(4-6)	6.87	Envolvente	Combination	Max	0	1136.05	1033.2
VC(4-6)	7.315	Envolvente	Combination	Max	0	1338.14	1134.2
VC(4-6)	7.76	Envolvente	Combination	Max	0	1540.22	1208.24
VC(4-6)	7.76	Envolvente	Combination	Max	0	-3.41	-0.02
VC(4-6)	7.77	Envolvente	Combination	Max	0	0	0
VC(4-6)	0.175	Envolvente	Combination	Min	0	-1537.53	-1473.96
VC(4-6)	0.5225	Envolvente	Combination	Min	0	-1379.72	-972.75
VC(4-6)	0.87	Envolvente	Combination	Min	0	-1222.28	-587.73
VC(4-6)	0.87	Envolvente	Combination	Min	0	-1062.92	-587.71
VC(4-6)	1.37	Envolvente	Combination	Min	0	-835.86	-171.81
VC(4-6)	1.87	Envolvente	Combination	Min	0	-608.8	158.91
VC(4-6)	1.87	Envolvente	Combination	Min	0	-470.07	158.9
VC(4-6)	2.37	Envolvente	Combination	Min	0	-289.57	346.15
VC(4-6)	2.87	Envolvente	Combination	Min	0	-119.27	233.08
VC(4-6)	2.87	Envolvente	Combination	Min	0	-30.52	233.1
VC(4-6)	3.37	Envolvente	Combination	Min	0	139.78	-219.76
VC(4-6)	3.87	Envolvente	Combination	Min	0	310.07	-832.57
VC(4-6)	3.87	Envolvente	Combination	Min	0	444.13	-832.61
VC(4-6)	4.45	Envolvente	Combination	Min	0	641.68	-1855.26
VC(4-6)	4.45	Envolvente	Combination	Min	0	-2163.95	-1787.4
VC(4-6)	4.87	Envolvente	Combination	Min	0	-1973.22	-998.19
VC(4-6)	4.87	Envolvente	Combination	Min	0	-1569.54	-998.12
VC(4-6)	5.37	Envolvente	Combination	Min	0	-1342.48	-277.62
VC(4-6)	5.87	Envolvente	Combination	Min	0	-1115.42	178.22
VC(4-6)	5.87	Envolvente	Combination	Min	0	-915.93	178.21
VC(4-6)	6.37	Envolvente	Combination	Min	0	-691.43	-131.96
VC(4-6)	6.87	Envolvente	Combination	Min	0	-521.13	-527.31
VC(4-6)	6.87	Envolvente	Combination	Min	0	-429.23	-527.32

VC(4-6)	7.315	Envolvente	Combination	Min	0	-277.67	-1021.73
VC(4-6)	7.76	Envolvente	Combination	Min	0	-126.11	-1645.75
VC(4-6)	7.76	Envolvente	Combination	Min	0	-4.54	-0.02
VC(4-6)	7.77	Envolvente	Combination	Min	0	0	0
VD	0.175	Envolvente	Combination	Max	0	-385.79	1190.49
VD	0.6375	Envolvente	Combination	Max	0	-228.27	1448.13
VD	1.1	Envolvente	Combination	Max	0	-70.74	1608.74
VD	1.1	Envolvente	Combination	Max	0	57.23	1608.75
VD	1.6	Envolvente	Combination	Max	0	227.53	1670.72
VD	2.1	Envolvente	Combination	Max	0	397.82	1844.52
VD	2.1	Envolvente	Combination	Max	0	523.83	1844.52
VD	2.6	Envolvente	Combination	Max	0	750.9	1626
VD	3.1	Envolvente	Combination	Max	0	977.96	1293.95
VD	3.1	Envolvente	Combination	Max	0	1424.13	1293.97
VD	3.6	Envolvente	Combination	Max	0	1651.2	571.67
VD	4.1	Envolvente	Combination	Max	0	1878.26	261.24
VD	4.1	Envolvente	Combination	Max	0	2455	261.23
VD	4.52	Envolvente	Combination	Max	0	2645.73	-65.2
VD	4.94	Envolvente	Combination	Max	0	2836.46	-451.65
VD	4.94	Envolvente	Combination	Max	0	-836.12	-269.83
VD	5.1	Envolvente	Combination	Max	0	-781.62	-140.1
VD	5.1	Envolvente	Combination	Max	0	-578.72	-140.03
VD	5.6	Envolvente	Combination	Max	0	-408.42	108.39
VD	6.1	Envolvente	Combination	Max	0	-238.13	275.88
VD	6.1	Envolvente	Combination	Max	0	-137.38	275.86
VD	6.6	Envolvente	Combination	Max	0	32.92	384.54
VD	7.1	Envolvente	Combination	Max	0	203.22	677.46
VD	7.1	Envolvente	Combination	Max	0	320.45	677.45
VD	7.6	Envolvente	Combination	Max	0	500.49	940.84
VD	8.1	Envolvente	Combination	Max	0	727.55	1091.68
VD	8.1	Envolvente	Combination	Max	0	864	1091.73
VD	8.5775	Envolvente	Combination	Max	0	1080.84	1108.55
VD	9.055	Envolvente	Combination	Max	0	1297.68	1041.1
VD	0.175	Envolvente	Combination	Min	0	-1761.92	-1097.45
VD	0.6375	Envolvente	Combination	Min	0	-1551.89	-547.35
VD	1.1	Envolvente	Combination	Min	0	-1341.86	-70.21
VD	1.1	Envolvente	Combination	Min	0	-887.57	-70.21
VD	1.6	Envolvente	Combination	Min	0	-660.51	271.45
VD	2.1	Envolvente	Combination	Min	0	-433.45	527.68
VD	2.1	Envolvente	Combination	Min	0	-284.84	527.68
VD	2.6	Envolvente	Combination	Min	0	-114.54	626.36
VD	3.1	Envolvente	Combination	Min	0	55.75	498.52
VD	3.1	Envolvente	Combination	Min	0	213.17	498.53
VD	3.6	Envolvente	Combination	Min	0	383.46	-41.19
VD	4.1	Envolvente	Combination	Min	0	553.76	-734.07
VD	4.1	Envolvente	Combination	Min	0	705.37	-734.09
VD	4.52	Envolvente	Combination	Min	0	848.41	-1581.13
VD	4.94	Envolvente	Combination	Min	0	991.46	-2579.69
VD	4.94	Envolvente	Combination	Min	0	-2408.07	-2255.17
VD	5.1	Envolvente	Combination	Min	0	-2335.41	-1910.65

VD	5.1	Envolvente	Combination	Min	0	-1833.47	-1910.54
VD	5.6	Envolvente	Combination	Min	0	-1606.4	-1052.21
VD	6.1	Envolvente	Combination	Min	0	-1379.34	-311.62
VD	6.1	Envolvente	Combination	Min	0	-1205.85	-311.66
VD	6.6	Envolvente	Combination	Min	0	-978.78	151.89
VD	7.1	Envolvente	Combination	Min	0	-751.72	232.6
VD	7.1	Envolvente	Combination	Min	0	-648.58	232.6
VD	7.6	Envolvente	Combination	Min	0	-431.52	33.92
VD	8.1	Envolvente	Combination	Min	0	-261.22	-250.87
VD	8.1	Envolvente	Combination	Min	0	-245.91	-250.85
VD	8.5775	Envolvente	Combination	Min	0	-83.28	-653.55
VD	9.055	Envolvente	Combination	Min	0	79.35	-1152.55
VE	0.175	Envolvente	Combination	Max	0	-1117.4	-120.12
VE	0.6375	Envolvente	Combination	Max	0	-959.87	361.18
VE	1.1	Envolvente	Combination	Max	0	-802.35	799.48
VE	1.1	Envolvente	Combination	Max	0	-704.61	799.47
VE	1.6	Envolvente	Combination	Max	0	-534.32	1253.89
VE	2.1	Envolvente	Combination	Max	0	-364.02	1596.58
VE	2.1	Envolvente	Combination	Max	0	-393.09	1596.57
VE	2.6	Envolvente	Combination	Max	0	-222.79	1969.33
VE	3.1	Envolvente	Combination	Max	0	-52.5	2285.61
VE	3.1	Envolvente	Combination	Max	0	-113.64	2285.59
VE	3.6	Envolvente	Combination	Max	0	56.66	2438.79
VE	4.1	Envolvente	Combination	Max	0	251.61	2478.47
VE	4.1	Envolvente	Combination	Max	0	73.7	2478.46
VE	4.6	Envolvente	Combination	Max	0	283.49	2445.87
VE	5.1	Envolvente	Combination	Max	0	510.56	2299.74
VE	5.1	Envolvente	Combination	Max	0	392.49	2299.76
VE	5.6	Envolvente	Combination	Max	0	619.55	2046.75
VE	6.1	Envolvente	Combination	Max	0	846.61	1680.2
VE	6.1	Envolvente	Combination	Max	0	855.52	1680.22
VE	6.6	Envolvente	Combination	Max	0	1082.58	1195.7
VE	7.1	Envolvente	Combination	Max	0	1309.64	662.93
VE	7.1	Envolvente	Combination	Max	0	1494.07	662.94
VE	7.6	Envolvente	Combination	Max	0	1721.13	217.74
VE	8.1	Envolvente	Combination	Max	0	1948.19	-204.43
VE	8.1	Envolvente	Combination	Max	0	2198.83	-204.39
VE	8.6	Envolvente	Combination	Max	0	2425.89	-724.99
VE	9.1	Envolvente	Combination	Max	0	2652.96	-1330.18
VE	9.1	Envolvente	Combination	Max	0	3097.33	-1330.29
VE	9.23	Envolvente	Combination	Max	0	3156.37	-1522.98
VE	9.23	Envolvente	Combination	Max	0	-795.91	-728.68
VE	9.665	Envolvente	Combination	Max	0	-647.76	-414.51
VE	10.1	Envolvente	Combination	Max	0	-499.6	-164.57
VE	10.1	Envolvente	Combination	Max	0	-437.74	-164.56
VE	10.6	Envolvente	Combination	Max	0	-267.44	12.03
VE	11.1	Envolvente	Combination	Max	0	-97.15	104.75
VE	11.1	Envolvente	Combination	Max	0	-72.07	104.74
VE	11.6	Envolvente	Combination	Max	0	98.23	131.47
VE	12.1	Envolvente	Combination	Max	0	268.52	354.49

VE	12.1	Envolvente	Combination	Max	0	307.35	354.49
VE	12.6	Envolvente	Combination	Max	0	532.29	457.28
VE	13.1	Envolvente	Combination	Max	0	759.35	450.78
VE	13.1	Envolvente	Combination	Max	0	821.51	450.78
VE	13.68	Envolvente	Combination	Max	0	1084.9	368.42
VE	13.68	Envolvente	Combination	Max	0	70.77	703.37
VE	14.1	Envolvente	Combination	Max	0	213.82	643.71
VE	14.1	Envolvente	Combination	Max	0	229.49	643.71
VE	14.6	Envolvente	Combination	Max	0	399.78	538.96
VE	15.1	Envolvente	Combination	Max	0	570.08	372.72
VE	15.1	Envolvente	Combination	Max	0	581.39	372.7
VE	15.6	Envolvente	Combination	Max	0	780.63	662.01
VE	16.1	Envolvente	Combination	Max	0	1007.7	878.86
VE	16.1	Envolvente	Combination	Max	0	1058.12	878.86
VE	16.4575	Envolvente	Combination	Max	0	1220.47	970.16
VE	16.815	Envolvente	Combination	Max	0	1382.82	1044.28
VE	0.175	Envolvente	Combination	Min	0	-2323.41	-2294.11
VE	0.6375	Envolvente	Combination	Min	0	-2113.38	-1381.04
VE	1.1	Envolvente	Combination	Min	0	-1903.34	-595.36
VE	1.1	Envolvente	Combination	Min	0	-1575.15	-595.36
VE	1.6	Envolvente	Combination	Min	0	-1348.09	-55.78
VE	2.1	Envolvente	Combination	Min	0	-1121.03	396.84
VE	2.1	Envolvente	Combination	Min	0	-973.14	396.83
VE	2.6	Envolvente	Combination	Min	0	-746.08	735.38
VE	3.1	Envolvente	Combination	Min	0	-519.02	988.14
VE	3.1	Envolvente	Combination	Min	0	-508.15	988.13
VE	3.6	Envolvente	Combination	Min	0	-281.09	1152.03
VE	4.1	Envolvente	Combination	Min	0	-78.77	1230.61
VE	4.1	Envolvente	Combination	Min	0	-194.25	1230.6
VE	4.6	Envolvente	Combination	Min	0	-6.76	1274.74
VE	5.1	Envolvente	Combination	Min	0	163.54	1222.18
VE	5.1	Envolvente	Combination	Min	0	57.16	1222.19
VE	5.6	Envolvente	Combination	Min	0	227.45	1036.44
VE	6.1	Envolvente	Combination	Min	0	397.75	765.05
VE	6.1	Envolvente	Combination	Min	0	287.72	765.06
VE	6.6	Envolvente	Combination	Min	0	458.02	448.84
VE	7.1	Envolvente	Combination	Min	0	628.32	47.17
VE	7.1	Envolvente	Combination	Min	0	583.26	47.19
VE	7.6	Envolvente	Combination	Min	0	753.56	-494.53
VE	8.1	Envolvente	Combination	Min	0	923.86	-1258.09
VE	8.1	Envolvente	Combination	Min	0	954.45	-1258.04
VE	8.6	Envolvente	Combination	Min	0	1124.75	-2279.58
VE	9.1	Envolvente	Combination	Min	0	1295.05	-3549.29
VE	9.1	Envolvente	Combination	Min	0	1459.44	-3549.59
VE	9.23	Envolvente	Combination	Min	0	1503.72	-3956.08
VE	9.23	Envolvente	Combination	Min	0	-2001.03	-2900.66
VE	9.665	Envolvente	Combination	Min	0	-1803.49	-2096.25
VE	10.1	Envolvente	Combination	Min	0	-1605.95	-1377.99
VE	10.1	Envolvente	Combination	Min	0	-1373.17	-1377.97
VE	10.6	Envolvente	Combination	Min	0	-1146.1	-748.45

VE	11.1	Envolvente	Combination	Min	0	-919.04	-233.73
VE	11.1	Envolvente	Combination	Min	0	-813.71	-233.75
VE	11.6	Envolvente	Combination	Min	0	-586.65	83.06
VE	12.1	Envolvente	Combination	Min	0	-359.59	4.92
VE	12.1	Envolvente	Combination	Min	0	-321.43	4.92
VE	12.6	Envolvente	Combination	Min	0	-149.2	-190.16
VE	13.1	Envolvente	Combination	Min	0	21.1	-474.37
VE	13.1	Envolvente	Combination	Min	0	41.76	-474.39
VE	13.68	Envolvente	Combination	Min	0	239.3	-1026.4
VE	13.68	Envolvente	Combination	Min	0	-1492.28	-1268.12
VE	14.1	Envolvente	Combination	Min	0	-1301.55	-681.51
VE	14.1	Envolvente	Combination	Min	0	-1239.53	-681.49
VE	14.6	Envolvente	Combination	Min	0	-1012.47	-171.25
VE	15.1	Envolvente	Combination	Min	0	-785.41	239.13
VE	15.1	Envolvente	Combination	Min	0	-774.61	239.13
VE	15.6	Envolvente	Combination	Min	0	-576.87	-89.85
VE	16.1	Envolvente	Combination	Min	0	-406.58	-508.11
VE	16.1	Envolvente	Combination	Min	0	-427.08	-508.11
VE	16.4575	Envolvente	Combination	Min	0	-305.32	-875.94
VE	16.815	Envolvente	Combination	Min	0	-183.56	-1327.48
VF	0.175	Envolvente	Combination	Max	0	-1424.53	-294.35
VF	0.6375	Envolvente	Combination	Max	0	-1267.01	328.08
VF	1.1	Envolvente	Combination	Max	0	-1109.48	942.13
VF	1.1	Envolvente	Combination	Max	0	-900.1	942.13
VF	1.6	Envolvente	Combination	Max	0	-729.81	1521.29
VF	2.1	Envolvente	Combination	Max	0	-559.51	2394.53
VF	2.1	Envolvente	Combination	Max	0	-494.38	2394.51
VF	2.6	Envolvente	Combination	Max	0	-324.08	2984.7
VF	3.1	Envolvente	Combination	Max	0	-153.79	3461.37
VF	3.1	Envolvente	Combination	Max	0	-110.27	3461.34
VF	3.6	Envolvente	Combination	Max	0	60.03	3604.31
VF	4.1	Envolvente	Combination	Max	0	257.46	3633.76
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VF	4.6	Envolvente	Combination	Max	0	390.29	3495.36
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VF	5.6	Envolvente	Combination	Max	0	999.9	2800.27
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VF	6.6	Envolvente	Combination	Max	0	1542.42	1529.12
VF	7.1	Envolvente	Combination	Max	0	1769.48	701.15
VF	7.1	Envolvente	Combination	Max	0	2073.87	701.16
VF	7.6	Envolvente	Combination	Max	0	2300.93	128.71
VF	8.1	Envolvente	Combination	Max	0	2528	-394.03
VF	8.1	Envolvente	Combination	Max	0	2928.86	-393.98
VF	8.6	Envolvente	Combination	Max	0	3155.92	-1044.54
VF	9.1	Envolvente	Combination	Max	0	3382.98	-1780.24
VF	9.1	Envolvente	Combination	Max	0	4090.92	-1780.4
VF	9.23	Envolvente	Combination	Max	0	4149.96	-2017.8
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VF	9.665	Envolvente	Combination	Max	0	-755.6	-656.61
VF	10.1	Envolvente	Combination	Max	0	-607.45	-359.81
VF	10.1	Envolvente	Combination	Max	0	-478.92	-359.79
VF	10.6	Envolvente	Combination	Max	0	-308.62	-162.29
VF	11.1	Envolvente	Combination	Max	0	-138.32	-47.25
VF	11.1	Envolvente	Combination	Max	0	-29.22	-47.26
VF	11.6	Envolvente	Combination	Max	0	141.08	301.35
VF	12.1	Envolvente	Combination	Max	0	311.38	655.61
VF	12.1	Envolvente	Combination	Max	0	405.94	655.61
VF	12.6	Envolvente	Combination	Max	0	613.82	867.62
VF	13.1	Envolvente	Combination	Max	0	840.88	966.49
VF	13.1	Envolvente	Combination	Max	0	949.2	966.48
VF	13.505	Envolvente	Combination	Max	0	1118.37	967.47
VF	0.175	Envolvente	Combination	Min	0	-3369.49	-2525.09
VF	0.6375	Envolvente	Combination	Min	0	-3159.46	-1404.27
VF	1.1	Envolvente	Combination	Min	0	-2949.42	-489.6
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VF	1.6	Envolvente	Combination	Min	0	-1997.11	132.71
VF	2.1	Envolvente	Combination	Min	0	-1770.05	669.87
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VF	2.6	Envolvente	Combination	Min	0	-1066.86	1052.15
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VF	3.6	Envolvente	Combination	Min	0	-267.08	1510.58
VF	4.1	Envolvente	Combination	Min	0	-67.24	1586.73
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VF	4.6	Envolvente	Combination	Min	0	58.03	1600.19
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VF	9.1	Envolvente	Combination	Min	0	1556.49	-4755.57
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VF	9.23	Envolvente	Combination	Min	0	1848.01	-5291.69
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VF	9.665	Envolvente	Combination	Min	0	-2486.79	-2774.02
VF	10.1	Envolvente	Combination	Min	0	-2289.24	-1735.23
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VF	10.6	Envolvente	Combination	Min	0	-1569.17	-893.81
VF	11.1	Envolvente	Combination	Min	0	-1342.11	-171.87
VF	11.1	Envolvente	Combination	Min	0	-1050.18	-171.9
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VF	13.505	Envolvente	Combination	Min	0	-6.7	-1153.31
VG	0.175	Envolvente	Combination	Max	0	-1373.22	-210.19
VG	0.6375	Envolvente	Combination	Max	0	-1215.69	388.5
VG	1.1	Envolvente	Combination	Max	0	-1058.17	992.6
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VG	2.1	Envolvente	Combination	Max	0	-525.74	2382.39
VG	2.1	Envolvente	Combination	Max	0	-477.6	2382.36
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VG	3.6	Envolvente	Combination	Max	0	61.52	3517.21
VG	4.1	Envolvente	Combination	Max	0	259.56	3540.33
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VG	4.6	Envolvente	Combination	Max	0	363.61	3415.27
VG	5.1	Envolvente	Combination	Max	0	590.67	3176.69
VG	5.1	Envolvente	Combination	Max	0	713.1	3176.7
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VG	11.6	Envolvente	Combination	Max	0	141.19	156.49
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VG	13.1	Envolvente	Combination	Max	0	686.42	951.34
VG	13.505	Envolvente	Combination	Max	0	870.34	1061.45
VG	0.175	Envolvente	Combination	Min	0	-3167.66	-2365.92

VG	0.6375	Envolvente	Combination	Min	0	-2957.62	-1316.82
VG	1.1	Envolvente	Combination	Min	0	-2747.59	-443.52
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VG	1.6	Envolvente	Combination	Min	0	-1865.82	164.31
VG	2.1	Envolvente	Combination	Min	0	-1638.76	686.99
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VG	3.1	Envolvente	Combination	Min	0	-771.16	1352.01
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VG	3.6	Envolvente	Combination	Min	0	-264.33	1512.26
VG	4.1	Envolvente	Combination	Min	0	-65.1	1587.37
VG	4.1	Envolvente	Combination	Min	0	-120.22	1587.36
VG	4.6	Envolvente	Combination	Min	0	50.07	1604.86
VG	5.1	Envolvente	Combination	Min	0	220.37	1536.88
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VG	5.6	Envolvente	Combination	Min	0	333.89	1323.11
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VG	6.6	Envolvente	Combination	Min	0	591.16	625.09
VG	7.1	Envolvente	Combination	Min	0	761.45	164.24
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VG	8.6	Envolvente	Combination	Min	0	1343.01	-2799.97
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VG	9.23	Envolvente	Combination	Min	0	1780.73	-4825.86
VG	9.23	Envolvente	Combination	Min	0	-2258.16	-3681.66
VG	9.665	Envolvente	Combination	Min	0	-2060.62	-2742.33
VG	10.1	Envolvente	Combination	Min	0	-1863.07	-1888.93
VG	10.1	Envolvente	Combination	Min	0	-1607.16	-1888.88
VG	10.6	Envolvente	Combination	Min	0	-1380.1	-1180.61
VG	11.1	Envolvente	Combination	Min	0	-1153.04	-585.86
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VG	12.1	Envolvente	Combination	Min	0	-620.89	-319.19
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VG	13.1	Envolvente	Combination	Min	0	-280.05	-822.31
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VG	13.505	Envolvente	Combination	Min	0	-255.57	-1115.73
VH	0.175	Envolvente	Combination	Max	0	-1537.59	-411.77
VH	0.6375	Envolvente	Combination	Max	0	-1380.06	263.11
VH	1.1	Envolvente	Combination	Max	0	-1222.54	914.08
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VH	1.6	Envolvente	Combination	Max	0	-815.74	1555.89
VH	2.1	Envolvente	Combination	Max	0	-645.45	2648.33
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VH	2.6	Envolvente	Combination	Max	0	-392.7	3364.44

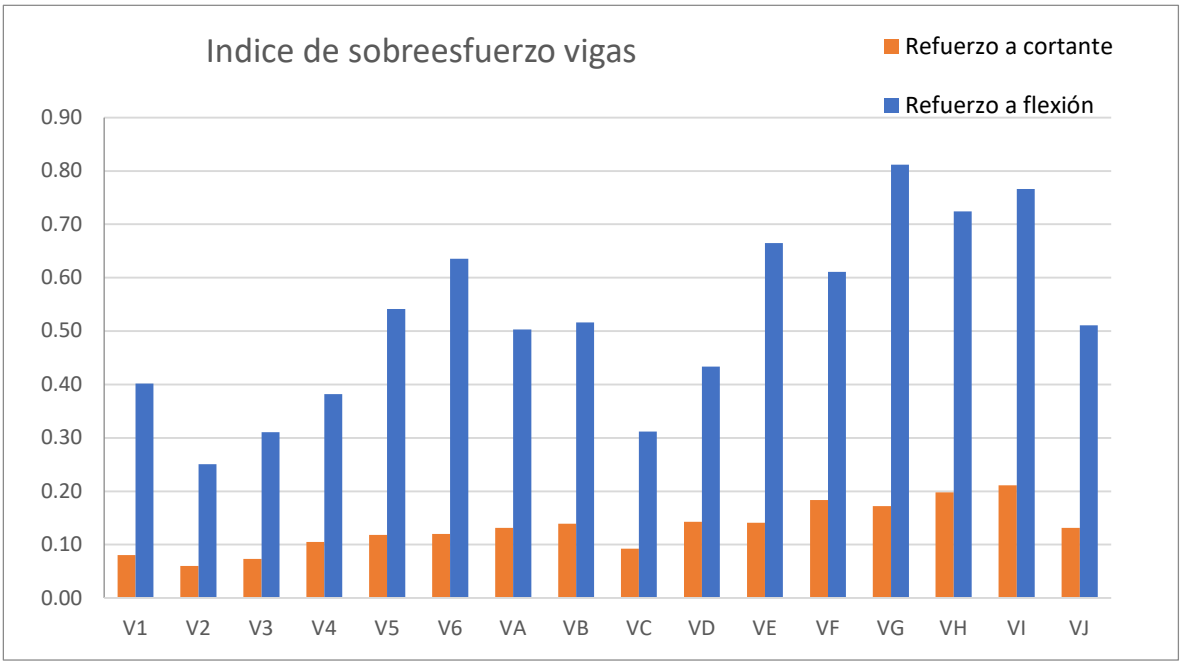
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VH	6.1	Envolvente	Combination	Max	0	1064.18	3247.64
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VH	7.1	Envolvente	Combination	Max	0	1569.61	1905.1
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VH	8.1	Envolvente	Combination	Max	0	2365.58	567.29
VH	8.1	Envolvente	Combination	Max	0	2928.98	567.32
VH	8.5775	Envolvente	Combination	Max	0	3145.82	43.87
VH	9.055	Envolvente	Combination	Max	0	3362.67	-557.08
VH	0.175	Envolvente	Combination	Min	0	-3818.6	-3020.57
VH	0.6375	Envolvente	Combination	Min	0	-3608.56	-1610.46
VH	1.1	Envolvente	Combination	Min	0	-3398.53	-570.73
VH	1.1	Envolvente	Combination	Min	0	-2558.02	-570.73
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VH	2.1	Envolvente	Combination	Min	0	-2103.9	735.87
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VH	3.6	Envolvente	Combination	Min	0	-389.22	1745.18
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VH	8.1	Envolvente	Combination	Min	0	897.53	-794.39
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VH	8.5775	Envolvente	Combination	Min	0	1176.56	-1828.01
VH	9.055	Envolvente	Combination	Min	0	1339.19	-3237.57
VI	0.175	Envolvente	Combination	Max	0	-1587.44	-445.1
VI	0.6375	Envolvente	Combination	Max	0	-1429.92	253
VI	1.1	Envolvente	Combination	Max	0	-1272.4	923.46
VI	1.1	Envolvente	Combination	Max	0	-1020.33	923.46

VI	1.6	Envolvente	Combination	Max	0	-850.03	1590.59
VI	2.1	Envolvente	Combination	Max	0	-679.74	2744.91
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VI	2.6	Envolvente	Combination	Max	0	-414.85	3513.56
VI	3.1	Envolvente	Combination	Max	0	-244.56	4168.7
VI	3.1	Envolvente	Combination	Max	0	-167.34	4168.67
VI	3.6	Envolvente	Combination	Max	0	2.96	4419.85
VI	4.1	Envolvente	Combination	Max	0	173.26	4557.51
VI	4.1	Envolvente	Combination	Max	0	86.47	4557.48
VI	4.6	Envolvente	Combination	Max	0	288.19	4507.04
VI	5.1	Envolvente	Combination	Max	0	515.25	4343.08
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VI	5.6	Envolvente	Combination	Max	0	875.82	3961.93
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VI	8.1	Envolvente	Combination	Max	0	2488.29	652.7
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VI	8.5775	Envolvente	Combination	Max	0	3298.59	120.11
VI	9.055	Envolvente	Combination	Max	0	3515.44	-489.55
VI	0.175	Envolvente	Combination	Min	0	-4038.73	-3285.27
VI	0.6375	Envolvente	Combination	Min	0	-3828.7	-1696.77
VI	1.1	Envolvente	Combination	Min	0	-3618.67	-606.48
VI	1.1	Envolvente	Combination	Min	0	-2715.68	-606.48
VI	1.6	Envolvente	Combination	Min	0	-2488.61	119.66
VI	2.1	Envolvente	Combination	Min	0	-2261.55	760.38
VI	2.1	Envolvente	Combination	Min	0	-1650.88	760.36
VI	2.6	Envolvente	Combination	Min	0	-1423.82	1224.65
VI	3.1	Envolvente	Combination	Min	0	-1196.76	1603.05
VI	3.1	Envolvente	Combination	Min	0	-646.22	1603.04
VI	3.6	Envolvente	Combination	Min	0	-419.16	1823.49
VI	4.1	Envolvente	Combination	Min	0	-213.4	1956.93
VI	4.1	Envolvente	Combination	Min	0	-263.47	1956.92
VI	4.6	Envolvente	Combination	Min	0	-67.93	2028.36
VI	5.1	Envolvente	Combination	Min	0	102.36	1879.67
VI	5.1	Envolvente	Combination	Min	0	39.75	1879.68
VI	5.6	Envolvente	Combination	Min	0	210.04	1650.56
VI	6.1	Envolvente	Combination	Min	0	380.34	1335.49
VI	6.1	Envolvente	Combination	Min	0	254.4	1335.5
VI	6.6	Envolvente	Combination	Min	0	424.7	960.72
VI	7.1	Envolvente	Combination	Min	0	595	500.25
VI	7.1	Envolvente	Combination	Min	0	571.82	500.27
VI	7.6	Envolvente	Combination	Min	0	742.11	-97.13
VI	8.1	Envolvente	Combination	Min	0	912.41	-801.31
VI	8.1	Envolvente	Combination	Min	0	1029.9	-801.28
VI	8.5775	Envolvente	Combination	Min	0	1192.53	-1864.26
VI	9.055	Envolvente	Combination	Min	0	1355.17	-3356.88

VJ	0.175	Envolvente	Combination	Max	0	-1256.97	-92.91
VJ	0.6375	Envolvente	Combination	Max	0	-1099.45	453.04
VJ	1.1	Envolvente	Combination	Max	0	-941.92	982.56
VJ	1.1	Envolvente	Combination	Max	0	-804.24	982.55
VJ	1.6	Envolvente	Combination	Max	0	-633.94	1508.23
VJ	2.1	Envolvente	Combination	Max	0	-463.64	1929.74
VJ	2.1	Envolvente	Combination	Max	0	-462.73	1929.72
VJ	2.6	Envolvente	Combination	Max	0	-292.44	2426.45
VJ	3.1	Envolvente	Combination	Max	0	-122.14	2809.65
VJ	3.1	Envolvente	Combination	Max	0	-131.48	2809.63
VJ	3.6	Envolvente	Combination	Max	0	38.82	2980.71
VJ	4.1	Envolvente	Combination	Max	0	218.99	3038.25
VJ	4.1	Envolvente	Combination	Max	0	71.06	3038.23
VJ	4.6	Envolvente	Combination	Max	0	268.75	3019.55
VJ	5.1	Envolvente	Combination	Max	0	495.81	2887.33
VJ	5.1	Envolvente	Combination	Max	0	354.07	2887.33
VJ	5.6	Envolvente	Combination	Max	0	581.13	2663.25
VJ	6.1	Envolvente	Combination	Max	0	808.19	2325.64
VJ	6.1	Envolvente	Combination	Max	0	694.07	2325.65
VJ	6.6	Envolvente	Combination	Max	0	921.14	1921.84
VJ	7.1	Envolvente	Combination	Max	0	1148.2	1523.89
VJ	7.1	Envolvente	Combination	Max	0	1243.84	1523.91
VJ	7.6	Envolvente	Combination	Max	0	1470.91	1163.26
VJ	8.1	Envolvente	Combination	Max	0	1697.97	702.48

VJ	8.1	Envolvente	Combination	Max	0	1893.85	702.51
VJ	8.5775	Envolvente	Combination	Max	0	2110.69	312.26
VJ	9.055	Envolvente	Combination	Max	0	2327.53	-154.49
VJ	0.175	Envolvente	Combination	Min	0	-2599.31	-2529.45
VJ	0.6375	Envolvente	Combination	Min	0	-2389.28	-1482.25
VJ	1.1	Envolvente	Combination	Min	0	-2179.25	-589.07
VJ	1.1	Envolvente	Combination	Min	0	-1772.99	-589.07
VJ	1.6	Envolvente	Combination	Min	0	-1545.93	37.52
VJ	2.1	Envolvente	Combination	Min	0	-1318.87	578.19
VJ	2.1	Envolvente	Combination	Min	0	-1124.07	578.18
VJ	2.6	Envolvente	Combination	Min	0	-897.01	981.9
VJ	3.1	Envolvente	Combination	Min	0	-669.94	1299.28
VJ	3.1	Envolvente	Combination	Min	0	-593.67	1299.26
VJ	3.6	Envolvente	Combination	Min	0	-366.61	1498.64
VJ	4.1	Envolvente	Combination	Min	0	-149.53	1611.68
VJ	4.1	Envolvente	Combination	Min	0	-276.31	1611.66
VJ	4.6	Envolvente	Combination	Min	0	-76.73	1688.62
VJ	5.1	Envolvente	Combination	Min	0	93.56	1559.62
VJ	5.1	Envolvente	Combination	Min	0	-32.13	1559.63
VJ	5.6	Envolvente	Combination	Min	0	138.17	1368.35
VJ	6.1	Envolvente	Combination	Min	0	308.46	1090.59
VJ	6.1	Envolvente	Combination	Min	0	137.91	1090.61
VJ	6.6	Envolvente	Combination	Min	0	308.21	768.93
VJ	7.1	Envolvente	Combination	Min	0	478.51	360.34
VJ	7.1	Envolvente	Combination	Min	0	375.63	360.36
VJ	7.6	Envolvente	Combination	Min	0	545.93	-161.75
VJ	8.1	Envolvente	Combination	Min	0	716.22	-781.97
VJ	8.1	Envolvente	Combination	Min	0	729.96	-781.95
VJ	8.5775	Envolvente	Combination	Min	0	892.59	-1696.04
VJ	9.055	Envolvente	Combination	Min	0	1055.23	-2714.84

VIGA		Indice de sobreesfuerzo	
		Flexión	Cortante
A-106	V1	0.40	0.08
A-105	V2	0.25	0.06
A-104	V3	0.31	0.07
A-103	V4	0.38	0.11
A-102	V5	0.54	0.12
A-101	V6	0.64	0.12
A-111	VA	0.50	0.13
A-112	VB	0.52	0.14
A-113	VC	0.31	0.09
A-114	VD	0.43	0.14
A-115	VE	0.67	0.14
A-116	VF	0.61	0.18
A-117	VG	0.81	0.17
A-118	VH	0.72	0.20
A-119	VI	0.77	0.21
A-120	VJ	0.51	0.13
Indice de sobreesfuerzo max		0.81	0.21
Vulnerabilidad		1.232	123.2%


Indice de sobreesfuerzo vigas
Refuerzo a cortante
Refuerzo a flexión
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
V1
V2
V3
V4
V5
V6
VA
VB
VC
VD
VE
VF
VG
VH
VI
VJ

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V1 (A-106)

f'c = 210.00 kgf/cm² = 21.00 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego: d= 40.00 cm = 400.00 mm

Recubrimiento= 5.00 cm

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estructura = 1.00

Øe = Coeficiente por estado de la edificación = 0.80

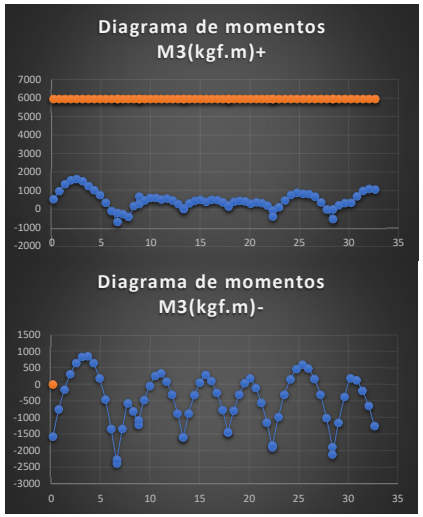
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -															
V1 (C1)	0.175	-815.08	541.98	-1565.76	-1572.1	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	0.7636	-592.7	977.1	-1298.45	-749.78	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	1.3523	-369.94	1348.51	-1031.13	-152.23	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	1.9409	-147.18	1562.57	-763.82	314.2	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	2.5295	75.58	1619.27	-496.51	649.5	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	3.1182	304.63	1518.64	-235.48	836.2	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	3.7068	571.95	1260.66	-12.72	854.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	4.2955	839.26	1024.48	210.04	648.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	4.8841	1106.57	766	432.8	186.04	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	5.4727	1373.89	359.12	655.57	-457.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	6.0614	1641.2	-92.33	871.66	-1344.84	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(D1)	6.65	1908.51	-674.91	1072.14	-2389.59	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(D1)	6.65	33.93	-187.57	-1824.82	-2271.96	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	7.1975	241.12	-262.87	-1576.19	-1340.93	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	7.745	448.31	-405.44	-1327.56	-570.22	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	8.2925	655.51	171.03	-1078.93	-812.05	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(E1)	8.84	865.65	683.94	-833.24	-1217.93	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(E1)	8.84	-463.51	278.22	-1228.77	-1085.73	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	9.4013	-251.11	479.77	-973.89	-468.62	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	9.9625	-38.72	611.69	-719.01	-44.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	10.5238	173.68	600.57	-464.14	261.14	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	11.085	402.15	528.51	-225.33	340.67	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	11.6463	657.03	574.39	-12.94	88.83	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	12.2075	911.91	477.26	199.46	-306.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	12.7688	1166.78	290.2	411.86	-874.48	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(F1)	13.33	1421.66	-0.56	624.26	-1600.86	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(F1)	13.33	-550.88	67.13	-1387.44	-1593.19	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	13.8975	-336.12	318.82	-1129.73	-878.95	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	14.465	-121.36	461.14	-872.01	-323.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	15.0325	93.4	508.14	-614.3	59.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	15.6	308.17	408.88	-356.58	291.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	16.1675	561.48	515.51	-137.42	106.79	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	16.735	819.2	498.49	77.34	-250.91	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	17.3025	1076.91	371.16	292.11	-766.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(G1)	17.87	1334.63	144.45	506.87	-1450.7	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(G1)	17.87	-409.76	224.92	-1282.79	-1436.22	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	18.4288	-198.31	394.8	-1029.04	-790.35	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	18.9875	13.14	461.1	-775.3	-300.83	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	19.5463	224.59	421.59	-521.56	34.58	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	20.105	451.33	296.59	-283.11	184.57	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	20.6638	705.07	375.34	-71.66	-107.16	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	21.2225	958.82	331.93	139.79	-547.63	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	21.7813	1212.56	194.74	351.24	-1154.25	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(H1)	22.34	1466.3	-60.59	562.69	-1902.66	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(H1)	22.34	-901.16	-392.64	-1557.09	-1843.22	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	22.946	-694.76	104.78	-1281.89	-983.01	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	23.552	-476.84	479.02	-1006.69	-305.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	24.158	-247.51	766.33	-731.49	153.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	24.764	-18.17	886.86	-456.29	469.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	25.37	213.89	840.63	-183.83	596.67	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	25.976	489.09	816.47	45.51	484.56	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	26.582	764.29	676.06	274.84	170.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	27.188	1039.49	368.87	504.17	-304.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	27.794	1314.69	-11.99	719.36	-1012.01	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(I1)	28.4	1589.89	-525.98	925.76	-1892.1	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(I1)	28.4	-518.88	-20.61	-1710.19	-2116.3	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	29.0079	-288.84	224.88	-1434.15	-1160.64	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	29.6157	-58.81	330.54	-1158.11	-372.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	30.2236	171.23	345.81	-882.07	191.94	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	30.8314	401.26	699.57	-606.03	122.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	31.4393	658.69	984.05	-357.38	-191.44	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1	32.0471	934.73	1100.73	-127.34	-645.1	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61
V1(J1)	32.655	1210.77	1066.8	102.69	-1255.75	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61

c	a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.26	0.26	0.03	0.06	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.13	0.16	0.02	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.03	0.23	0.02	0.06	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.05	0.26	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.11	0.27	0.00	0.03	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.14	0.26	0.02	0.01	0.02
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.14	0.21	0.03	0.00	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.11	0.17	0.05	0.01	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.03	0.13	0.06	0.03	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.08	0.08	0.08	0.04	0.08
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.23	0.23	0.06	0.03	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.40	0.40	0.07	0.04	0.07
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.38	0.38	0.00	0.07	0.07
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.23	0.23	0.01	0.06	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.10	0.10	0.03	0.08	0.08
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.14	0.14	0.03	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.20	0.20	0.03	0.03	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.18	0.18	0.02	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.08	0.08	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.01	0.10	0.00	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.04	0.10	0.01	0.03	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.06	0.09	0.02	0.01	0.02
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.01	0.10	0.04	0.00	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.05	0.08	0.05	0.01	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.15	0.15	0.04	0.02	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.27	0.27	0.05	0.02	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.27	0.27	0.02	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.15	0.15	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.05	0.08	0.01	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.01	0.09	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.02	0.02	0.02
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.02	0.09	0.03	0.01	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.04	0.08	0.05	0.00	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.13	0.13	0.04	0.01	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.24	0.24	0.05	0.02	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.24	0.24	0.02	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.13	0.13	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.05	0.08	0.00	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.01	0.07	0.01	0.03	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.03	0.05	0.03	0.02	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.02	0.06	0.04	0.00	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.09	0.09	0.06	0.01	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.19	0.19	0.05	0.01	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.32	0.32	0.06	0.02	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.31	0.31	0.03	0.06	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.17	0.17	0.03	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.05	0.08	0.03	0.06	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.03	0.13	0.01	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.08	0.15	0.00	0.03	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.10	0.14	0.01	0.01	0.01
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.08	0.14	0.03	0.00	0.03
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.03	0.11	0.04	0.02	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.05	0.06	0.06	0.03	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.17	0.17	0.05	0.03	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.32	0.32	0.06	0.04	0.06
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.36	0.36	0.02	0.07	0.07
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.20	0.20	0.01	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.06	0.06	0.00	0.07	0.07
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.03	0.06	0.01	0.05	0.05
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.02	0.12	0.02	0.04	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.03	0.17	0.04	0.02	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.11	0.19	0.04	0.00	0.04
4.605	3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.21	0.21	0.05	0.00	0.05

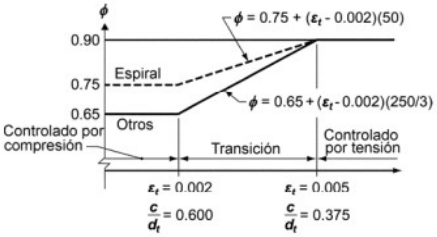
	Indice de sobreesfuerzo
Flexion	0.40
Cortante	0.08



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

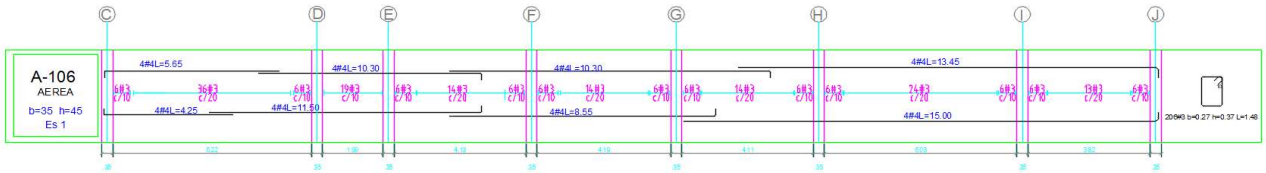
		Recubrimiento
5	Viga	5
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de ε_t/d_t .



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



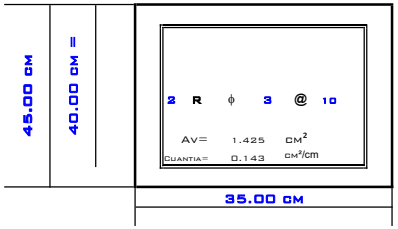
#REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISO 1

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc kg/cm²	Fys kg/cm²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < MIN: 10.00 ✔ 30 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V2 (A-105)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estru 1.00

Øe = Coeficiente por estado de la edificación = 0.80

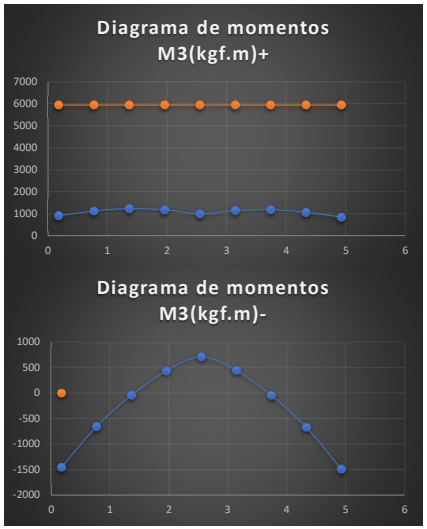
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
V2(A2)	0.175	-406.1	908.58	-1549.91	-1456.08	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	0.7688	-181.4	1125.46	-1280.27	-658.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	1.3625	43.29	1232.02	-1010.63	-43.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	1.9563	267.99	1178.48	-741	437.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	2.55	494.63	999.38	-473.3	710.48	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	3.1438	764.26	1144	-248.6	446.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	3.7375	1033.9	1183.72	-23.91	-46.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2	4.3313	1303.53	1063.36	200.79	-672.2	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V2(B2)	4.925	1573.17	841.87	425.49	-1490.66	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.24	0.24	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.11	0.19	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.01	0.21	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.07	0.20	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.12	0.17	0.03	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.08	0.19	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.01	0.20	0.06	0.00	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.11	0.18	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.25	0.25	0.06	0.02	0.06

	Indice de sobreesfuerzo
Flexion	0.25
Cortante	0.06

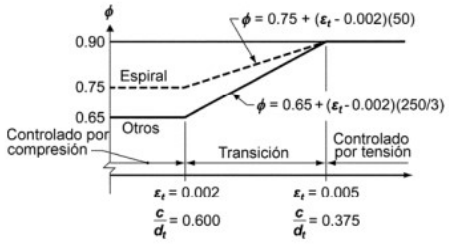


Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

		Recubrimiento
5	Viga	5
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	



ecuaciones para ϕ como una función de ε_t :



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

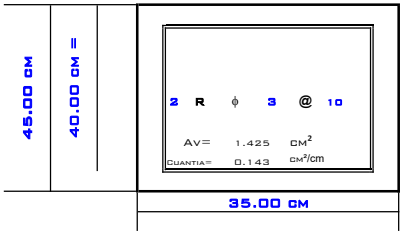
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8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc kg/cm²	Fys kg/cm²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < min: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 20.0 ✔ 60 ✔ 513.041323 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 10 ✔ 30 ✔ 513.041323 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V3 (A-104)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín= 0.0033

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estr 1.00

Øe = Coeficiente por estado de la edificación = 0.80

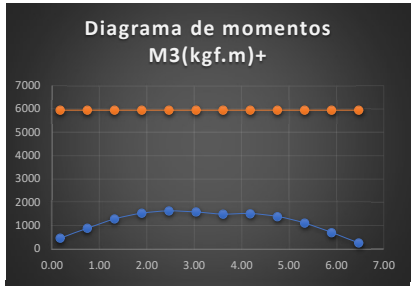
Beta	0.85		
ecu	0.003		
E	2100000	kg/cm2	
	0.002		

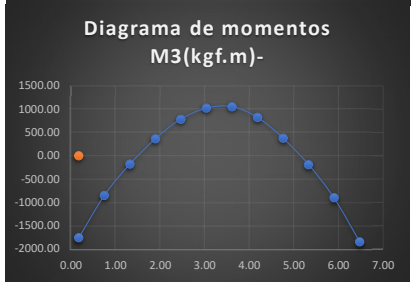
capas de acero	d'	d	
1	5		40.00
2	5		40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
V3(C3)	0.18	-847.63	466.54	-1727.94	-1759.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	0.75	-630.89	894.09	-1467.85	-848.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	1.32	-414.15	1290.21	-1207.76	-179.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	1.89	-197.41	1537.38	-947.67	366.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	2.47	19.33	1635.58	-687.58	787.18	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	3.04	236.07	1584.83	-427.49	1023.33	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	3.61	478.76	1497.21	-193.35	1055.02	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	4.18	738.85	1518.53	23.39	823.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	4.76	998.94	1390.96	240.13	377.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	5.33	1259.03	1114.44	456.87	-191.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3	5.90	1519.12	706.82	673.61	-903.39	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V3(D3)	6.48	1779.2	258.96	890.35	-1847.91	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.30	0.30	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.14	0.15	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.03	0.22	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.06	0.26	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.13	0.28	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.17	0.27	0.01	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.18	0.25	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.14	0.26	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.06	0.23	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.03	0.19	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.15	0.15	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.31	0.31	0.07	0.03	0.07

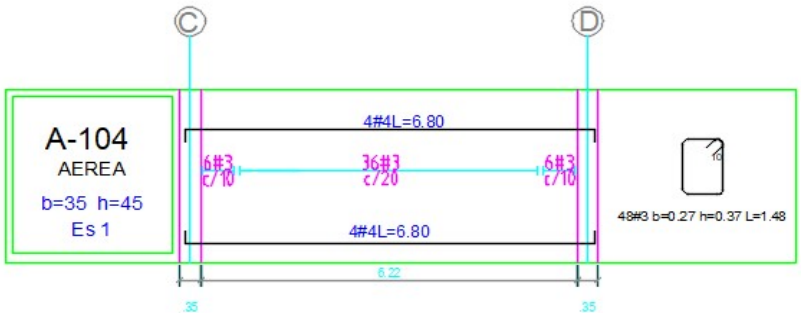
	Indice de sobreesfuerzo
Flexion	0.31
Cortante	0.07



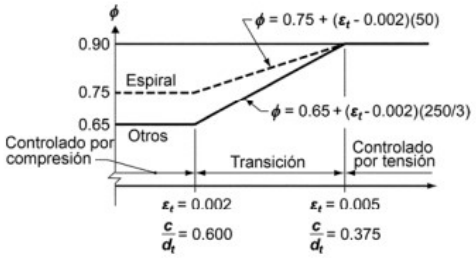


Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	



ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

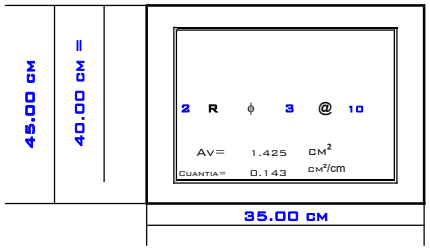
Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

#¡REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA									0.75
Fc	Fys	Vmax	Vlim	Vu <	(ϕVc	+	ϕVs)	ϕVcmax	DISEÑO
kg/cm²	kg/cm²	tf	tf	tf	tf		tf	tf	OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - tf	VALOR LIMITE DE (ϕVs) - tf	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < min: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V4 (A-103)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm²

Area varilla

As = **5.1600 cm²**

ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la es 1.00

Øe = Coeficiente por estado de la edificación = 0.80

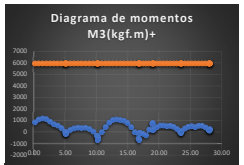
Beta	0.85	
ecu	0.003	
E	2100000 kg/cm2	
	0.002	

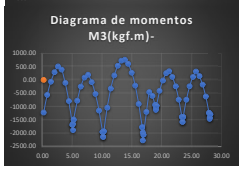
capas de acero	d'	d	
1	5		40.00
2	5		40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
V4(A4)	0.18	-417.68	855.8	-1318.64	-1225.86	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	0.78	-189.43	1086.69	-1044.75	-560.96	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	1.38	38.81	1186.04	-770.85	-67.37	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	1.98	267.06	1120.22	-496.96	288.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	2.59	520.05	889.31	-247.82	506.69	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	3.19	793.94	686.72	-19.57	393.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	3.79	1067.84	572.81	208.67	-110.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	4.40	1341.73	336.02	436.92	-795.43	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	5.00	1615.62	3.64	665.16	-1687.21	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	5.00	2141.37	3.13	956.53	-1687.17	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(B4)	5.10	2186.78	-96.26	994.37	-1887.41	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(B4)	5.10	-854.13	-201.42	-1675.66	-1652.29	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	5.20	-816.29	-113.88	-1630.25	-1491.24	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	5.20	-586.03	-113.35	-1304.66	-1491.31	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	5.81	-355.65	173.29	-1028.21	-781.25	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	6.42	-125.28	326.99	-751.77	-246.79	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	7.03	105.09	367.9	-475.32	91.94	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	7.64	347.88	339.41	-211.29	190.98	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	8.24	624.33	376.24	19.08	-82.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	8.85	900.78	267.8	249.46	-520.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	9.46	1177.23	45.81	479.83	-1152.69	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	10.07	1453.67	-316.41	710.20	-1953.47	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	10.07	1884.01	-316.79	948.58	-1953.15	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(C4)	10.17	1929.42	-416.15	986.42	-2135.18	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(C4)	10.17	-1352.67	-714.57	-2739.17	-2141.08	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	10.27	-1318.61	-568.47	-2693.76	-1928.87	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	10.27	-1033.09	-568.09	-1642.85	-1929.20	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	10.86	-833.37	-7.7	-1376.57	-1044.01	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	11.44	-622.76	432.38	-1110.29	-324.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	12.03	-400.86	811.99	-844.01	168.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	12.62	-178.96	1035.61	-577.72	531.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	13.20	42.95	1103.5	-311.44	724.26	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	13.79	284.82	1042.14	-65.13	759.70	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	14.37	551.1	988.47	156.77	605.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	14.96	817.38	781.53	378.67	270.70	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	15.55	1083.66	417.55	600.57	-209.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	16.13	1349.94	-18.61	813.41	-904.30	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	16.72	1616.23	-565.99	1013.12	-1773.88	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	16.72	2704.31	-566.47	1259.38	-1773.70	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(D4)	16.82	2749.73	-706.49	1293.44	-1973.68	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(D4)	16.82	-195.86	-92.84	-2153.50	-2272.53	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	16.92	-158.02	-74.82	-2108.09	-2059.78	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	16.92	45.89	-74.38	-1838.87	-2059.90	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	17.42	234.16	-143.94	-1612.94	-1201.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	17.92	422.43	-290.64	-1387.02	-457.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	18.41	610.71	214.12	-1161.09	-599.66	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	18.91	798.98	719.97	-935.17	-934.72	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	18.91	1095.78	719.48	-661.67	-934.69	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(E4)	19.01	1141.2	783.47	-623.83	-1046.26	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(E4)	19.01	-812.99	152.2	-1746.46	-1125.70	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	19.11	-775.15	234.97	-1701.05	-968.28	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	19.11	-461.72	235.53	-1170.92	-968.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	19.65	-258.78	430.84	-927.39	-407.86	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	20.18	-55.85	562.21	-683.87	-22.85	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	20.72	147.09	563.09	-440.35	253.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	21.26	363.95	500.52	-210.75	331.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	21.79	607.48	539.49	-7.81	112.53	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	22.33	851	448.88	195.12	-238.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	22.86	1094.52	270.58	398.06	-740.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	23.40	1338.05	2.66	600.99	-1392.71	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	23.40	2077.19	2.05	988.79	-1392.75	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(F4)	23.50	2122.6	-101.93	1026.63	-1576.92	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(F4)	23.50	-967.31	-27.76	-2094.58	-1575.95	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	23.60	-929.47	69.67	-2049.17	-1392.80	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	23.60	-541.01	70.28	-1330.40	-1392.73	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	24.14	-335.71	308.1	-1084.04	-737.82	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	24.69	-130.41	454.36	-837.68	-236.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	25.23	74.89	506.08	-591.31	114.58	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	25.77	280.19	439.48	-344.95	316.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	26.31	520.67	545.41	-133.76	145.51	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	26.86	767.03	532.04	71.54	-173.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	27.40	1013.39	404.95	276.84	-623.87	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	27.94	1259.75	199.07	482.14	-1240.46	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	27.94	1881.67	198.49	842.98	-1240.47	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(G4)	28.04	1927.08	109.56	880.83	-1413.46	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(G4)	28.04	-759.17	144.39	-1691.89	-1459.69	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	28.14	-721.33	221.15	-1646.48	-1295.51	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	28.14	-392.78	221.71	-1219.79	-1295.52	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	28.69	-186.06	379.81	-971.73	-696.97	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	29.23	20.67	442.36	-723.66	-251.30	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	29.78	227.39	398.27	-475.60	52.59	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	30.33	452.89	286.89	-246.31	172.90	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	30.87	700.95	342.33	-39.59	-117.15	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	31.42	949.02	286.97	167.13	-547.28	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	31.96	1197.08	139.2	373.85	-1133.42	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(H4)	32.51	1445.15	-121.48	580.57	-1855.07	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(H4)	32.51	-942.83	-461.34	-1546.15	-1809.93	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	33.12	-726.85	48.63	-1270.95	-956.36	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	33.72	-497.52	433.26	-995.75	-283.20	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	34.33	-268.19	733.66	-720.55	168.46	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	34.93	-38.86	867.31	-445.35	481.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	35.54	192.32	834.52	-172.00	598.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	36.15	467.52	810.1	57.33	501.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	36.75	742.72	663.02	286.66	189.84	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	37.36	1017.92	349.19	516.00	-273.01	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	37.96	1293.12	-39.93	745.33	-966.32	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(I4)	38.57	1568.32	-561.09	959.46	-1833.33	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(I4)	38.57	-561.84	-102.02	-1678.39	-2054.30	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	39.18	-331.81	169.59	-1402.35	-1117.99	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	39.79	-101.77	301.39	-1126.31	-349.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	40.39	128.26	343	-850.26	201.23	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	41.00	358.3	684.32	-574.22	145.34	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	41.61	614.71	949.42	-324.56	-142.32	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4	42.22	890.75	1046.77	-94.52	-569.85	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V4(J4)	42.83	1166.79	990.95	135.51	-1151.83	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.21	0.21	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.09	0.18	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.01	0.20	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.05	0.19	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.09	0.15	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.07	0.12	0.05	0.00	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.02	0.10	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.13	0.13	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.28	0.28	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.28	0.28	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.32	0.32	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.28	0.28	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.25	0.25	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.25	0.25	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.13	0.13	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.04	0.05	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.02	0.06	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.03	0.06	0.02	0.01	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.01	0.06	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.09	0.09	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.19	0.19	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.33	0.33	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.33	0.33	0.07	0.04	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.36	0.36	0.07	0.04	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.36	0.36	0.05	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.32	0.32	0.05	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.32	0.32	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.18	0.18	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.03	0.14	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.09	0.17	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.12	0.19	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.13	0.18	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.10	0.17	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.05	0.13	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.04	0.07	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.15	0.15	0.05	0.03	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.30	0.30	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.30	0.30	0.10	0.05	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.33	0.33	0.11	0.05	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.38	0.38	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.35	0.35	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.35	0.35	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.20	0.20	0.01	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.08	0.08	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.10	0.10	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.16	0.16	0.03	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.16	0.16	0.04	0.03	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.18	0.18	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.19	0.19	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.16	0.16	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.16	0.16	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.07	0.07	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.00	0.09	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.04	0.09	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.06	0.08	0.02	0.01	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.02	0.09	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.04	0.08	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.12	0.12	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.23	0.23	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.23	0.23	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.27	0.27	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.26	0.26	0.04	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.23	0.23	0.04	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.23	0.23	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.12	0.12	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.04	0.08	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.02	0.09	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.02	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.02	0.09	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.03	0.09	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.10	0.10	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.21	0.21	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.21	0.21	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.24	0.24	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.25	0.25	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.22	0.22	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.22	0.22	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.12	0.12	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.04	0.07	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.01	0.07	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.03	0.05	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.02	0.06	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.09	0.09	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.19	0.19	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.31	0.31	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.30	0.30	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.16	0.16	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.03	0.12	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.08	0.15	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.10	0.14	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.08	0.14	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.03	0.11	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.05	0.06	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.16	0.16	0.05	0.03	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.31	0.31	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.35	0.35	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.19	0.19	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.06	0.06	0.01	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.03	0.06	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.02	0.12	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.02	0.16	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.19	0.19	0.04	0.01	0.04

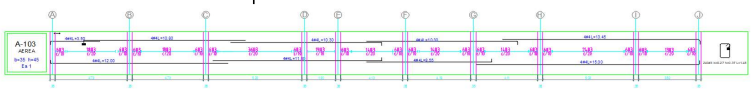
	Indice de sobreesfuerzo
Flexion	0.38
Cortante	0.11



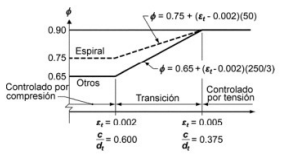


Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

	Recubrimiento
4	Viga 4
FALSO	Viga Fundación
VERDADERO	Vigueta
	Vigueta Fundación
	Nervio
	Nervio Fundación
	Nervio Borde
	Nervio Borde Fundación
	Nervio Temperatura
	Nervio Temperatura Fundación
	Columna



ecuaciones para ϕ como una función de ε_t y c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

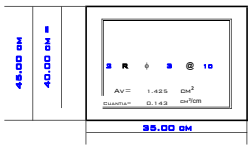
Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc + ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2 + 18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu < ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3Fys} = 0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs < 4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V5(A-102)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín=	0.0033
ρ máx=	0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la e 1.00

Øe = Coeficiente por estado de la edificación = 0.80

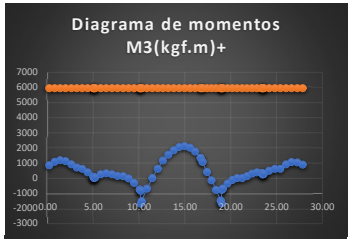
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

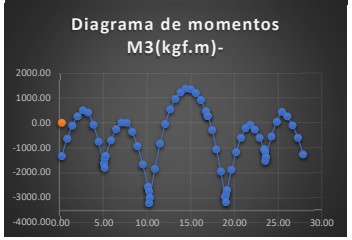
capas de acero	d'	d	
1	5	40.00	
2	5	40.00	

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
V5(A5)	0.18	-420.68	872.25	-1363.08	-1335.53	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	0.78	-192.44	1099.07	-1089.18	-637.94	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	1.38	35.8	1202.81	-815.29	-120.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	1.98	264.05	1141.36	-541.40	260.02	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	2.59	512.73	914.72	-287.94	502.51	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	3.19	786.62	710.1	-59.69	411.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	3.79	1060.51	623.65	168.55	-83.27	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	4.40	1334.41	404.03	396.79	-756.37	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	5.00	1608.3	95.89	625.04	-1643.78	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	5.00	1638.75	95.56	651.16	-1643.94	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(B5)	5.10	1684.17	28.55	689.00	-1810.09	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(B5)	5.10	-499.13	12.78	-1235.72	-1460.20	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	5.20	-461.29	60.81	-1190.31	-1338.90	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	5.20	-441.7	61.08	-1167.33	-1338.80	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	5.81	-211.33	259.84	-890.88	-712.33	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	6.42	19.05	324.2	-614.43	-259.99	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	7.03	249.42	261.41	-337.99	10.98	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	7.64	517.82	157.35	-99.56	1.91	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	8.24	794.26	132.2	130.81	-369.03	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	8.85	1070.71	-17.56	361.18	-936.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	9.46	1347.16	-307.55	591.56	-1672.62	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	10.07	1623.61	-737.78	821.93	-2576.85	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	10.07	1648.59	-738.06	843.08	-2576.98	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(C5)	10.17	1694	-824.26	880.92	-2744.10	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(C5)	10.17	-1482.17	-1682.63	-2260.75	-3220.48	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	10.27	-1448.11	-1524.74	-2215.34	-3003.65	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	10.27	-1420.02	-1524.39	-2107.94	-3003.44	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	10.86	-1220.31	-693.11	-1841.66	-1845.49	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	11.44	-1020.6	8.05	-1575.38	-843.69	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	12.03	-820.89	631.92	-1309.09	-50.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	12.62	-621.18	1175.64	-1042.81	535.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	13.20	-419.11	1563.23	-776.53	954.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	13.79	-197.21	1855.61	-510.25	1222.33	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	14.37	24.69	2067.27	-243.97	1372.59	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	14.96	271.04	2122.79	-20.08	1350.67	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	15.55	537.32	2022.17	201.82	1188.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	16.13	803.6	1765.42	423.72	908.30	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	16.72	1069.88	1352.52	641.48	463.12	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	16.72	1198.49	1352.35	675.16	463.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	16.92	1289.32	1103.57	743.28	266.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	16.92	1578.68	1103.4	764.45	267.01	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	17.42	1804.61	416.76	933.89	-299.23	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	17.92	2030.53	-133.16	1103.34	-1068.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	18.41	2256.46	-765.97	1272.78	-1961.04	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	18.91	2482.38	-1492.37	1442.23	-2966.00	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	18.91	2506.02	-1492.49	1446.92	-2965.94	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(E5)	19.01	2551.43	-1650.29	1480.97	-3190.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(E5)	19.01	-784.71	-773.5	-1728.27	-2887.06	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	19.11	-746.87	-696.92	-1682.85	-2716.51	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	19.11	-739.02	-696.76	-1673.18	-2716.53	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	19.65	-536.09	-354.87	-1429.65	-1884.59	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	20.18	-333.15	-121.8	-1186.13	-1183.23	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	20.72	-130.21	2.45	-942.61	-612.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	21.26	72.72	17.91	-699.08	-216.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	21.79	275.66	137.38	-455.56	-81.84	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	22.33	502.83	316.33	-236.27	-277.83	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	22.86	746.35	385.11	-33.33	-609.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	23.40	989.88	348.57	169.61	-1074.78	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	23.40	995.27	348.27	182.35	-1074.57	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(F5)	23.50	1040.68	328.11	220.19	-1176.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(F5)	23.50	-491.88	247.29	-1553.91	-1535.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	23.60	-454.04	294.6	-1508.50	-1382.33	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	23.60	-446.41	294.87	-1495.31	-1382.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	24.21	-215.83	496.62	-1218.62	-555.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	24.82	14.74	617.94	-941.93	42.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	25.43	245.32	623.32	-665.24	432.00	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	26.04	483.83	913.13	-396.49	258.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	26.65	760.53	1065.56	-165.91	-101.29	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5	27.26	1037.22	1049.42	64.66	-601.97	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V5(G5)	27.87	1313.91	899.1	295.24	-1277.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.22	0.22	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.11	0.18	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.02	0.20	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.04	0.19	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.08	0.15	0.03	0.02	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.07	0.12	0.05	0.00	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.01	0.10	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.13	0.13	0.08	0.02	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.28	0.28	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.28	0.28	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.30	0.30	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.25	0.25	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.23	0.23	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.23	0.23	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.12	0.12	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.04	0.05	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.00	0.04	0.01	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.00	0.03	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.06	0.06	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.16	0.16	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.28	0.28	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.43	0.43	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.43	0.43	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.46	0.46	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.54	0.54	0.06	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.51	0.51	0.06	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.51	0.51	0.05	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.31	0.31	0.05	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.14	0.14	0.06	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.01	0.11	0.05	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.09	0.20	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.16	0.26	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.31	0.21	0.31	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.35	0.23	0.35	0.00	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.36	0.23	0.36	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.34	0.20	0.34	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.15	0.30	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.08	0.23	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.08	0.23	0.07	0.04	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.04	0.19	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.04	0.19	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.11	0.05	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.18	0.18	0.12	0.06	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.33	0.33	0.09	0.05	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.50	0.50	0.09	0.06	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.50	0.50	0.10	0.06	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.54	0.54	0.10	0.06	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.49	0.49	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.46	0.46	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.46	0.46	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.32	0.32	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.20	0.20	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.10	0.10	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.04	0.04	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.01	0.02	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.05	0.05	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.10	0.10	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.18	0.18	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.18	0.18	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.20	0.20	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.26	0.26	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.23	0.23	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.23	0.23	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.09	0.09	0.01	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.01	0.10	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.07	0.10	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.04	0.15	0.03	0.02	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.02	0.18	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.21	0.21	0.05	0.01	0.05

	Indice de sobreesfuerzo
Flexion	0.542
Cortante	0.12

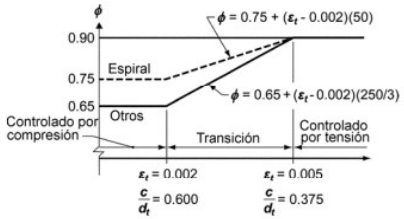




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

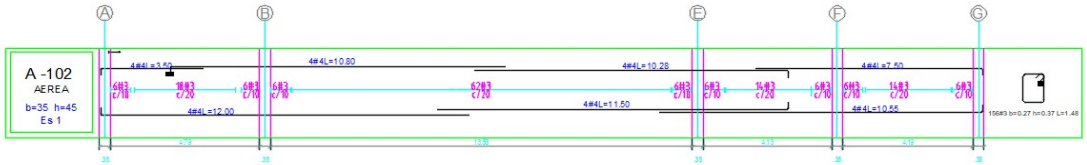
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



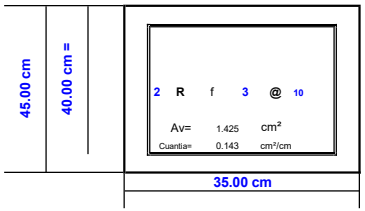
#¡REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc	Fys	Vmax	Vlim	Vu <	(fVc	+	fVs)	fVcmax	DISEÑO
kg/cm²	kg/cm²	tf	tf	tf	tf		tf	tf	OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	a

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

V u

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - tf	VALOR LIMITE DE (fVs) - tf	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5fVc 10.0 4.1		SI SE REQUIERE	
0.5fVc < Vu <fVc 4.1 10.0 8.2		Av= BS / 3FysS = 0.028 ✔	S < min: 20 ✔ 60 ✔
USE fVc < Vu 8.2 10.0	fVs < 2fVc 18.0 16.4	Av= (Vu-fVc)S / fFysD = 0.144 ✔	S < min: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2fVc< fVs < 4fVc 16.4 18.0 32.7 a a	Av= (Vu-fVc)S / fFysD = 0.144 ✔	S < min: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4fVc > fVs 32.7 18.0 a	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga V6(A-101)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION: **Øc =** Coeficiente por Calidad del diseño y construccion de la es 1.00

Øe = Coeficiente por estado de la edificación = 0.80

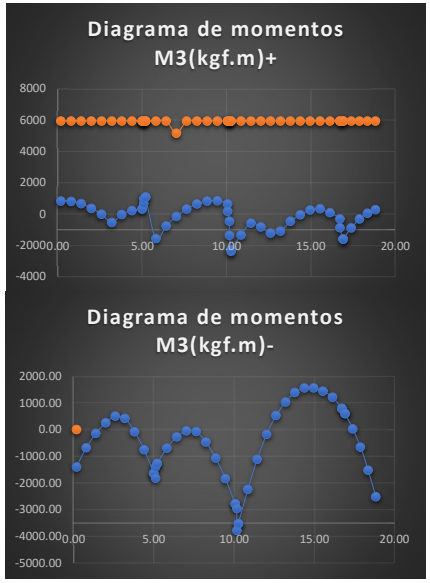
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
V6(A6)	0.18	-369.94	840.63	-1393.74	-1398.33	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	0.78	-147.18	816.47	-1119.85	-680.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	1.38	75.58	676.06	-845.95	-145.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	1.98	304.63	368.87	-572.06	251.80	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	2.59	571.95	-11.99	-316.43	504.95	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	3.19	839.26	-525.98	-88.19	416.17	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	3.79	1106.57	-20.61	140.06	-78.23	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	4.40	1373.89	224.88	368.30	-749.27	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	5.00	1641.2	330.54	596.55	-1639.47	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	5.00	1908.51	345.81	676.85	-1639.47	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6(B6)	5.10	33.93	699.57	714.69	-1816.55	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6(B6)	5.10	241.12	984.05	-1238.28	-1395.97	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	5.20	448.31	1100.73	-1192.87	-1274.44	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	5.20	655.51	1066.8	-1101.51	-1274.49	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	5.81	865.65	-1572.1	-825.06	-688.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	6.42	-463.51	-749.78	-548.62	-275.14	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	7.03	-251.11	-152.23	-274.23	-38.08	20.00	16035.84	5.16	5.16	1	4.7	35.0	0.00	0.000000	No fluye	-5310.38	-10836.00	152787.60	-6.48035	4.44	4.440
V6	7.64	-38.72	314.2	-43.86	-76.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	8.24	173.68	649.5	186.51	-462.84	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	8.85	402.15	836.2	416.89	-1064.31	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	9.46	657.03	854.13	647.26	-1834.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	10.07	911.91	648.13	875.27	-2772.12	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	10.07	1166.78	186.04	910.27	-2772.26	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6(C6)	10.17	1421.66	-457.45	948.12	-2953.42	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6(C6)	10.17	-550.88	-1344.84	-2834.70	-3778.38	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	10.27	-336.12	-2389.59	-2789.29	-3524.62	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	10.27	-121.36	-2271.96	-2329.04	-3524.79	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	10.86	93.4	-1340.93	-2062.76	-2238.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	11.44	308.17	-570.22	-1796.47	-1108.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	12.03	561.48	-812.05	-1530.19	-172.76	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	12.62	819.2	-1217.93	-1263.91	526.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	13.20	1076.91	-1085.73	-997.63	1030.97	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	13.79	1334.63	-468.62	-731.35	1393.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	14.37	-409.76	-44.13	-465.07	1564.69	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	14.96	-198.31	261.14	-230.98	1566.48	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	15.55	13.14	340.67	-9.08	1451.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	16.13	224.59	88.83	212.82	1218.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	16.72	451.33	-306.66	434.72	801.00	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	16.72	705.07	-874.48	604.64	801.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	16.92	958.82	-1600.86	672.76	603.08	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	16.92	1212.56	-1593.19	724.14	603.30	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	17.40	1466.3	-878.95	887.20	20.90	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	17.88	-901.16	-323.47	1050.26	-648.27	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6	18.36	-694.76	59.21	1213.31	-1525.49	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
V6(E6)	18.84	-476.84	291.36	1376.37	-2518.30	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.24	0.24	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.11	0.14	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.02	0.11	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.04	0.06	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.08	0.08	0.03	0.02	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.07	0.09	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.01	0.01	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.13	0.13	0.08	0.02	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.28	0.28	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.28	0.28	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.31	0.31	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.23	0.23	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.21	0.21	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.21	0.21	0.03	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.12	0.26	0.05	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.05	0.13	0.03	0.03	0.03
3.774	-0.00017581	-369	5.62	-0.46	5173.35	0.03	0.01	0.03	0.02	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.01	0.05	0.00	0.00	0.00
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.08	0.11	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.18	0.18	0.02	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.31	0.31	0.04	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.47	0.47	0.03	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.47	0.47	0.04	0.03	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.50	0.50	0.05	0.04	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.64	0.64	0.02	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.40	0.59	0.59	0.01	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.59	0.59	0.00	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.38	0.38	0.01	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.19	0.19	0.02	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.03	0.14	0.03	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.09	0.20	0.05	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.17	0.18	0.06	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.23	0.23	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.26	0.26	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.26	0.26	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.24	0.24	0.00	0.00	0.00
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.20	0.20	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.13	0.13	0.03	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.13	0.15	0.04	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.10	0.27	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.10	0.27	0.07	0.04	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.00	0.15	0.09	0.05	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.11	0.11	0.05	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.26	0.26	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.42	0.42	0.02	0.05	0.05

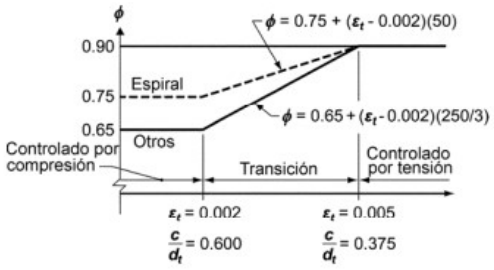
	Indice de sobreesfuerzo
Flexion	0.64
Cortante	0.12



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

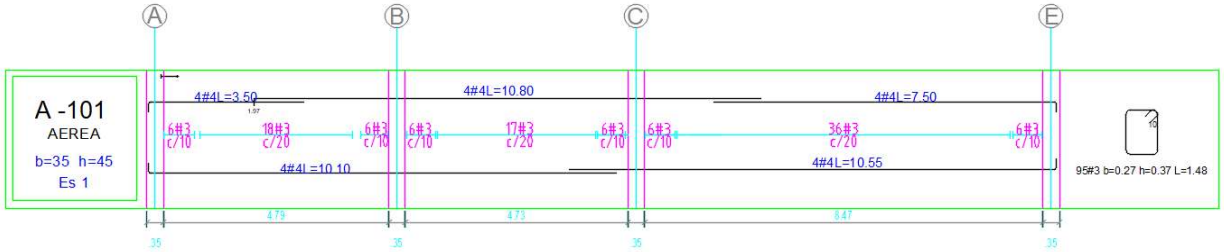
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

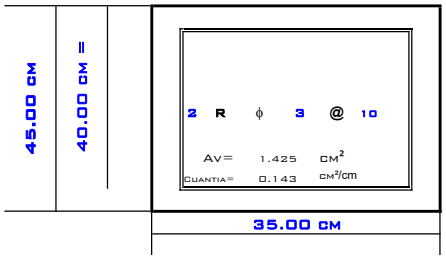


#REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA									0.75
Fc	Fys	Vmax	Vlim		Vu <	(ϕVc	+	ϕVs)	ϕVcmax	DISEÑO
KG/CM²	KG/CM²	TF	TF	TF		TF		TF	TF	OPTIMO
210	4200	40.1	24.1	10.0		8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VA(A-111)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

d= 40.00 cm = 400.00 mm

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION: **Øc =** Coeficiente por Calidad del diseño y construccion de la es 1.00

Beta 0.85 **Øe =** Coeficiente por estado de la edificación = 0.80

ecu 0.003

E 2100000 kg/cm2

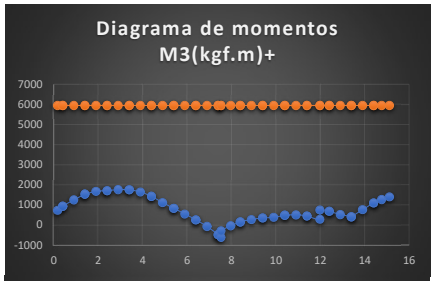
0.002

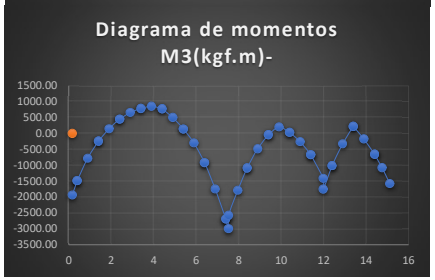
capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VA(A2)	0.175	-920.51	739.34	-2356.36	-1934.94	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	0.4	-843.88	939.14	-2254.19	-1483.80	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	0.4	-577.14	939.16	-1662.16	-1483.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	0.9	-406.85	1254.83	-1435.10	-779.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	1.4	-236.55	1536.34	-1208.03	-239.44	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	1.4	-209.96	1536.29	-1049.01	-239.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	1.9	-39.66	1677.45	-821.95	149.61	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	2.4	130.64	1706.36	-594.89	452.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	2.4	28	1706.35	-591.07	452.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	2.9	198.3	1766.18	-364.01	661.50	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	3.4	401.6	1756.69	-170.10	784.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	3.4	230.24	1756.68	-237.56	784.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	3.9	456.18	1648.81	-66.28	858.12	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	4.4	683.24	1427.41	104.02	776.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	4.4	557.96	1427.42	5.85	776.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	4.9	785.02	1116.47	176.15	502.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	5.4	1012.08	831.78	346.45	141.44	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	5.4	987.21	831.79	245.49	141.46	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	5.9	1214.27	552.05	415.78	-294.57	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	6.4	1441.34	259.64	586.08	-916.29	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	6.4	1566.63	259.67	562.61	-916.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	6.9	1793.7	-67.59	732.91	-1746.14	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	7.4	2020.76	-477.65	903.20	-2691.91	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	7.4	2369.91	-477.7	1014.62	-2691.99	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA(A4)	7.53	2428.95	-613.16	1058.89	-2992.95	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA(A4)	7.53	-659.87	-291.8	-1916.44	-2575.04	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	7.965	-511.71	-35.6	-1718.89	-1785.73	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	8.4	-363.55	158.25	-1521.35	-1084.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	8.4	-309.34	158.26	-1326.31	-1084.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	8.9	-139.04	272.83	-1099.25	-480.53	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	9.4	31.25	350.65	-872.19	-38.64	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	9.4	91.24	350.64	-702.79	-38.65	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	9.9	261.53	386.73	-475.73	206.03	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	10.4	457.88	489.17	-274.92	37.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	10.4	558.27	489.17	-217.45	37.12	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	10.9	785.33	511.8	-47.15	-255.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	11.4	1012.39	454.62	123.14	-666.40	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	11.4	1155.49	454.61	189.38	-666.42	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA(A5)	11.98	1418.88	285.56	386.92	-1411.07	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA(A5)	11.98	89.88	751.33	-1855.67	-1747.67	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	12.4	232.93	683.66	-1664.94	-1008.46	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	12.4	289.81	683.67	-1547.90	-1008.43	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	12.9	460.1	525.37	-1320.84	-320.65	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	13.4	630.4	413.43	-1093.78	222.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	13.4	703.15	413.41	-1018.91	222.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	13.9	884.82	765.13	-803.72	-170.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	14.4	1111.88	1104.27	-633.42	-649.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	14.4	1221.74	1104.26	-631.24	-649.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA	14.7575	1384.09	1270.64	-509.48	-1078.34	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VA(A6)	15.115	1546.44	1403.82	-387.71	-1574.31	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.33	0.33	0.04	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.25	0.25	0.05	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.25	0.25	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.13	0.21	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.04	0.26	0.01	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.04	0.26	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.03	0.28	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.29	0.08	0.29	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.29	0.08	0.29	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.11	0.30	0.01	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.13	0.30	0.02	0.01	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.13	0.30	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.14	0.28	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.24	0.13	0.24	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.24	0.13	0.24	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.08	0.19	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.02	0.14	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.02	0.14	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.05	0.09	0.07	0.02	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.15	0.15	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.15	0.15	0.09	0.03	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.29	0.29	0.10	0.04	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.45	0.45	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.45	0.45	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.50	0.50	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.43	0.43	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.30	0.30	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.18	0.18	0.02	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.18	0.18	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.08	0.08	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.01	0.06	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.01	0.06	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.03	0.07	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.01	0.08	0.03	0.02	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.01	0.08	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.04	0.09	0.05	0.00	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.11	0.11	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.11	0.11	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.24	0.24	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.29	0.29	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.17	0.17	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.17	0.17	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.05	0.09	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.04	0.07	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.04	0.07	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.03	0.13	0.05	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.11	0.19	0.06	0.04	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.11	0.19	0.07	0.04	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.18	0.21	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.24	0.26	0.26	0.06	0.01	0.06

	Indice de sobreesfuerzo
Flexion	0.50
Cortante	0.13

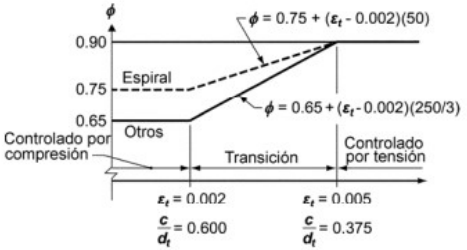




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

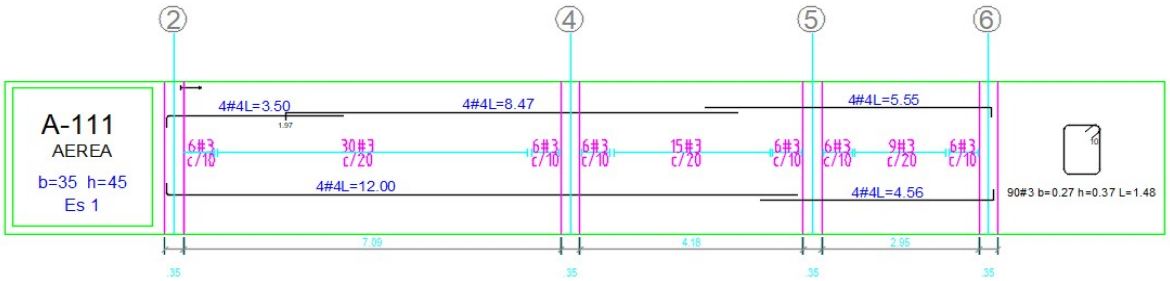
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de ε_t :



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

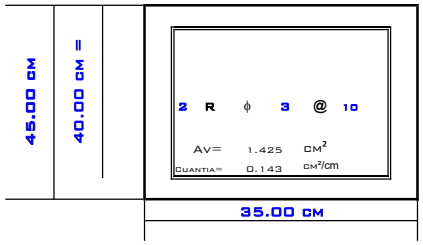


8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs < 4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VB(A-112)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín= 0.0033

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la est 1.00

Øe = Coeficiente por estado de la edificación = 0.80

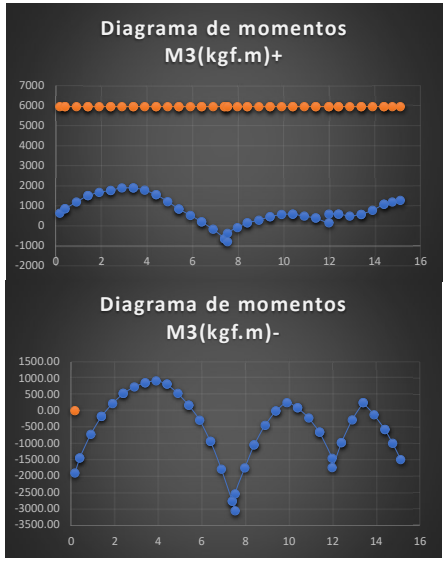
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d	
1	5	40.00	
2	5	40.00	

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VB(B2)	0.175	-984.88	635.64	-2489.86	-1907.60	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	0.4	-908.24	849.82	-2387.68	-1444.85	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	0.4	-636.8	849.84	-1734.77	-1444.80	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	0.9	-466.51	1194.85	-1507.71	-721.43	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	1.4	-296.21	1512.82	-1280.65	-169.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	1.4	-247.72	1512.77	-1061.92	-169.10	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	1.9	-77.43	1676	-834.85	223.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	2.4	92.87	1772.01	-607.79	528.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	2.4	4.19	1772	-590.60	528.95	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	2.9	174.49	1893.68	-363.54	736.47	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	3.4	374.46	1901.83	-166.30	857.72	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	3.4	229.45	1901.82	-213.51	857.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	3.9	456.51	1787.25	-43.21	919.63	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	4.4	683.58	1559.14	127.09	819.64	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	4.4	575.22	1559.15	43.66	819.65	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	4.9	802.29	1219.42	213.96	538.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	5.4	1029.35	844.1	384.25	171.51	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	5.4	1129.28	844.11	314.70	171.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	5.9	1356.34	526.92	484.99	-283.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	6.4	1583.4	203.31	655.29	-930.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	6.4	1825.24	203.34	663.93	-930.63	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	6.9	2052.3	-173.76	834.22	-1790.43	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	7.4	2279.37	-634.59	1004.52	-2765.18	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	7.4	2790.7	-634.68	1154.49	-2765.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB(B2)	7.53	2849.73	-788.01	1198.77	-3069.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB(B2)	7.53	-743.06	-367.06	-2145.59	-2544.91	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	7.965	-594.9	-76.01	-1948.05	-1752.42	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	8.4	-446.74	150.62	-1750.50	-1045.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	8.4	-361.83	150.63	-1340.61	-1045.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	8.9	-191.53	289	-1113.54	-440.32	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	9.4	-21.23	452.54	-886.48	-4.69	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	9.4	80.49	452.52	-676.14	-4.70	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	9.9	250.78	574.02	-449.07	247.51	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	10.4	449.41	581.98	-250.53	91.30	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	10.4	618.84	582.02	-153.66	91.32	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	10.9	825.91	489.02	16.63	-218.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	11.4	1052.97	399.59	186.93	-649.85	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	11.4	1641.03	399.57	309.48	-649.90	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB(B5)	11.98	1904.42	162.66	507.03	-1458.03	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB(B5)	11.98	-74.01	593.59	-1937.71	-1744.51	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	12.4	69.04	594.66	-1746.98	-970.75	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	12.4	178.24	594.7	-1561.43	-970.69	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	12.9	348.54	493.8	-1334.37	-277.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	13.4	518.83	575.06	-1107.31	245.50	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	13.4	648.2	575.02	-944.84	245.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	13.9	832.63	779.33	-732.36	-120.53	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	14.4	1059.69	1081.44	-562.06	-572.33	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	14.4	1229.08	1081.43	-497.39	-572.35	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB	14.7575	1391.43	1192.74	-375.63	-996.20	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VB(B6)	15.115	1553.78	1277.45	-253.87	-1494.21	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.32	0.32	0.04	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.24	0.24	0.05	0.14	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.24	0.24	0.04	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.12	0.20	0.03	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.03	0.25	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.03	0.25	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.04	0.28	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.09	0.30	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.09	0.30	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.12	0.32	0.01	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.14	0.32	0.02	0.01	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.14	0.32	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.15	0.30	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.14	0.26	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.14	0.26	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.09	0.21	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.03	0.14	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.14	0.03	0.14	0.07	0.02	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.05	0.09	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.16	0.16	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.16	0.16	0.11	0.04	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.30	0.30	0.12	0.05	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.46	0.46	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.46	0.46	0.11	0.04	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.52	0.52	0.11	0.05	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.43	0.43	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.29	0.29	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.18	0.18	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.18	0.18	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.07	0.07	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.00	0.08	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.00	0.08	0.00	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.04	0.10	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.02	0.10	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.02	0.10	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.04	0.08	0.05	0.00	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.11	0.11	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.11	0.11	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.25	0.25	0.07	0.02	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.29	0.29	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.16	0.16	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.16	0.16	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.05	0.08	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.04	0.10	0.03	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.04	0.10	0.04	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.02	0.13	0.05	0.04	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.17	0.20	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.25	0.25	0.06	0.01	0.06

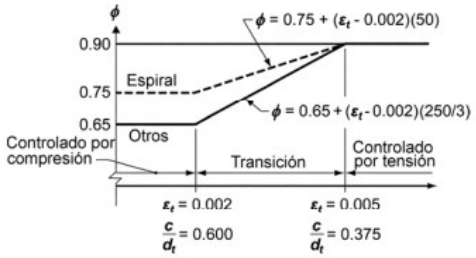
	Indice de sobreesfuerzo
Flexion	0.52
Cortante	0.14



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

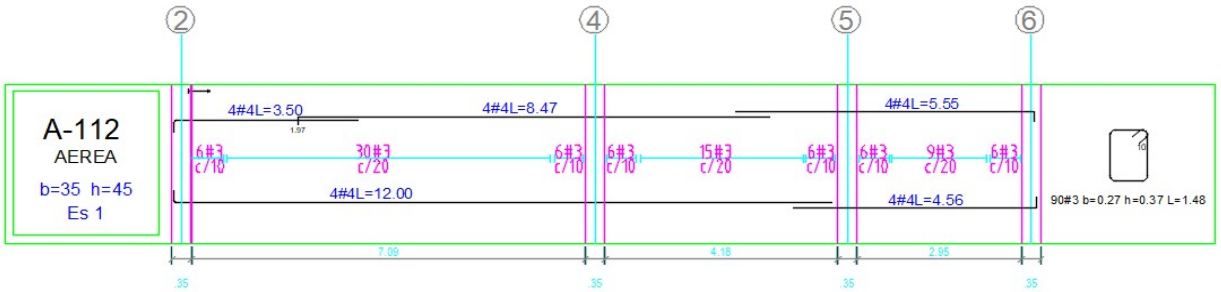
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

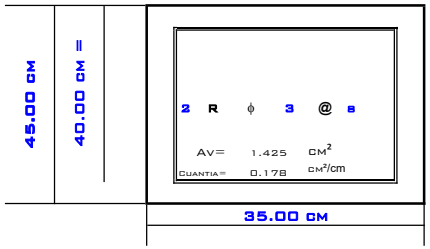
Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA										0.75
Fc	Fys	Vmax	Vlim	Vu <	(ϕVc	+	ϕVs)	ϕVcmax		DISEÑO
kg/cm²	kg/cm²	tf	tf	tf	tf		tf	tf		OPTIMO
210	4200	40.1	24.1	10.0	8.2		22.4	14.4		✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ s @ 20 @ s

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - tf	VALOR LIMITE DE (ϕVs) - tf	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av=\frac{BS}{3FysS}=$ 0.022 ✔	S < min: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 22.4 16.4	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.116 ✔	S < min: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 22.4 32.7 ✔	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.116 ✔	S < min: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 22.4	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VC(A-113)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estruc 1.00

Øe = Coeficiente por estado de la edificación = 0.80

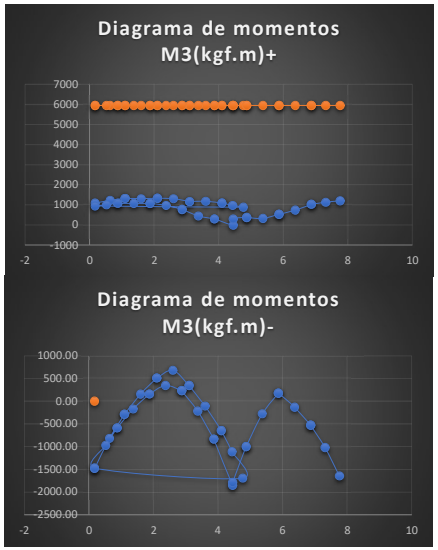
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VC (1-3)(C1)	0.175	-254.85	1092.34	-1660.76	-1479.97	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	0.6375	-97.33	1232.69	-1450.73	-819.92	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	1.1	60.2	1331.86	-1240.70	-287.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	1.1	76.19	1331.86	-1119.69	-287.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	1.6	246.48	1312.24	-892.62	154.22	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	2.1	416.78	1338.12	-665.56	510.06	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	2.1	418.33	1338.11	-626.35	510.05	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	2.6	615.51	1308.22	-426.47	681.67	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	3.1	842.57	1164.8	-256.17	346.08	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	3.1	919.33	1164.82	-260.24	346.10	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	3.6	1146.4	1179.82	-89.94	-107.72	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	4.1	1373.46	1091.79	80.35	-647.41	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	4.1	1522.83	1091.79	97.82	-647.42	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)	4.4325	1673.83	975.59	211.06	-1113.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (1-3)(C3)	4.765	1824.83	885.59	324.31	-1694.19	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)(C4)	0.175	-212.98	946.52	-1537.53	-1473.96	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	0.5225	-94.62	1004.24	-1379.72	-972.75	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	0.87	23.74	1082.89	-1222.28	-587.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	0.87	40.69	1082.89	-1062.92	-587.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	1.37	210.99	1078.9	-835.86	-171.81	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	1.87	381.28	1072.88	-608.80	158.91	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	1.87	397.89	1072.86	-470.07	158.90	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	2.37	614.5	982.66	-289.57	346.15	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	2.87	841.57	778.91	-119.27	233.08	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	2.87	1008.46	778.97	-30.52	233.10	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	3.37	1235.52	454.69	139.78	-219.76	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	3.87	1462.59	308.71	310.07	-832.57	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	3.87	2157.18	308.69	444.13	-832.61	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)(C5)	4.45	2420.57	-6.25	641.68	-1855.26	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)(C5)	4.45	-253.42	304.37	-2163.95	-1787.40	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	4.87	-110.37	380.76	-1973.22	-998.19	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	4.87	32.26	380.81	-1569.54	-998.12	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	5.37	202.56	329.44	-1342.48	-277.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	5.87	372.85	537.37	-1115.42	178.22	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	5.87	535.25	537.32	-915.93	178.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	6.37	707.7	745.54	-691.43	-131.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	6.87	934.76	1033.21	-521.13	-527.31	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	6.87	1136.05	1033.2	-429.23	-527.32	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)	7.315	1338.14	1134.2	-277.67	-1021.73	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VC (4-6)(C6)	7.76	1540.22	1208.24	-126.11	-1645.75	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.25	0.25	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.14	0.21	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.05	0.22	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.05	0.22	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.03	0.22	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.09	0.23	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.23	0.09	0.23	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.11	0.22	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.06	0.20	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.06	0.20	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.02	0.20	0.07	0.01	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.11	0.18	0.08	0.00	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.11	0.18	0.09	0.01	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.19	0.19	0.06	0.01	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.28	0.28	0.07	0.01	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.25	0.25	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.16	0.17	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.10	0.18	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.03	0.18	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.03	0.18	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.03	0.18	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.06	0.17	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.04	0.13	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.04	0.13	0.06	0.00	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.04	0.08	0.07	0.01	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.14	0.14	0.09	0.02	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.14	0.14	0.08	0.02	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.31	0.31	0.09	0.02	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.30	0.30	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.17	0.17	0.00	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.17	0.17	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.05	0.06	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.03	0.09	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.03	0.09	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.02	0.13	0.04	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.09	0.17	0.05	0.03	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.09	0.17	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.17	0.19	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.28	0.28	0.06	0.00	0.06

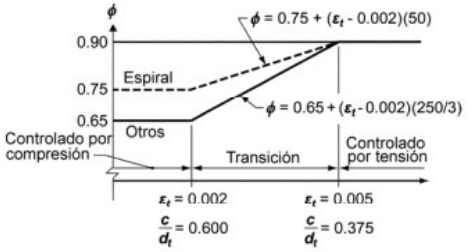
	Indice de sobreesfuerzo
Flexion	0.31
Cortante	0.09



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

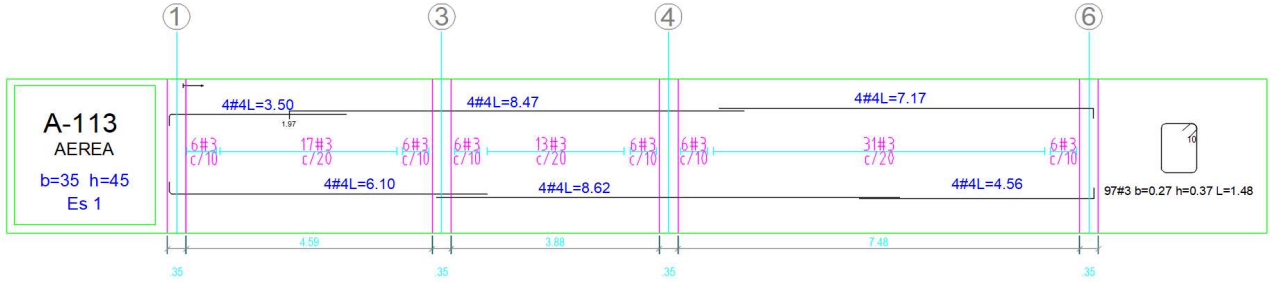
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t .



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

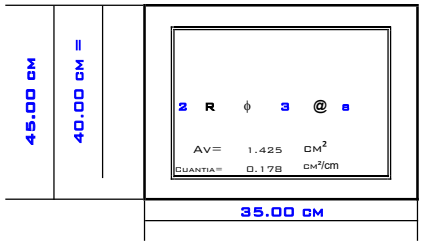


8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		22.4	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ s @ 20 @ s

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.022$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 22.4 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.116$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs < 4ϕVc 16.4 ✔ 22.4 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.116$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	32.7 ✔ 22.4		

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VD(A-114)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego: d = 40.00 cm = 400.00 mm

Recubrimiento = 5.00 cm

Area varilla

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm²

ρ = 0.00368571

As = 5.1600 cm²

ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la est 1.00

Øe = Coeficiente por estado de la edificación = 0.80

Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS(cm)	AS'(cm)	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VD(D1)	0.18	-385.79	1190.49	-1761.92	-1097.45	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	0.64	-228.27	1448.13	-1551.89	-547.35	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	1.10	-70.74	1608.74	-1341.86	-70.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	1.10	57.23	1608.75	-887.57	-70.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	1.60	227.53	1670.72	-660.51	271.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	2.10	397.82	1844.52	-433.45	527.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	2.10	523.83	1844.52	-284.84	527.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	2.60	750.9	1626	-114.54	626.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	3.10	977.96	1293.95	55.75	498.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	3.10	1424.13	1293.97	213.17	498.53	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	3.60	1651.2	571.67	383.46	-41.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	4.10	1878.26	261.24	553.76	-734.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	4.10	2455	261.23	705.37	-734.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	4.52	2645.73	-65.2	848.41	-1581.13	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD(D3)	4.94	2836.46	-451.65	991.46	-2579.69	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD(D3)	4.94	-836.12	-269.83	-2408.07	-2255.17	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	5.10	-781.62	-140.1	-2335.41	-1910.65	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	5.10	-578.72	-140.03	-1833.47	-1910.54	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	5.60	-408.42	108.39	-1606.40	-1052.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	6.10	-238.13	275.88	-1379.34	-311.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	6.10	-137.38	275.86	-1205.85	-311.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	6.60	32.92	384.54	-978.78	151.89	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	7.10	203.22	677.46	-751.72	232.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	7.10	320.45	677.45	-648.58	232.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	7.60	500.49	940.84	-431.52	33.92	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	8.10	727.55	1091.68	-261.22	-250.87	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	8.10	864	1091.73	-245.91	-250.85	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD	8.58	1080.84	1108.55	-83.28	-653.55	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VD(D4)	9.06	1297.68	1041.1	79.35	-1152.55	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

Cálculo del esfuerzo que se genera en las barras de compresión fs'

$$fs' = Es * \varepsilon_s'$$

$$fs' = 2.1 * 10^6 * 0.00139 = 2919\ kg/cm2 < 4200\ kg/cm2$$

EL ACERO NO FLUYE, la hipótesis es correcta

Entonces

Calculamos As2 (Área que se equilibra con el refuerzo en compresión)

$$As * fy = As' * (Es * \varepsilon_s') + 0.85 * f'c * (\beta_1 * c) * b$$

$$As_2 = \frac{As' * fs'}{fy}$$

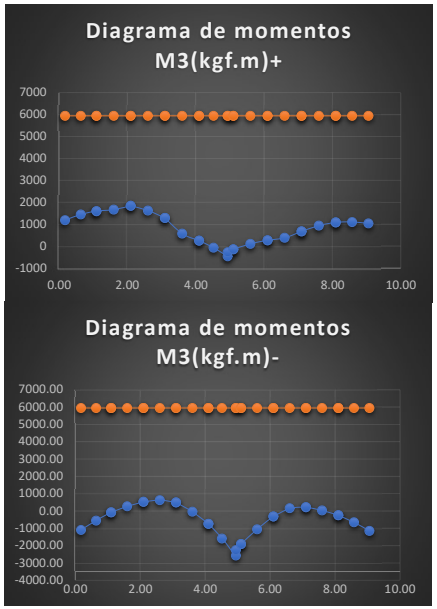
$$Mu = \phi[As_1 * fy * \left($$

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.20	0.18	0.20	0.01	0.07	0.07
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.24	0.09	0.24	0.01	0.06	0.06
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.27	0.01	0.27	0.00	0.08	0.08
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.27	0.01	0.27	0.00	0.05	0.05
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.28	0.05	0.28	0.01	0.04	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.31	0.09	0.31	0.02	0.03	0.03
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.31	0.09	0.31	0.03	0.02	0.03
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.27	0.11	0.27	0.04	0.01	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.22	0.08	0.22	0.06	0.00	0.06
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.22	0.08	0.22	0.08	0.01	0.08
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.10	0.01	0.10	0.10	0.02	0.10
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.04	0.12	0.12	0.11	0.03	0.11
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.04	0.12	0.12	0.14	0.04	0.14
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.01	0.27	0.27	0.10	0.03	0.10
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.08	0.43	0.43	0.11	0.04	0.11
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.05	0.38	0.38	0.03	0.09	0.09
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.02	0.32	0.32	0.03	0.09	0.09
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.02	0.32	0.32	0.02	0.07	0.07
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.02	0.18	0.18	0.02	0.09	0.09
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.05	0.05	0.05	0.01	0.08	0.08
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.05	0.05	0.05	0.01	0.07	0.07
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.06	0.03	0.06	0.00	0.06	0.06
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.11	0.04	0.11	0.01	0.04	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.11	0.04	0.11	0.02	0.04	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.16	0.01	0.16	0.03	0.03	0.03
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.18	0.04	0.18	0.04	0.02	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.18	0.04	0.18	0.05	0.01	0.05
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.19	0.11	0.19	0.04	0.00	0.04
3.915	-0.00026	-540	5.83	-0.67	5947.11	0.18	0.19	0.19	0.05	0.00	0.05

:

$$\left(d-\frac{a}{2}\right)+As_2*fy*\left(d-\frac{d'}{2}\right)]$$

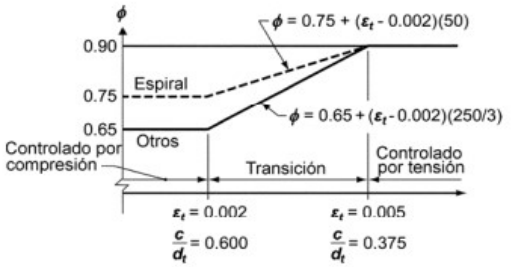
M3(Kgf.m) +/-	Indice de sobreesfuerzo
Flexion	0.43
Cortante	0.14



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

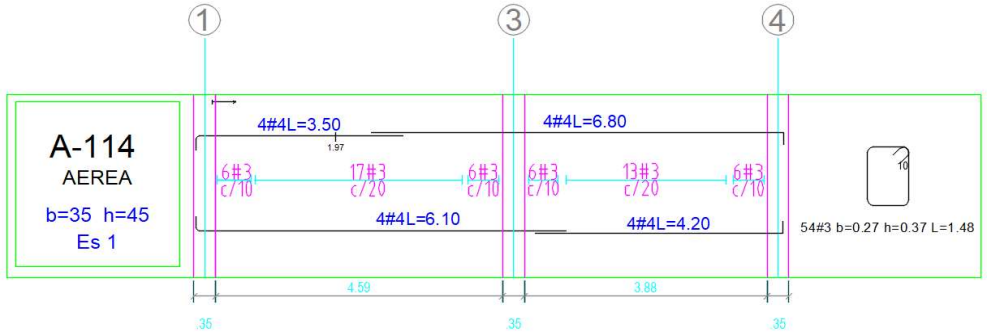
		Recubrimiento
4	Viga	4
VERDADERO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	
	Columna Fundación	
	Muro concreto	
	Muro concreto Fundación	

ecuaciones para ϕ como una función de c/d_t .



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

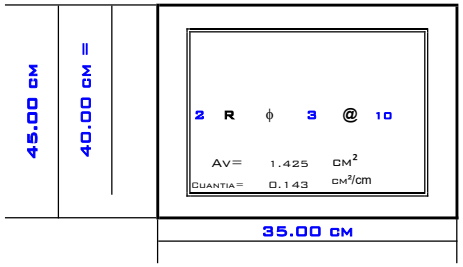


8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc kg/cm²	Fys kg/cm²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 10.0 8.2		$Av=\frac{BS}{3FysS}=0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VE(A-115)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estr 1.00

Øe = Coeficiente por estado de la edificación = 0.80

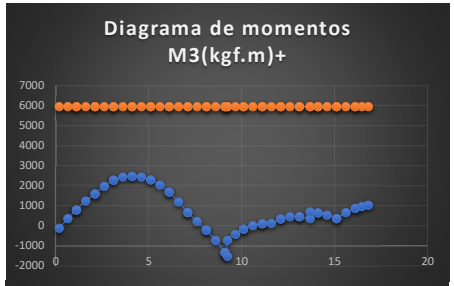
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

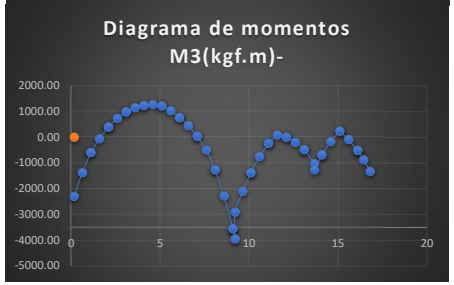
capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VE(E1)	0.175	-1117.4	-120.12	-2323.41	-2294.11	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	0.6375	-959.87	361.18	-2113.38	-1381.04	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	1.1	-802.35	799.48	-1903.34	-595.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	1.1	-704.61	799.47	-1575.15	-595.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	1.6	-534.32	1253.89	-1348.09	-55.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	2.1	-364.02	1596.58	-1121.03	396.84	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	2.1	-393.09	1596.57	-973.14	396.83	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	2.6	-222.79	1969.33	-746.08	735.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	3.1	-52.5	2285.61	-519.02	988.14	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	3.1	-113.64	2285.59	-508.15	988.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	3.6	56.66	2438.79	-281.09	1152.03	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	4.1	251.61	2478.47	-78.77	1230.61	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	4.1	73.7	2478.46	-194.25	1230.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	4.6	283.49	2445.87	-6.76	1274.74	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	5.1	510.56	2299.74	163.54	1222.18	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	5.1	392.49	2299.76	57.16	1222.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	5.6	619.55	2046.75	227.45	1036.44	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	6.1	846.61	1680.2	397.75	765.05	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	6.1	855.52	1680.22	287.72	765.06	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	6.6	1082.58	1195.7	458.02	448.84	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	7.1	1309.64	662.93	628.32	47.17	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	7.1	1494.07	662.94	583.26	47.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	7.6	1721.13	217.74	753.56	-494.53	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	8.1	1948.19	-204.43	923.86	-1258.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	8.1	2198.83	-204.39	954.45	-1258.04	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	8.6	2425.89	-724.99	1124.75	-2279.58	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	9.1	2652.96	-1330.18	1295.05	-3549.29	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	9.1	3097.33	-1330.29	1459.44	-3549.59	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE(E4)	9.23	3156.37	-1522.98	1503.72	-3956.08	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE(E4)	9.23	-795.91	-728.68	-2001.03	-2900.66	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	9.665	-647.76	-414.51	-1803.49	-2096.25	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	10.1	-499.6	-164.57	-1605.95	-1377.99	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	10.1	-437.74	-164.56	-1373.17	-1377.97	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	10.6	-267.44	12.03	-1146.10	-748.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	11.1	-97.15	104.75	-919.04	-233.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	11.1	-72.07	104.74	-813.71	-233.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	11.6	98.23	131.47	-586.65	83.06	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	12.1	268.52	354.49	-359.59	4.92	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	12.1	307.35	354.49	-321.43	4.92	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	12.6	532.29	457.28	-149.20	-190.16	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	13.1	759.35	450.78	21.10	-474.37	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	13.1	821.51	450.78	41.76	-474.39	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE(E5)	13.68	1084.9	368.42	239.30	-1026.40	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE(E5)	13.68	70.77	703.37	-1492.28	-1268.12	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	14.1	213.82	643.71	-1301.55	-681.51	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	14.1	229.49	643.71	-1239.53	-681.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	14.6	399.78	538.96	-1012.47	-171.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	15.1	570.08	372.72	-785.41	239.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	15.1	581.39	372.7	-774.61	239.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	15.6	780.63	662.01	-576.87	-89.85	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	16.1	1007.7	878.86	-406.58	-508.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	16.1	1058.12	878.86	-427.08	-508.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE	16.46	1220.47	970.16	-305.32	-875.94	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VE(E6)	16.815	1382.82	1044.28	-183.56	-1327.48	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.39	0.39	0.04	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.23	0.23	0.04	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.10	0.13	0.05	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.10	0.13	0.04	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.01	0.21	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.07	0.27	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.07	0.27	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.33	0.12	0.33	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.17	0.38	0.00	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.17	0.38	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.41	0.19	0.41	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.42	0.21	0.42	0.01	0.00	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.42	0.21	0.42	0.00	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.41	0.21	0.41	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.39	0.21	0.39	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.39	0.21	0.39	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.34	0.17	0.34	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.13	0.28	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.13	0.28	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.08	0.20	0.06	0.03	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.01	0.11	0.08	0.04	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.01	0.11	0.09	0.03	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.08	0.08	0.10	0.04	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.21	0.21	0.11	0.05	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.21	0.21	0.13	0.06	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.38	0.38	0.14	0.07	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.60	0.60	0.10	0.05	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.22	0.60	0.60	0.12	0.06	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.67	0.67	0.12	0.06	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.49	0.49	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.35	0.35	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.23	0.23	0.03	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.23	0.23	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.00	0.13	0.13	0.02	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.04	0.04	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.04	0.04	0.00	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.01	0.02	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.00	0.06	0.02	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.00	0.06	0.02	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.03	0.08	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.08	0.08	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.08	0.08	0.03	0.00	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.17	0.17	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.21	0.21	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.11	0.11	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.11	0.11	0.01	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.03	0.09	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.04	0.06	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.04	0.06	0.03	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.02	0.11	0.05	0.03	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.09	0.15	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.09	0.15	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.15	0.16	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.22	0.22	0.05	0.01	0.05

	Indice de sobreesfuerzo
Flexion	0.67
Cortante	0.14

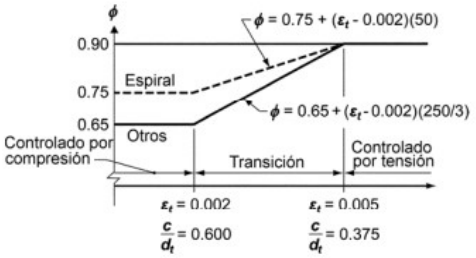




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

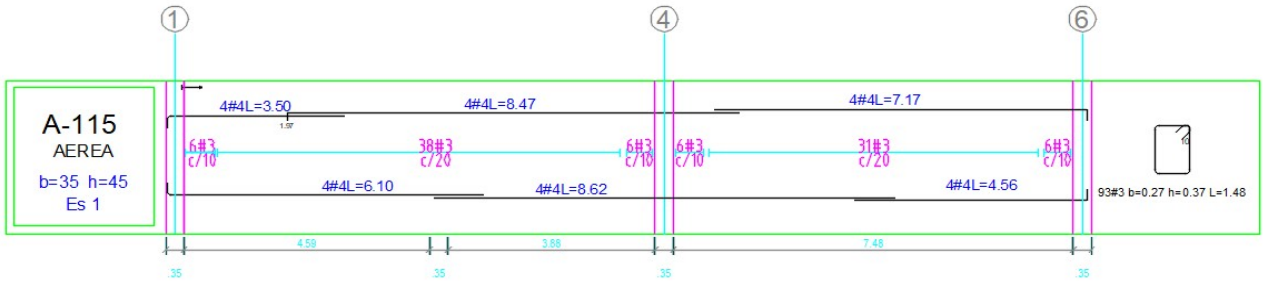
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

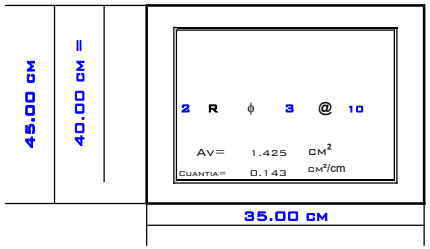


8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc kg/cm²	Fys kg/cm²	Vmax tf	Vlim tf	Vu < tf	(ϕVc tf	+	ϕVs) tf	ϕVcmax tf	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - tf	VALOR LIMITE DE (ϕVs) - tf	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < min: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < min: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VF(A-116)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varillas 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la est 1.00

Øe = Coeficiente por estado de la edificación = 0.80

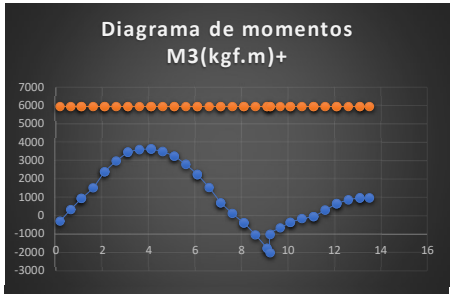
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

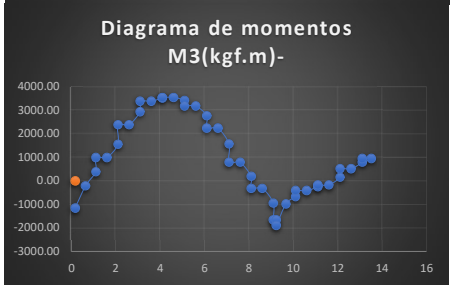
capas de acero	d'	d	
1	5		40.00
2	5		40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VF(F1)	0.175	-1424.53	-294.35	-3369.49	-1153.31	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	0.6375	-1267.01	328.08	-3159.46	-210.19	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	1.1	-1109.48	942.13	-2949.42	388.50	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	1.1	-900.1	942.13	-2224.17	992.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	1.6	-729.81	1521.29	-1997.11	992.60	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	2.1	-559.51	2394.53	-1770.05	1549.63	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	2.1	-494.38	2394.51	-1293.92	2382.39	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	2.6	-324.08	2984.7	-1066.86	2382.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	3.1	-153.79	3461.37	-839.80	2938.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	3.1	-110.27	3461.34	-494.14	3380.59	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	3.6	60.03	3604.31	-267.08	3380.56	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	4.1	257.46	3633.76	-67.24	3517.21	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	4.1	174.2	3633.74	-112.27	3540.33	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	4.6	390.29	3495.36	58.03	3540.31	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	5.1	617.35	3243.45	228.32	3415.27	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	5.1	772.84	3243.45	178.53	3176.69	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	5.6	999.9	2800.27	348.83	3176.70	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	6.1	1226.96	2243.55	519.13	2763.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	6.1	1315.36	2243.57	443.40	2236.54	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	6.6	1542.42	1529.12	613.70	2236.55	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	7.1	1769.48	701.15	784.00	1568.10	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	7.1	2073.87	701.16	790.00	786.12	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	7.6	2300.93	128.71	960.30	786.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	8.1	2528	-394.03	1130.59	189.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	8.1	2928.86	-393.98	1215.90	-318.12	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	8.6	3155.92	-1044.54	1386.19	-318.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	9.1	3382.98	-1780.24	1556.49	-947.02	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	9.1	4090.92	-1780.4	1803.73	-1661.11	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF(F4)	9.23	4149.96	-2017.8	1848.01	-1661.25	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF(F4)	9.23	-903.76	-1017.69	-2684.33	-1889.89	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	9.665	-755.6	-656.61	-2486.79	-978.02	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	10.1	-607.45	-359.81	-2289.24	-664.34	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	10.1	-478.92	-359.79	-1796.23	-414.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	10.6	-308.62	-162.29	-1569.17	-414.77	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	11.1	-138.32	-47.25	-1342.11	-252.00	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	11.1	-29.22	-47.26	-1050.18	-171.55	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	11.6	141.08	301.35	-823.12	-171.56	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	12.1	311.38	655.61	-596.06	156.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	12.1	405.94	655.61	-539.17	513.65	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	12.6	613.82	867.62	-349.95	513.64	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	13.1	840.88	966.49	-179.66	788.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF	13.1	949.2	966.48	-144.64	951.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VF(F5)	13.505	1118.37	967.47	-6.70	951.34	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.19	0.19	0.05	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.04	0.06	0.05	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.07	0.16	0.06	0.17	0.17
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.17	0.17	0.05	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.17	0.26	0.04	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.40	0.26	0.40	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.40	0.40	0.40	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.50	0.40	0.50	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.58	0.49	0.58	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.58	0.57	0.58	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.61	0.57	0.61	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.61	0.59	0.61	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.61	0.60	0.61	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.59	0.60	0.60	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.55	0.57	0.57	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.55	0.53	0.55	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.47	0.53	0.53	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.46	0.46	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.38	0.38	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.38	0.38	0.09	0.04	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.26	0.26	0.10	0.05	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.13	0.13	0.12	0.05	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.13	0.13	0.13	0.06	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.03	0.07	0.15	0.07	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.05	0.07	0.17	0.07	0.17
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.05	0.18	0.18	0.08	0.18
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.16	0.30	0.13	0.06	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.30	0.28	0.30	0.16	0.07	0.16
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.34	0.28	0.34	0.16	0.07	0.16
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.32	0.32	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.16	0.16	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.11	0.11	0.04	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.06	0.07	0.07	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.07	0.07	0.02	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.04	0.04	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.03	0.03	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.03	0.05	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.03	0.11	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.09	0.11	0.02	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.09	0.15	0.04	0.02	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.13	0.16	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.16	0.16	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.16	0.16	0.04	0.00	0.04

	Indice de sobreesfuerzo
Flexion	0.61
Cortante	0.18

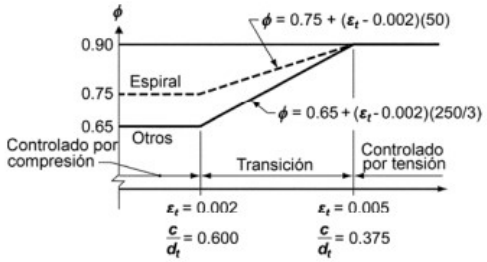




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

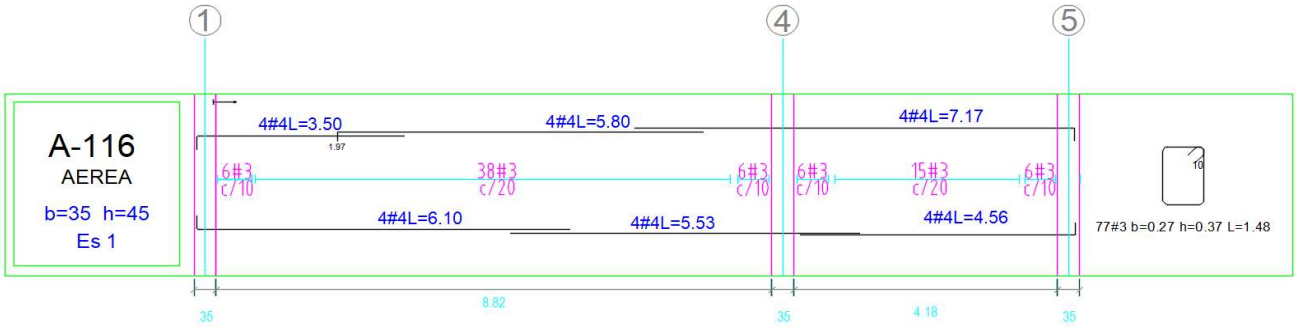
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de ε_t y c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

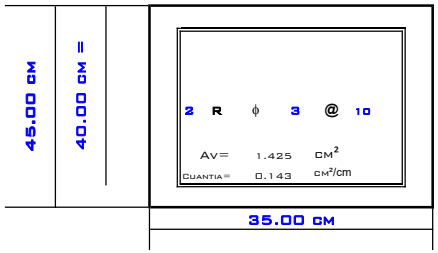


8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VG(A-117)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín= 0.0033

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estr 1.00

Øe = Coeficiente por estado de la edificación = 0.80

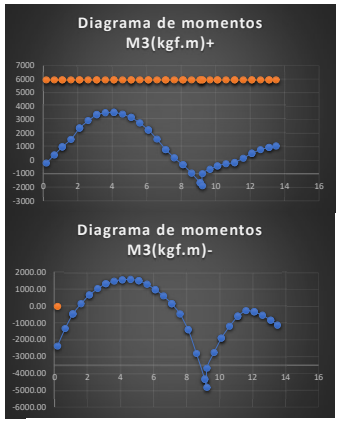
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d	
1	5		40.00
2	5		40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VG(G1)	0.175	-1373.22	-210.19	-3167.66	-2365.92	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	0.6375	-1215.69	388.5	-2957.62	-1316.82	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	1.1	-1058.17	992.6	-2747.59	-443.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	1.1	-866.33	992.6	-2092.88	-443.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	1.6	-696.04	1549.63	-1865.82	164.31	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	2.1	-525.74	2382.39	-1638.76	686.99	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	2.1	-477.6	2382.36	-1225.28	686.98	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	2.6	-307.31	2938.24	-998.22	1062.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	3.1	-137.01	3380.59	-771.16	1352.01	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	3.1	-108.77	3380.56	-491.39	1352.00	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	3.6	61.52	3517.21	-264.33	1512.26	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	4.1	259.56	3540.33	-65.10	1587.37	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	4.1	156.5	3540.31	-120.22	1587.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	4.6	363.61	3415.27	50.07	1604.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	5.1	590.67	3176.69	220.37	1536.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	5.1	713.1	3176.7	163.59	1536.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	5.6	940.16	2763.38	333.89	1323.11	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	6.1	1167.22	2236.54	504.18	1000.78	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	6.1	1223.37	2236.55	420.86	1000.79	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	6.6	1450.44	1568.1	591.16	625.09	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	7.1	1677.5	786.12	761.45	164.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	7.1	1938.23	786.13	760.10	164.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	7.6	2165.3	189.66	930.40	-444.55	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	8.1	2392.36	-318.12	1100.69	-1379.17	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	8.1	2728.26	-318.07	1172.71	-1379.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	8.6	2955.32	-947.02	1343.01	-2799.97	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	9.1	3182.38	-1661.11	1513.31	-4334.39	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	9.1	3748.11	-1661.25	1736.46	-4334.77	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG(G4)	9.23	3807.15	-1889.89	1780.73	-4825.86	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG(G4)	9.23	-794.29	-978.02	-2258.16	-3681.66	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	9.665	-646.14	-664.34	-2060.62	-2742.33	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	10.1	-497.98	-414.78	-1863.07	-1888.93	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	10.1	-408.5	-414.77	-1607.16	-1888.88	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	10.6	-238.2	-252	-1380.10	-1180.61	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	11.1	-67.9	-171.55	-1153.04	-585.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	11.1	-29.11	-171.56	-1075.01	-585.90	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	11.6	141.19	156.49	-847.95	-249.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	12.1	311.49	513.65	-620.89	-319.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	12.1	336	513.64	-667.94	-319.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	12.6	515.49	788.66	-450.34	-527.59	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	13.1	742.55	951.34	-280.05	-822.31	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG	13.1	686.42	951.34	-393.51	-822.32	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VG(G5)	13.505	870.34	1061.45	-255.57	-1115.73	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.40	0.40	0.05	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.22	0.22	0.05	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.07	0.17	0.06	0.16	0.16
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.07	0.17	0.05	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.03	0.26	0.04	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.40	0.12	0.40	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.40	0.12	0.40	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.49	0.18	0.49	0.02	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.57	0.23	0.57	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.57	0.23	0.57	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.59	0.25	0.59	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.60	0.27	0.60	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.60	0.27	0.60	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.57	0.27	0.57	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.53	0.26	0.53	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.53	0.26	0.53	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.46	0.22	0.46	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.17	0.38	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.38	0.17	0.38	0.07	0.02	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.11	0.26	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.03	0.13	0.10	0.04	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.03	0.13	0.11	0.04	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.07	0.07	0.13	0.05	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.23	0.23	0.14	0.06	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.23	0.23	0.16	0.07	0.16
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.47	0.47	0.17	0.08	0.17
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.73	0.73	0.12	0.06	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.28	0.73	0.73	0.14	0.07	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.81	0.81	0.15	0.07	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.62	0.62	0.03	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.46	0.46	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.32	0.32	0.03	0.11	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.32	0.32	0.02	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.20	0.20	0.01	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.10	0.10	0.00	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.10	0.10	0.00	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.04	0.04	0.01	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.05	0.09	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.05	0.09	0.02	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.13	0.09	0.13	0.03	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.14	0.16	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.14	0.16	0.03	0.02	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.18	0.19	0.19	0.03	0.01	0.03

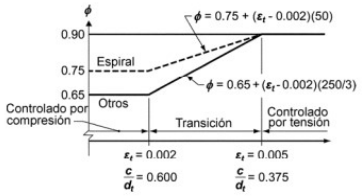
	Indice de sobreesfuerzo
Flexion	0.81
Cortante	0.17



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

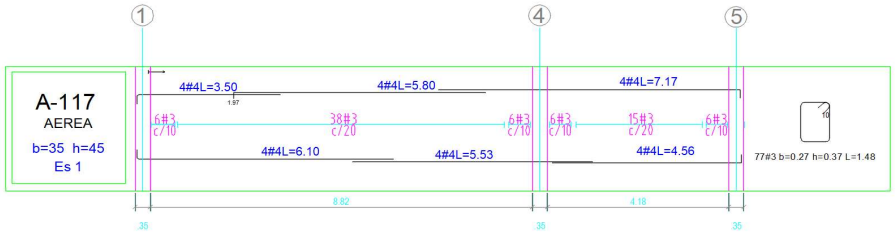
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t .



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



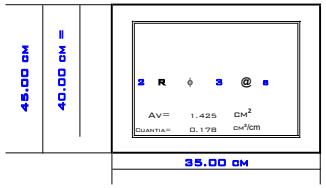
#REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc kg/cm²	Fys kg/cm²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		22.4	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ s @ 20 @ s

V u

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (cm²)	SEPARACION MAXIMA, S (cm)	
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE		
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		Av= 8S / 3FysS = 0.022 ✔	S < min:	20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 22.4 16.4	Av= (Vu-ϕVc)S / ϕFysD = 0.116 ✔	S < min:	98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 22.4 32.7 ✔	Av= (Vu-ϕVc)S / ϕFysD = 0.116 ✔	S < min:	98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 22.4	BIEN		

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VH(A-118)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm Luego:

Número varilla 4 **DIAMETRO VARILLAS =** No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²** ρ mín= 0.0033

fy = 4200.00 kgf/cm² = 420.00 MPa ρ máx= 0.025

FACTORES DE REDUCCION: **Øc =** Coeficiente por Calidad del diseño y construccion de la es 1.00

Øe = Coeficiente por estado de la edificación = 0.80

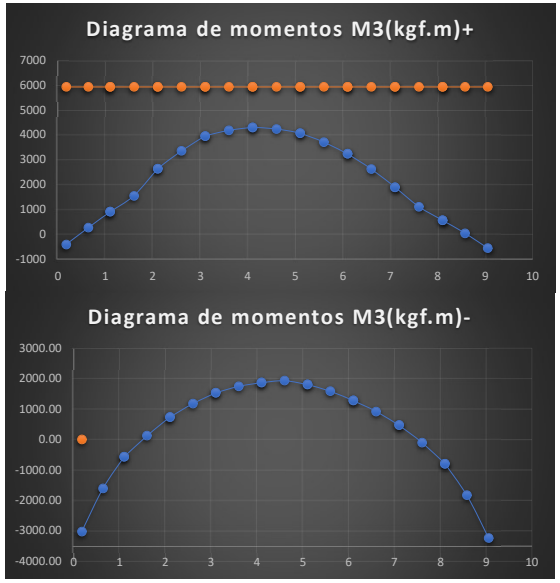
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d
1	5	40.00
2	5	40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VH(H1)	0.175	-1537.59	-411.77	-3818.60	-3020.57	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	0.6375	-1380.06	263.11	-3608.56	-1610.46	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	1.1	-1222.54	914.08	-3398.53	-570.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	1.1	-986.04	914.07	-2558.02	-570.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	1.6	-815.74	1555.89	-2330.96	125.20	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	2.1	-645.45	2648.33	-2103.90	735.87	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	2.1	-563	2648.3	-1545.81	735.86	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	2.6	-392.7	3364.44	-1318.74	1178.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	3.1	-222.4	3967.05	-1091.68	1535.73	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	3.1	-160.69	3967.02	-616.28	1535.71	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	3.6	9.61	4195.25	-389.22	1745.18	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	4.1	182.39	4309.95	-178.33	1868.96	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	4.1	83.83	4309.92	-247.07	1868.94	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	4.6	287.52	4254.11	-53.49	1936.56	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	5.1	514.58	4084.76	116.80	1806.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	5.1	610.06	4084.76	39.65	1806.24	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	5.6	837.12	3722.96	209.95	1586.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	6.1	1064.18	3247.64	380.24	1280.45	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	6.1	1115.49	3247.65	249.22	1280.46	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	6.6	1342.55	2633.14	419.52	919.64	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	7.1	1569.61	1905.1	589.81	473.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	7.1	1911.46	1905.15	556.93	473.28	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	7.6	2138.52	1119.01	727.23	-101.72	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	8.1	2365.58	567.29	897.53	-794.39	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	8.1	2928.98	567.32	1013.93	-794.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH	8.5775	3145.82	43.87	1176.56	-1828.01	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VH(H4)	9.055	3362.67	-557.08	1339.19	-3237.57	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.51	0.51	0.06	0.15	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.27	0.27	0.05	0.14	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.10	0.15	0.07	0.20	0.20
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.15	0.10	0.15	0.06	0.15	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.02	0.26	0.05	0.14	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.45	0.12	0.45	0.04	0.12	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.45	0.12	0.45	0.03	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.57	0.20	0.57	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.67	0.26	0.67	0.01	0.06	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.67	0.26	0.67	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.71	0.29	0.71	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.72	0.31	0.72	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.72	0.31	0.72	0.00	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.72	0.33	0.72	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.69	0.30	0.69	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.69	0.30	0.69	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.63	0.27	0.63	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.55	0.22	0.55	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.55	0.22	0.55	0.07	0.01	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.44	0.15	0.44	0.08	0.02	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.08	0.32	0.09	0.03	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.08	0.32	0.11	0.03	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.19	0.02	0.19	0.12	0.04	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.13	0.13	0.14	0.05	0.14
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.10	0.13	0.13	0.17	0.06	0.17
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.01	0.31	0.31	0.12	0.05	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.09	0.54	0.54	0.13	0.05	0.13

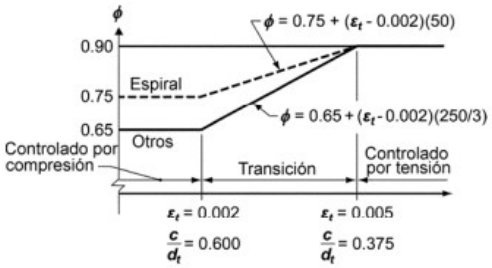
	Indice de sobreesfuerzo
Flexion	0.72
Cortante	0.20



Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

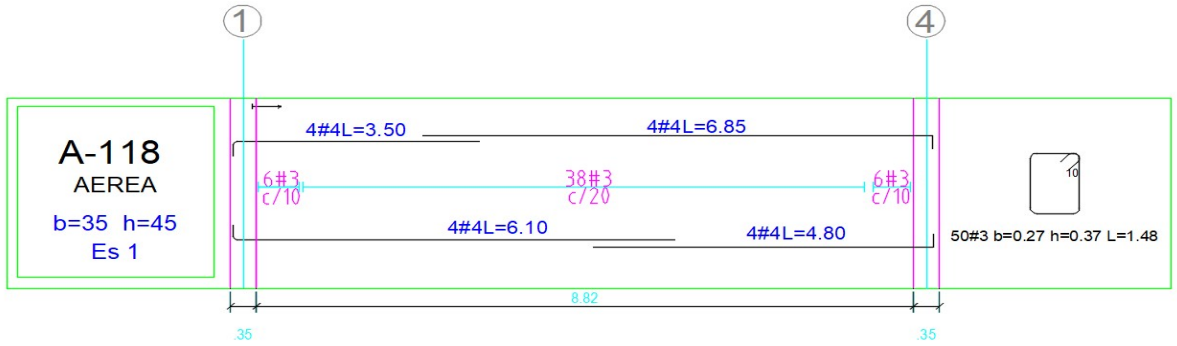
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado

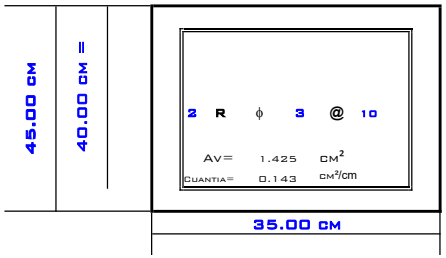


#REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA									0.75
Fc	Fys	Vmax	Vlim		Vu <	(ϕVc	+	ϕVs)	ϕVcmax	DISEÑO
KG/CM²	KG/CM²	TF	TF	TF		TF		TF	TF	OPTIMO
210	4200	40.1	24.1	10.0		8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av = \frac{BS}{3FysS} = 0.028$ ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs <4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av = \frac{(Vu-\phi Vc)S}{\phi FysD} = 0.144$ ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VI(A-119)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín= 0.0033

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estru 1.00

Øe = Coeficiente por estado de la edificación = 0.80

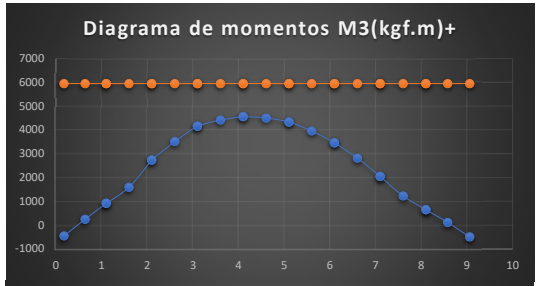
Beta	0.85	
ecu	0.003	
E	2100000	kg/cm2
	0.002	

capas de acero	d'	d	
1	5	40.00	
2	5	40.00	

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VI(I1)	0.175	-1587.44	-445.1	-4038.73	-3285.27	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	0.6375	-1429.92	253	-3828.70	-1696.77	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	1.1	-1272.4	923.46	-3618.67	-606.48	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	1.1	-1020.33	923.46	-2715.68	-606.48	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	1.6	-850.03	1590.59	-2488.61	119.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	2.1	-679.74	2744.91	-2261.55	760.38	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	2.1	-585.15	2744.88	-1650.88	760.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	2.6	-414.85	3513.56	-1423.82	1224.65	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	3.1	-244.56	4168.7	-1196.76	1603.05	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	3.1	-167.34	4168.67	-646.22	1603.04	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	3.6	2.96	4419.85	-419.16	1823.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	4.1	173.26	4557.51	-213.40	1956.93	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	4.1	86.47	4557.48	-263.47	1956.92	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	4.6	288.19	4507.04	-67.93	2028.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	5.1	515.25	4343.08	102.36	1879.67	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	5.1	648.76	4343.08	39.75	1879.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	5.6	875.82	3961.93	210.04	1650.56	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	6.1	1102.88	3467.26	380.34	1335.49	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	6.1	1185.81	3467.27	254.40	1335.50	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	6.6	1412.87	2817.6	424.70	960.72	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	7.1	1639.93	2054.4	595.00	500.25	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	7.1	2034.16	2054.45	571.82	500.27	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	7.6	2261.22	1229.02	742.11	-97.13	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	8.1	2488.29	652.7	912.41	-801.31	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	8.1	3081.75	652.73	1029.90	-801.28	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI	8.5775	3298.59	120.11	1192.53	-1864.26	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VI(I4)	9.055	3515.44	-489.55	1355.17	-3356.88	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.07	0.55	0.55	0.06	0.15	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.04	0.29	0.29	0.05	0.15	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.10	0.16	0.07	0.21	0.21
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.16	0.10	0.16	0.06	0.16	0.16
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.27	0.02	0.27	0.05	0.15	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.46	0.13	0.46	0.04	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.46	0.13	0.46	0.03	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.59	0.21	0.59	0.02	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.70	0.27	0.70	0.01	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.70	0.27	0.70	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.74	0.31	0.74	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.77	0.33	0.77	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.77	0.33	0.77	0.01	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.76	0.34	0.76	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.73	0.32	0.73	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.73	0.32	0.73	0.04	0.00	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.67	0.28	0.67	0.05	0.01	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.58	0.22	0.58	0.06	0.02	0.06
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.58	0.22	0.58	0.07	0.01	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.47	0.16	0.47	0.08	0.02	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.35	0.08	0.35	0.10	0.03	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.35	0.08	0.35	0.12	0.03	0.12
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.21	0.02	0.21	0.13	0.04	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.13	0.13	0.15	0.05	0.15
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.11	0.13	0.13	0.18	0.06	0.18
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.31	0.31	0.13	0.05	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.56	0.56	0.13	0.05	0.13

	Indice de sobreesfuerzo
Flexion	0.77
Cortante	0.21

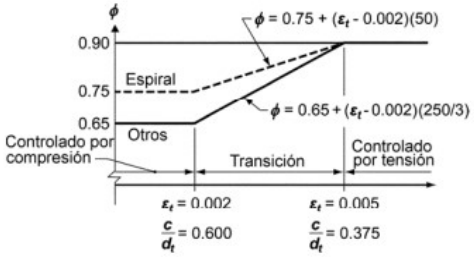




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

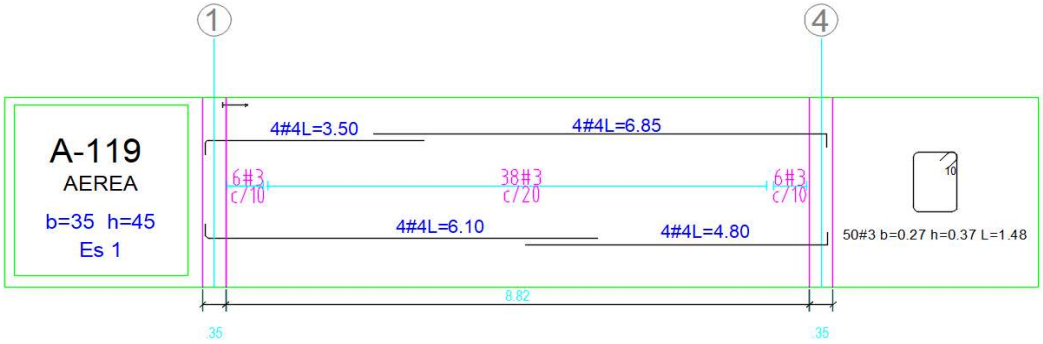
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



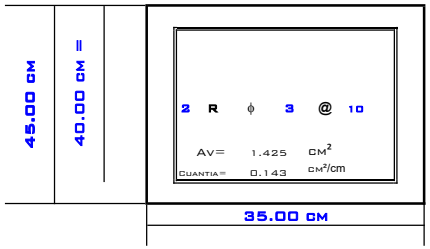
#¡REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av=\frac{BS}{3FysS}=$ 0.028 ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.144 ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs < 4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.144 ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	

ACERO EN VIGAS SOMETIDAS A COMPRESION EN VIGAS DE HORMIGON ARMADO

DATOS:

Tipo elemento: Viga VJ(A-120)

f'c = 210.00 kgf/cm² = 2.10 MPa

SECCION

b= 35.00 cm = 350.00 mm

h= 45.00 cm = 450.00 mm

Luego:

Número varillas 4

DIAMETRO VARILLAS = No. 4 = 4/8 pulg = 129.00 mm² Area varilla

As = **5.1600 cm²**

fy = 4200.00 kgf/cm² = 420.00 MPa

ρ mín= 0.0033

ρ máx= 0.025

FACTORES DE REDUCCION:

Øc = Coeficiente por Calidad del diseño y construccion de la estr 1.00

Øe = Coeficiente por estado de la edificación = 0.80

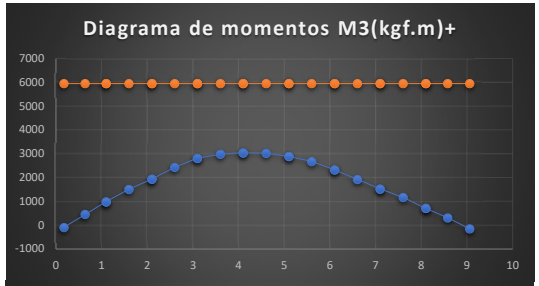
Beta	0.85		
ecu	0.003		
E	2100000	kg/cm2	
	0.002		

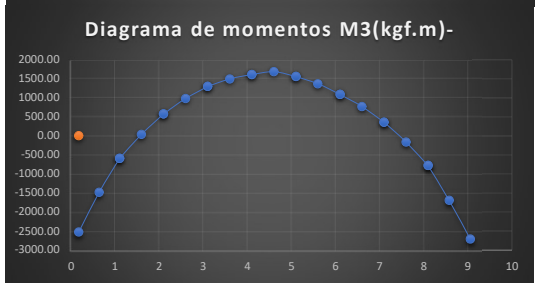
capas de acero	d'	d	
1	5		40.00
2	5		40.00

VIGA	DISTANCIA (m)	Envolvente max		Envolvente min		S(cm)	Φvu(kg)	AS	AS'	Capas	d'	d	C	e's	Fluye/No fluye	A	B	C	c1	c2	c
		V2(Kgf)	M3(Kgf.m) +	V2(Kgf)	M3(Kgf) -																
VJ(J1)	0.175	-1256.97	-92.91	-2599.31	-2529.45	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	0.6375	-1099.45	453.04	-2389.28	-1482.25	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	1.1	-941.92	982.56	-2179.25	-589.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	1.1	-804.24	982.55	-1772.99	-589.07	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	1.6	-633.94	1508.23	-1545.93	37.52	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	2.1	-463.64	1929.74	-1318.87	578.19	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	2.1	-462.73	1929.72	-1124.07	578.18	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	2.6	-292.44	2426.45	-897.01	981.90	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	3.1	-122.14	2809.65	-669.94	1299.28	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	3.1	-131.48	2809.63	-593.67	1299.26	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	3.6	38.82	2980.71	-366.61	1498.64	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	4.1	218.99	3038.25	-149.53	1611.68	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	4.1	71.06	3038.23	-276.31	1611.66	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	4.6	268.75	3019.55	-76.73	1688.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	5.1	495.81	2887.33	93.56	1559.62	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	5.1	354.07	2887.33	-32.13	1559.63	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	5.6	581.13	2663.25	138.17	1368.35	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	6.1	808.19	2325.64	308.46	1090.59	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	6.1	694.07	2325.65	137.91	1090.61	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	6.6	921.14	1921.84	308.21	768.93	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	7.1	1148.2	1523.89	478.51	360.34	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	7.1	1243.84	1523.91	375.63	360.36	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	7.6	1470.91	1163.26	545.93	-161.75	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	8.1	1697.97	702.48	716.22	-781.97	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	8.1	1893.85	702.51	729.96	-781.95	20.00	17158.12	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ	8.5775	2110.69	312.26	892.59	-1696.04	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605
VJ(J4)	9.055	2327.53	-154.49	1055.23	-2714.84	10.00	26136.34	5.16	5.16	1	5.0	40.0	0.00	0.000000	No fluye	-5310.38	-10836.00	162540.00	-6.64601	4.61	4.605

a	e's	f's	As1	As2(cm2)	ΦMn(kgf.m)	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a flexion	Indice de sobreesfuerzo +	Indice de sobreesfuerzo -	Indice de sobreesfuerzo a cortante
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.02	0.43	0.43	0.05	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.08	0.25	0.25	0.04	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.10	0.17	0.05	0.13	0.13
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.17	0.10	0.17	0.05	0.10	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.25	0.01	0.25	0.04	0.09	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.10	0.32	0.03	0.08	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.10	0.32	0.03	0.07	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.41	0.17	0.41	0.02	0.05	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.47	0.22	0.47	0.01	0.04	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.47	0.22	0.47	0.01	0.03	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.50	0.25	0.50	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.51	0.27	0.51	0.01	0.01	0.01
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.51	0.27	0.51	0.00	0.02	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.51	0.28	0.51	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.49	0.26	0.49	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.49	0.26	0.49	0.02	0.00	0.02
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.45	0.23	0.45	0.03	0.01	0.03
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.39	0.18	0.39	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.39	0.18	0.39	0.04	0.01	0.04
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.32	0.13	0.32	0.05	0.02	0.05
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.06	0.26	0.07	0.03	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.26	0.06	0.26	0.07	0.02	0.07
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.20	0.03	0.20	0.09	0.03	0.09
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.13	0.13	0.10	0.04	0.10
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.12	0.13	0.13	0.11	0.04	0.11
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.05	0.29	0.29	0.08	0.03	0.08
3.915	-0.00025699	-540	5.83	-0.67	5947.11	0.03	0.46	0.46	0.09	0.04	0.09

	Indice de sobreesfuerzo
Flexion	0.51
Cortante	0.13

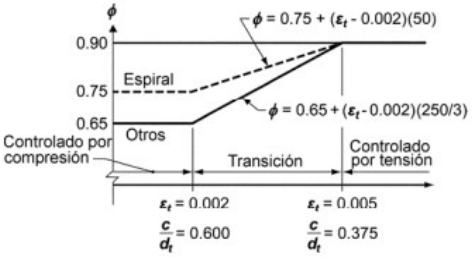




Diámetros	Diámetros	Area mm
2	1/4 pulg	32 mm²
3	3/8 pulg	71 mm²
4	1/2 pulg	129 mm²
5	5/8 pulg	199 mm²
6	3/4 pulg	284 mm²
7	7/8 pulg	387 mm²
8	1 pulg	510 mm²
9	1 1/8 pulg	645 mm²
10	1 1/4 pulg	819 mm²
11	1 3/8 pulg	1006 mm²
14	1 3/4 pulg	1452 mm²
18	2 1/4 pulg	2581 mm²

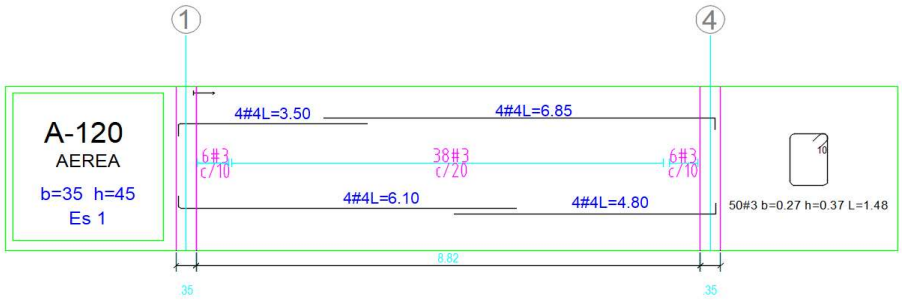
		Recubrimiento
4	Viga	4
FALSO	Viga Fundación	
VERDADERO	Vigueta	
	Vigueta Fundación	
	Nervio	
	Nervio Fundación	
	Nervio Borde	
	Nervio Borde Fundación	
	Nervio Temperatura	
	Nervio Temperatura Fundación	
	Columna	

ecuaciones para ϕ como una función de c/d_t.



Interpolación en c/d_t: Espiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Otros $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. CR9.3.2 — Variación de ϕ con la deformación unitaria neta de tracción en el acero extremo en tracción ε_t y c/d_t para refuerzo Grado 420 y para acero de preesforzado



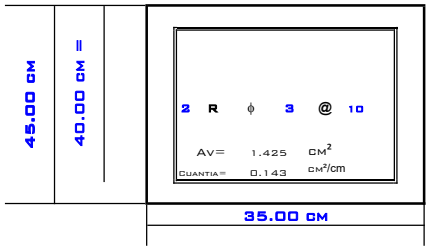
#¡REF!

8.7 REVISION LIMITE ELASTICO A CORTANTE VIGAS - PISOS 1-2

PROPIEDADES DE DISEÑO: SECCION SUB-REFORZADA 0.75

Fc KG/CM²	Fys KG/CM²	Vmax TF	Vlim TF	Vu < TF	(ϕVc TF	+	ϕVs) TF	ϕVcmax TF	DISEÑO OPTIMO
210	4200	40.1	24.1	10.0	8.2		18.0	14.4	✔

FLEJE DE DISEÑO



CORTANTE PROBABLE MAXIMA DE DISEÑO

Vu

@ 10 @ 20 @ 10

Vu

SEPARACION MAXIMA DEL REFUERZO A CORTANTE, S, EN VIGAS MAESTRAS, VIGAS Y VIGUETAS

RESISTENCIA REQUERIDA A CORTANTE Vu - TF	VALOR LIMITE DE (ϕVs) - TF	AREA MINIMA REQUERIDA DE REFUERZO A CORTANTE Av DENTRO DE UNA DISTANCIA S (CM²)	SEPARACION MAXIMA, S (CM)
Vu > 0.5ϕVc 10.0 4.1		SI SE REQUIERE	
0.5ϕVc < Vu <ϕVc 4.1 ### 8.2		$Av=\frac{BS}{3FysS}=$ 0.028 ✔	S < MIN: 20 ✔ 60 ✔
USE ϕVc < Vu 8.2 10.0	ϕVs < 2ϕVc 18.0 16.4	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.144 ✔	S < MIN: 98 ✔ 20.0 ✔ 60 ✔ 513.0413226 ✔
	USE 2ϕVc< ϕVs < 4ϕVc 16.4 ✔ 18.0 32.7 ✔	$Av=\frac{(Vu-\phi Vc)S}{\phi FysD}=$ 0.144 ✔	S < MIN: 98 ✔ 10 ✔ 30 ✔ 513.0413226 ✔
	4ϕVc > ϕVs 32.7 ✔ 18.0	BIEN	