

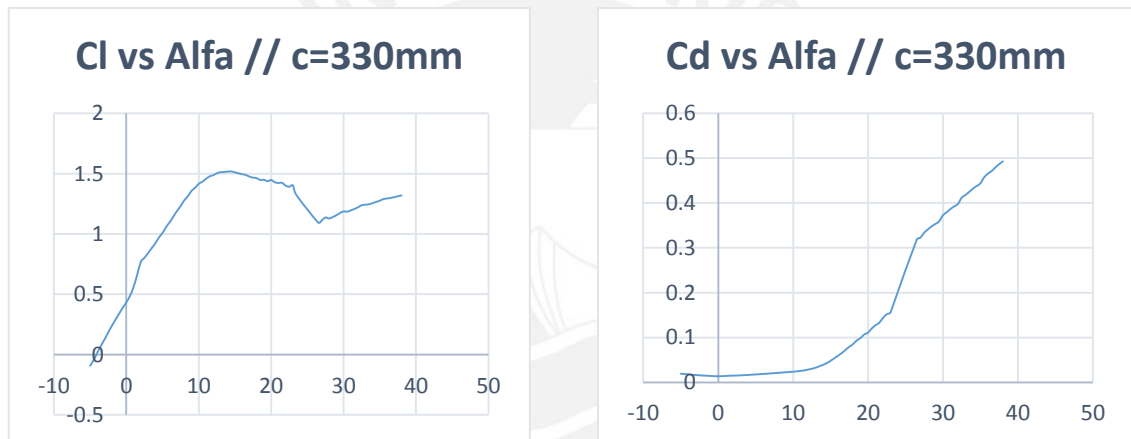
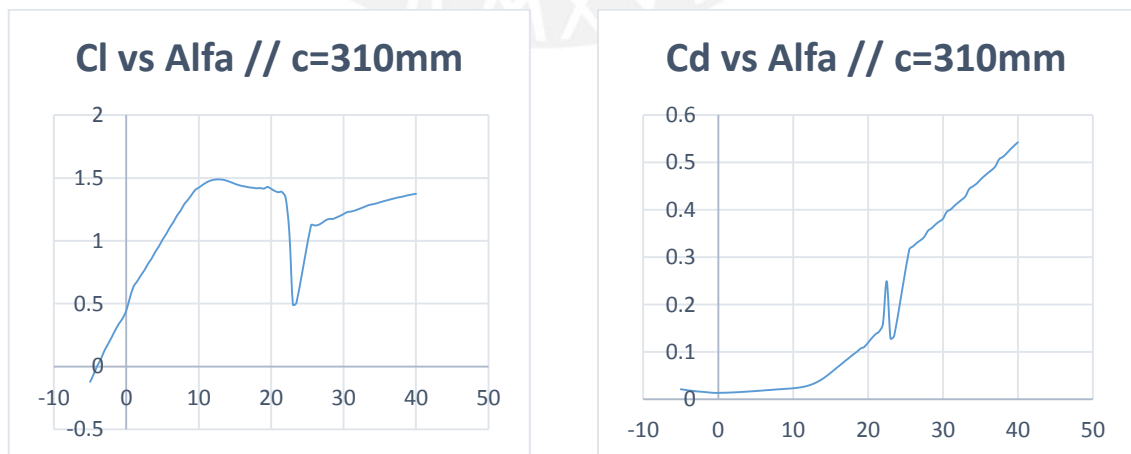
ANEXOS

A. Gráficas de Coeficiente de Sustentación (C_l) y Arrastre (C_d) de cada estación obtenidas por QBLADE

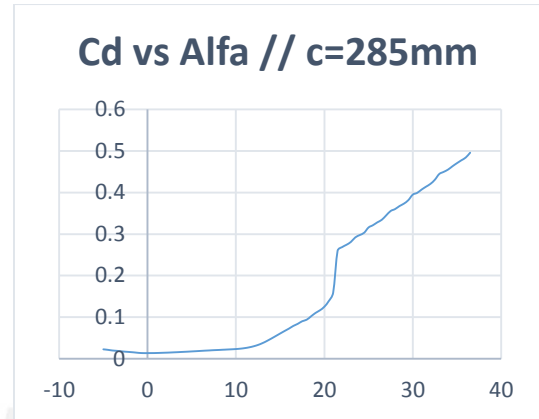
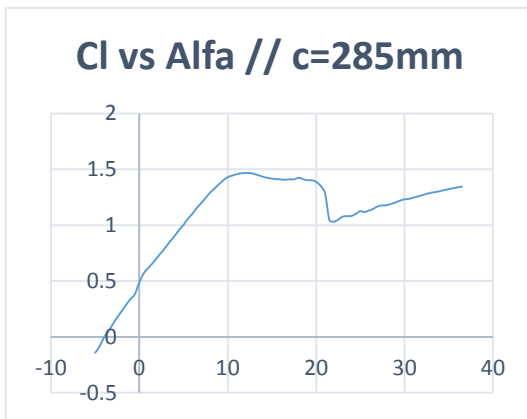
Caso:

Velocidad del aire = 7.5m/s

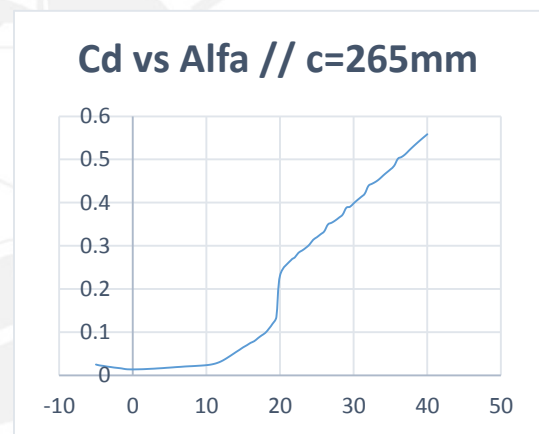
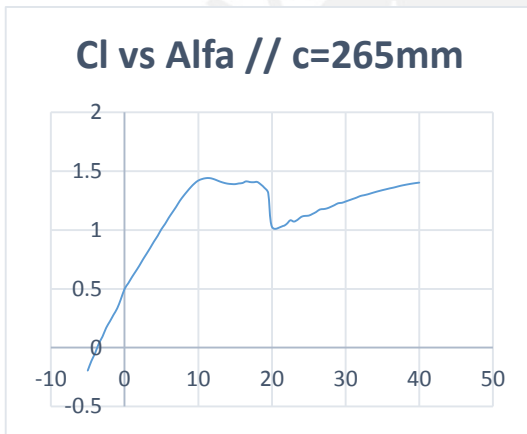
Velocidad angular del rotor = 300 RPM // 400 RPM // 500RPM

Estación 1: C=330 mm // $Re \approx 174\ 000$ Estación 2: C=310 mm // $Re \approx 164\ 000$ 

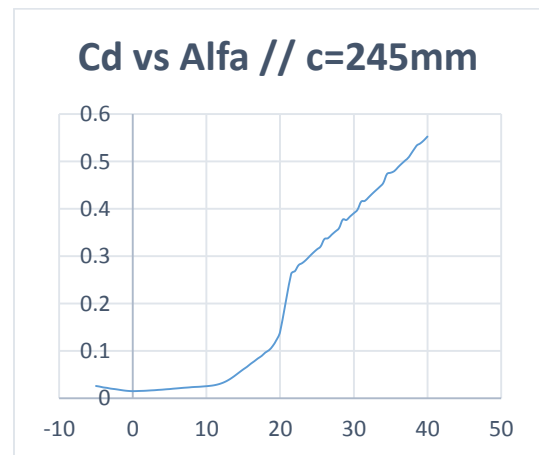
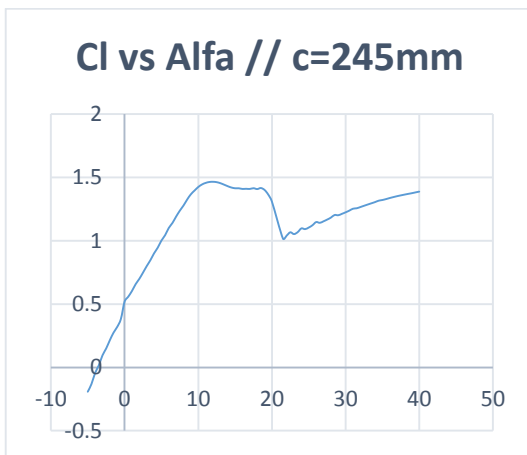
Estación 3: C=285 mm // Re≈150 000



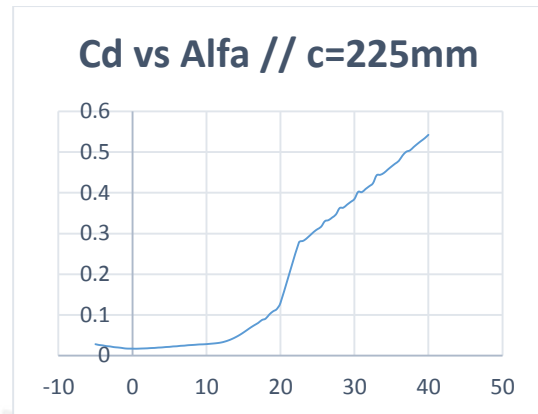
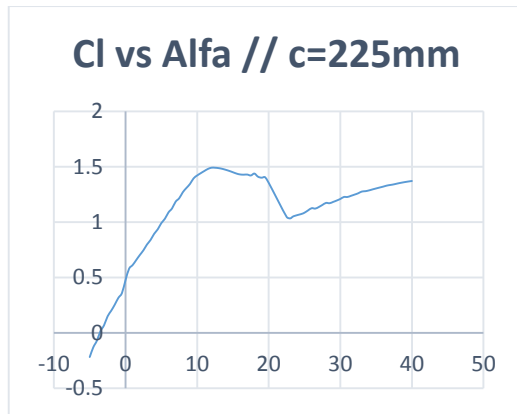
Estación 4: C=265 mm // Re≈140 000



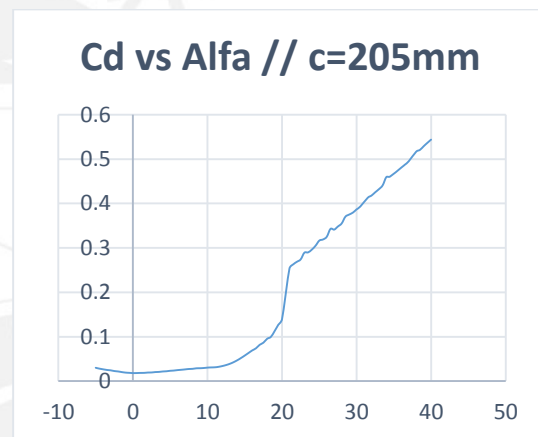
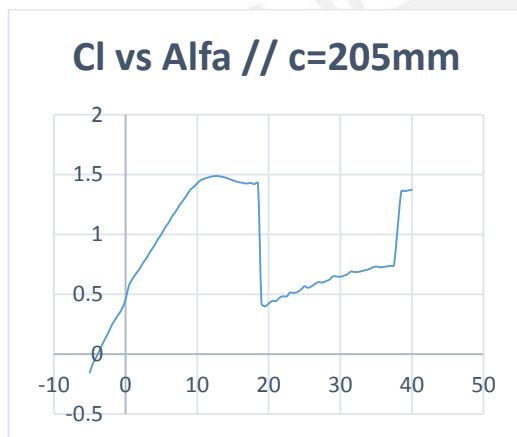
Estación 5: C=245 mm // Re≈129 000



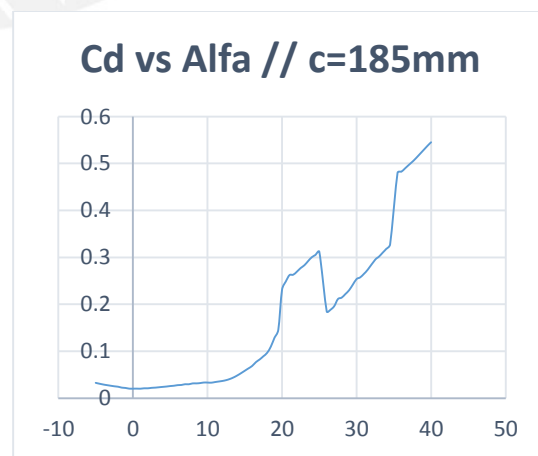
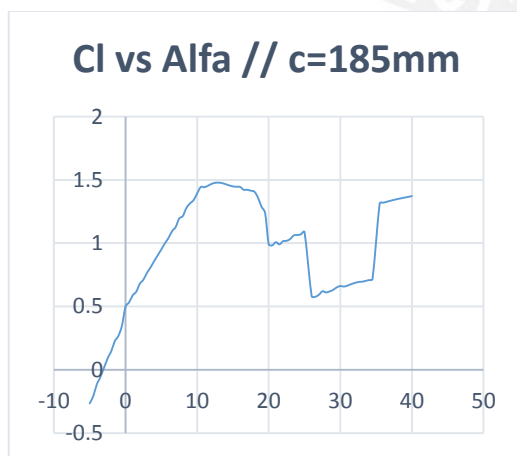
Estación 6: C=225 mm // Re≈119 000



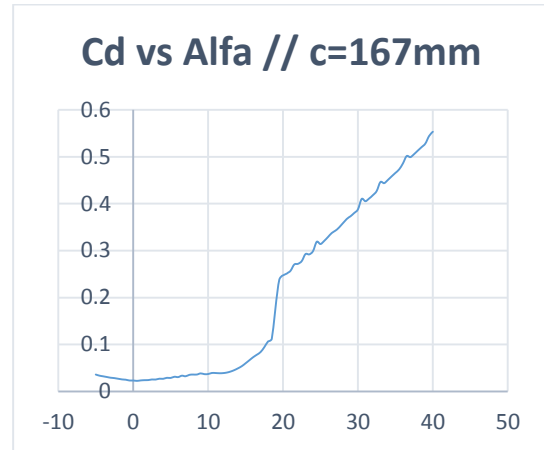
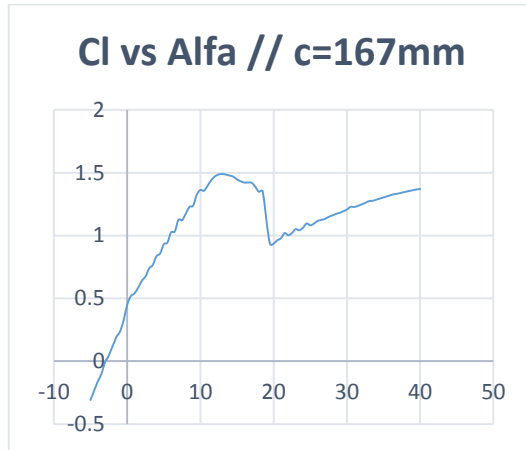
Estación 7: C=205 mm // Re≈108 000



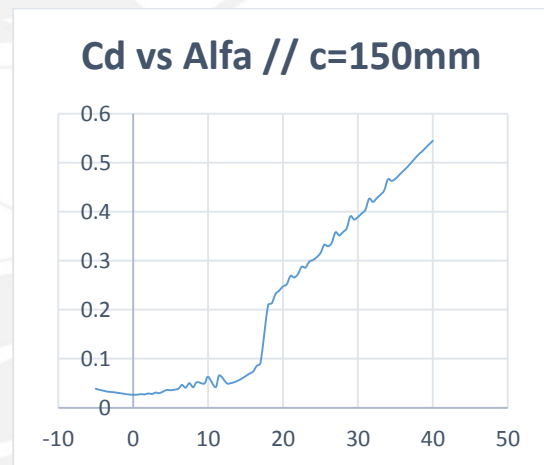
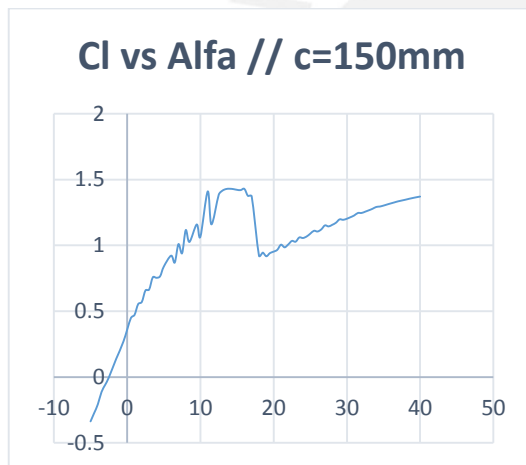
Estación 8: C=185 mm // Re≈98 000



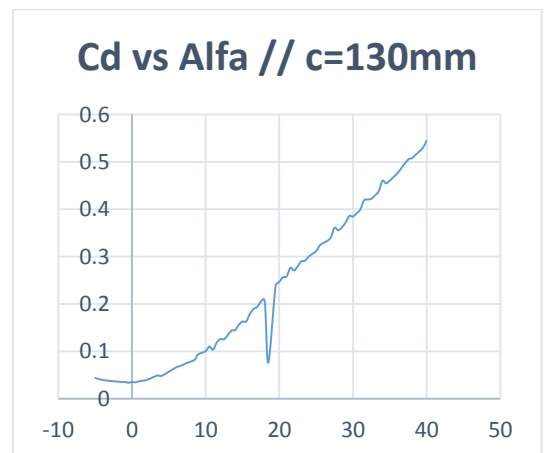
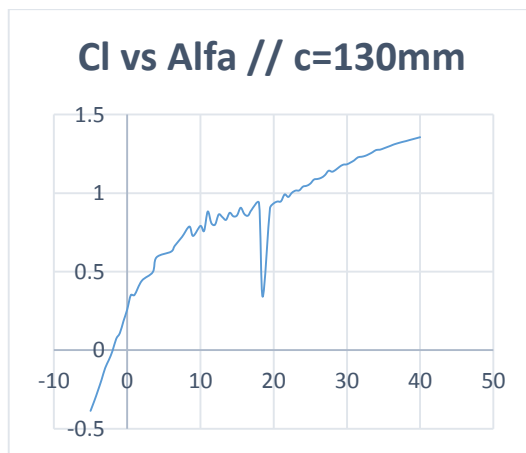
Estación 9: C=167 mm // Re≈88 000



Estación 10: C=150 mm // Re≈79 000



Estación 11: C=130 mm // Re≈69 000

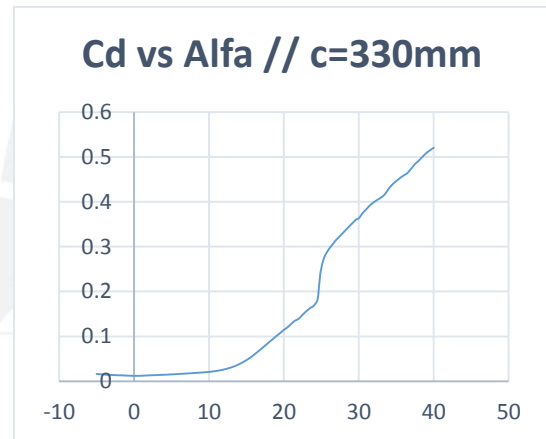
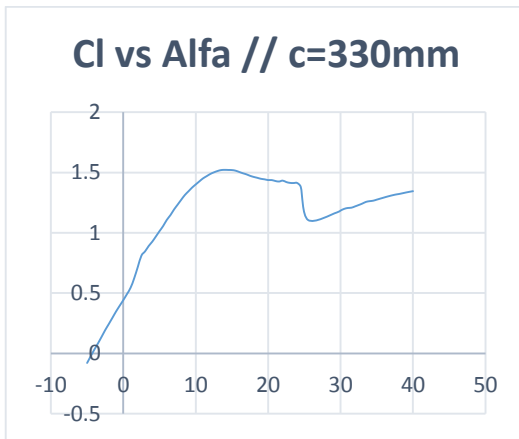


Caso:

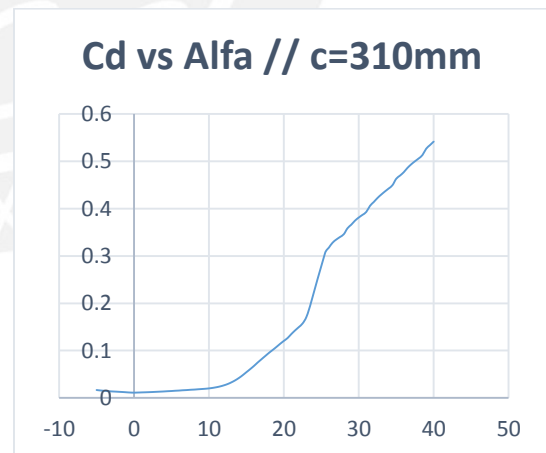
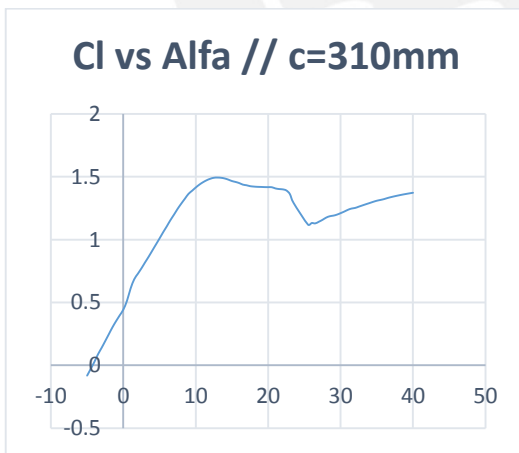
Velocidad del aire = 10m/s

Velocidad angular del rotor = 300 RPM // 400 RPM // 500 RPM

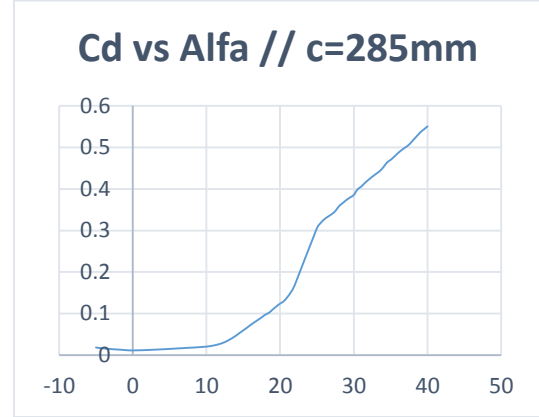
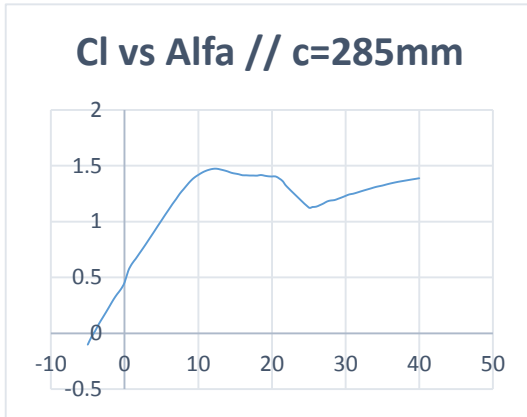
Estación 1: C=330 mm // Re≈230 000



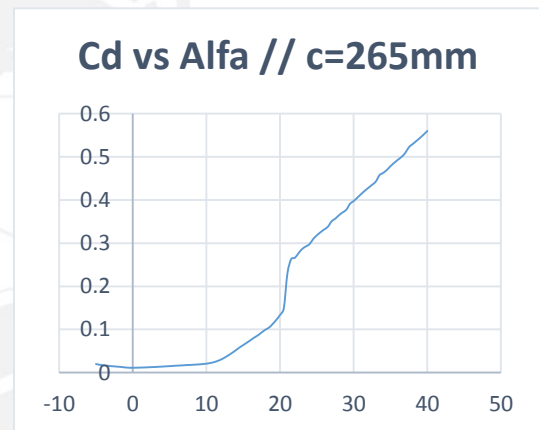
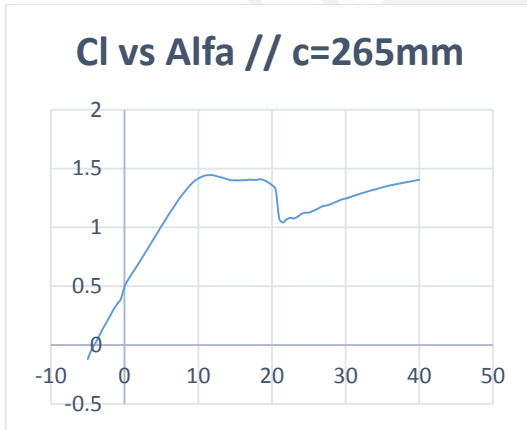
Estación 2: C=310 mm // Re≈218 000



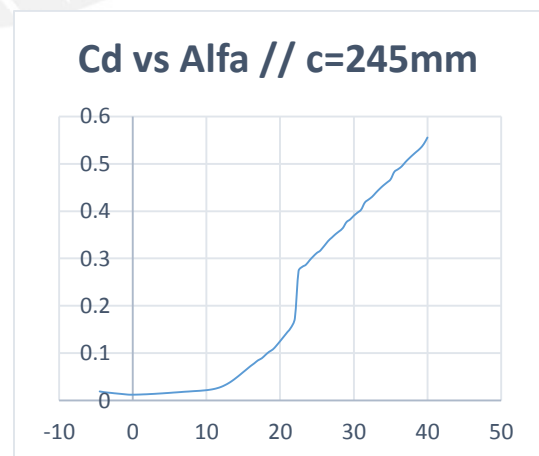
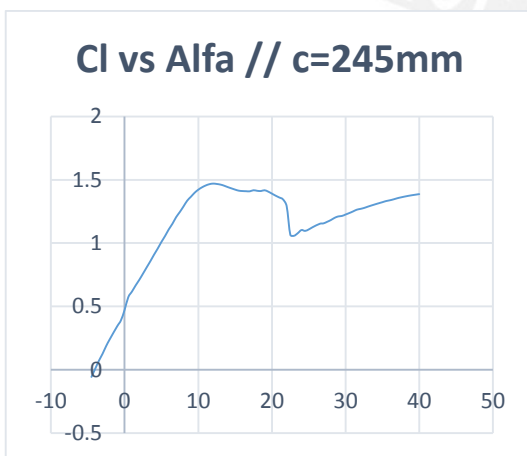
Estación 3: C=285 mm // Re≈201 000



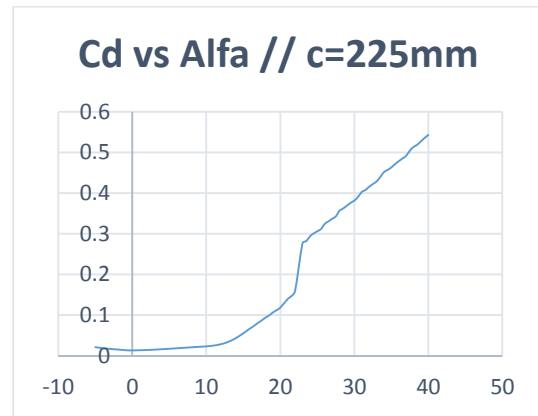
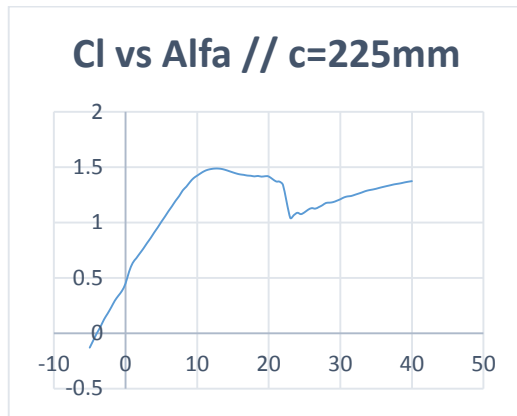
Estación 4: C=265 mm // Re≈187 000



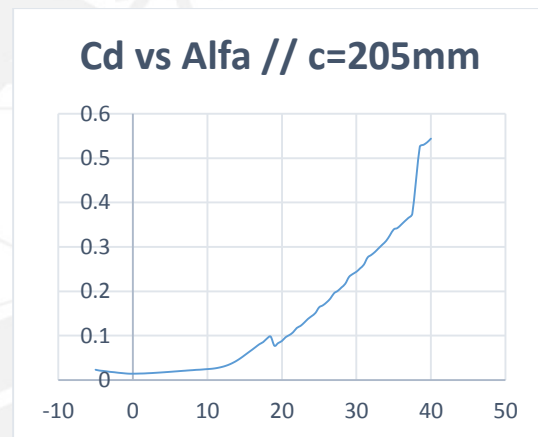
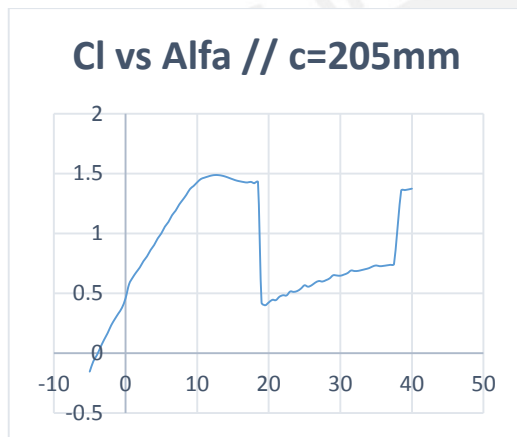
Estación 5: C=245 mm // Re≈172 000



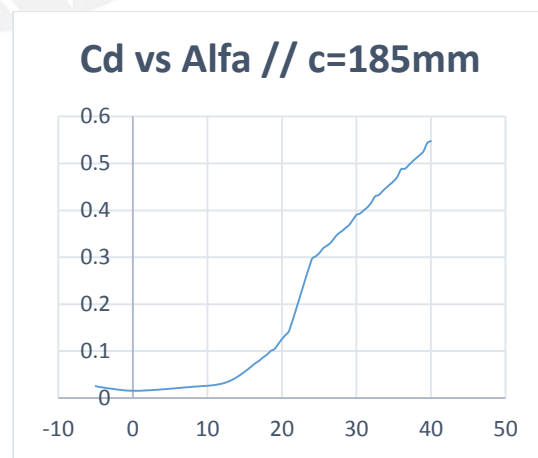
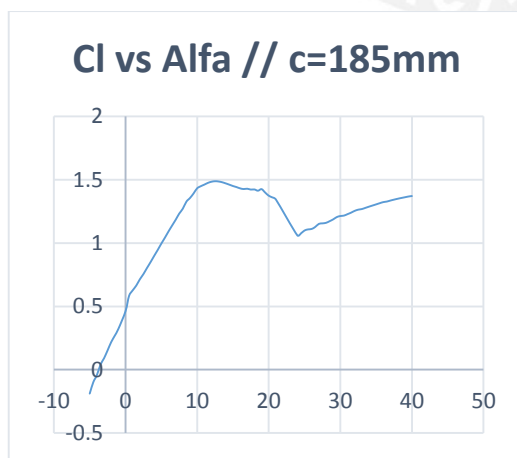
Estación 6: C=225 mm // Re≈158 000



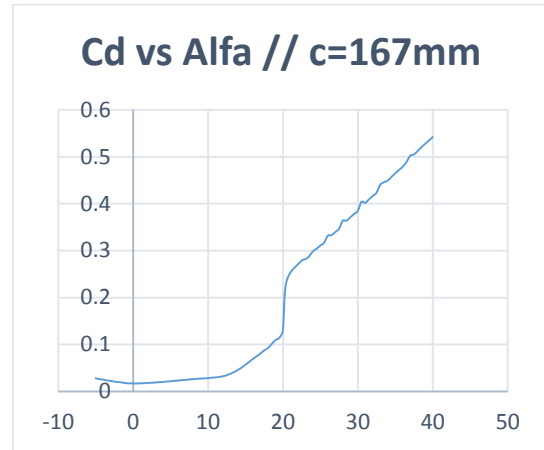
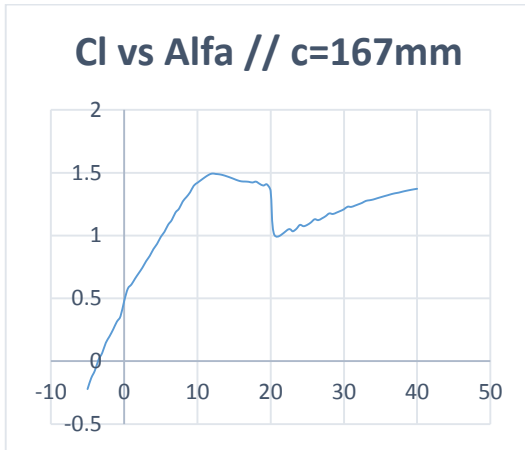
Estación 7: C=205 mm // Re≈144 000



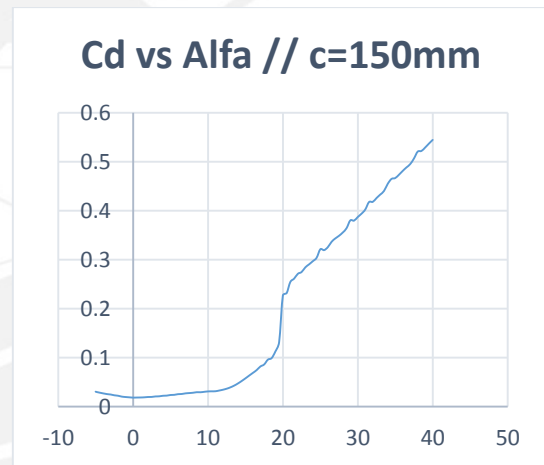
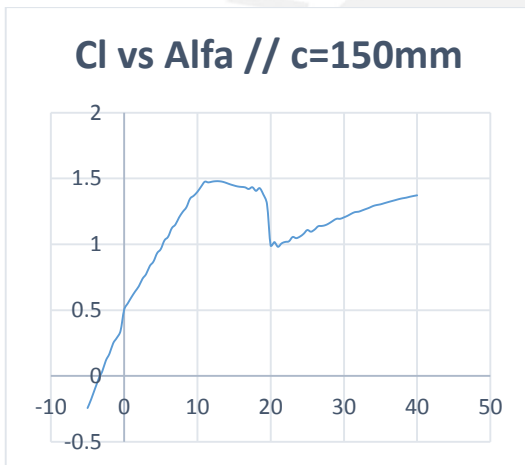
Estación 8: C=185 mm // Re≈130 000



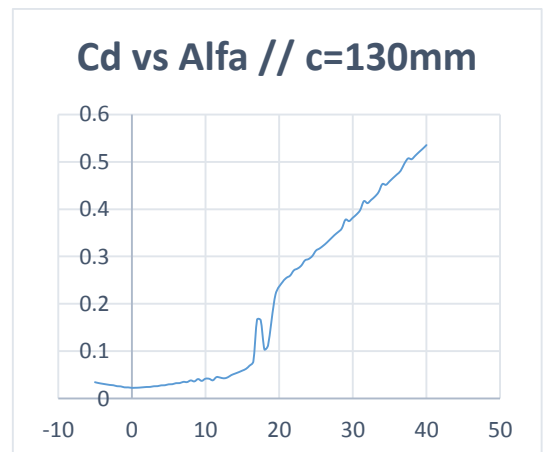
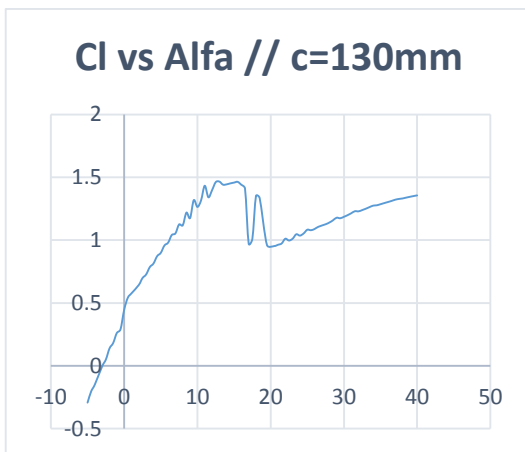
Estación 9: C=167 mm // Re≈118 000



Estación 10: C=150 mm // Re≈106 000



Estación 11: C=130 mm // Re≈92 000

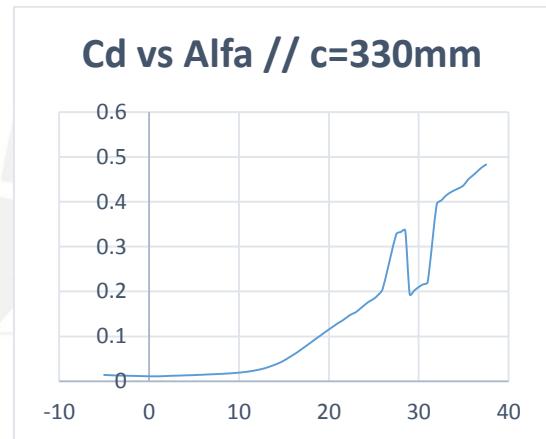
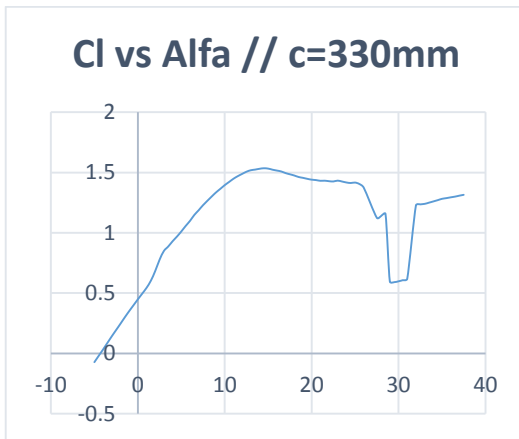


Caso:

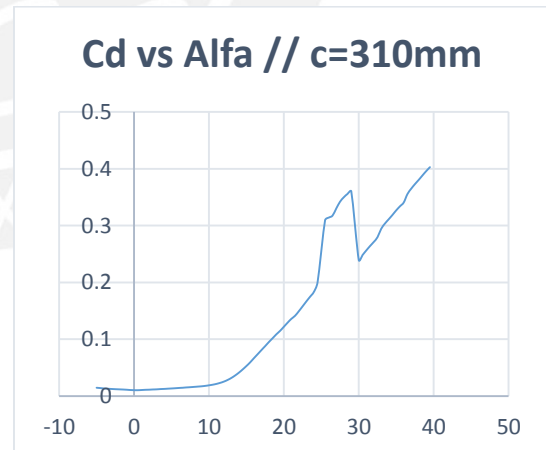
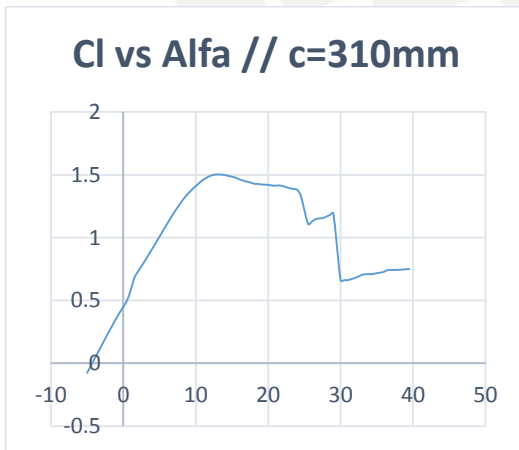
Velocidad del aire = 12.5m/s

Velocidad angular del rotor = 300 RPM // 400 RPM // 500RPM

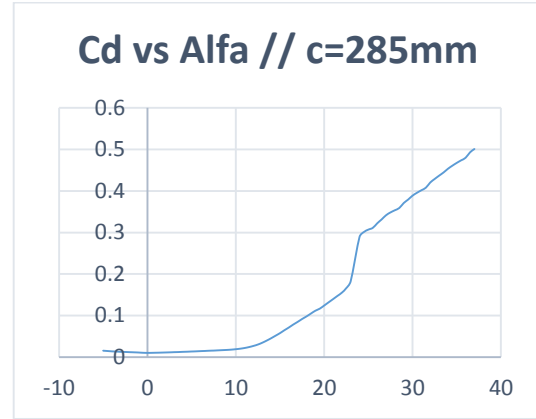
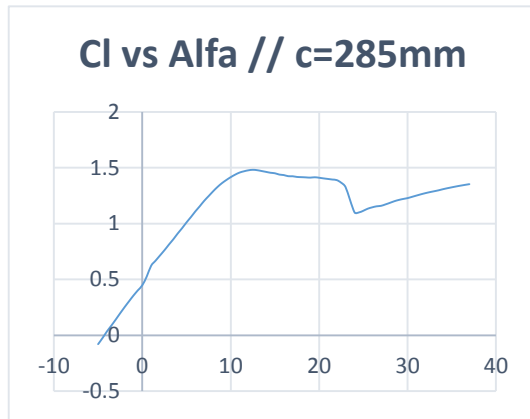
Estación 1: C=330 mm // Re≈290 000



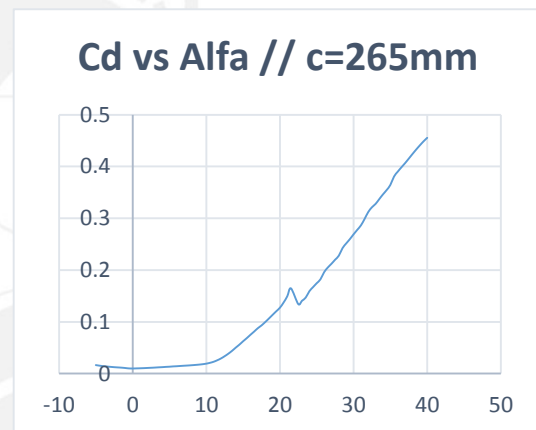
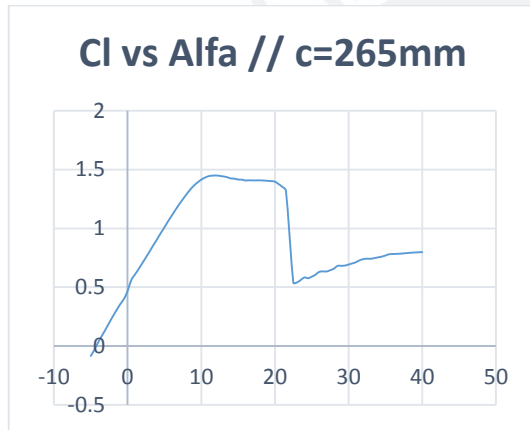
Estación 2: C=310 mm // Re≈273 000



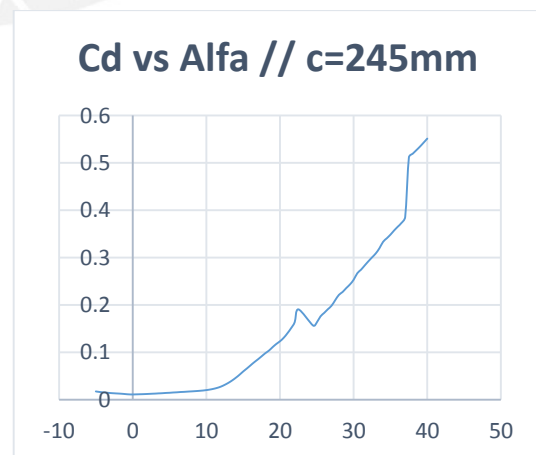
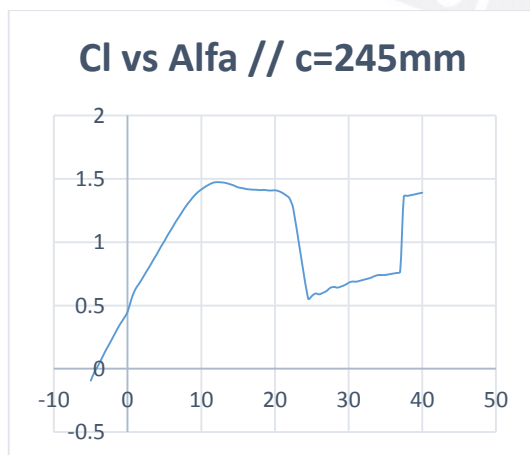
Estación 3: C=285 mm // Re≈251 000



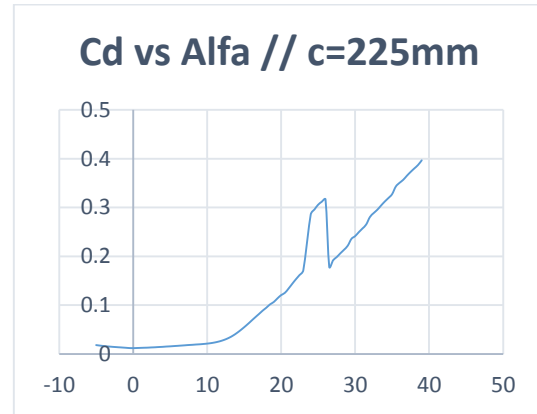
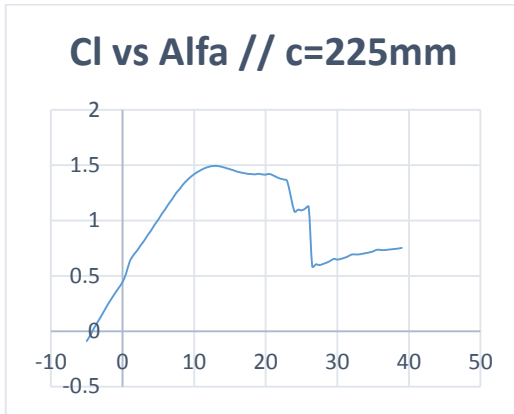
Estación 4: C=265 mm // Re≈233 000



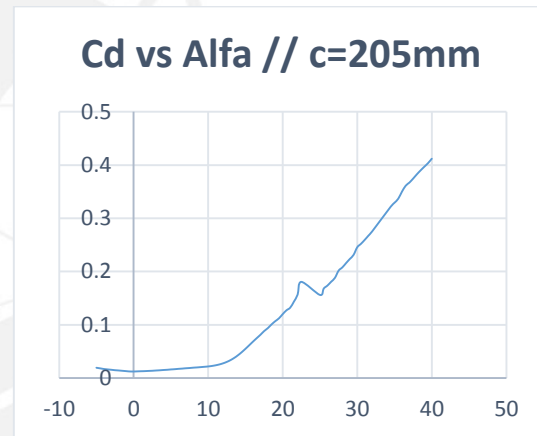
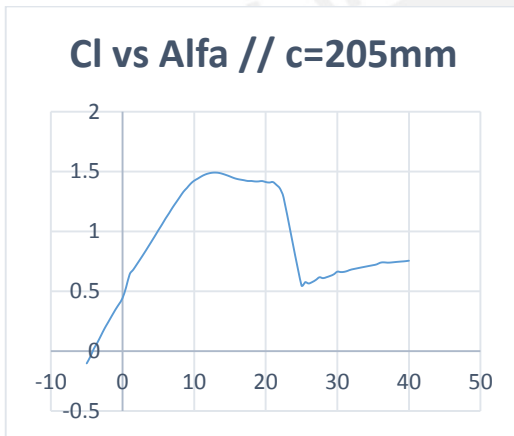
Estación 5: C=245 mm // Re≈216 000



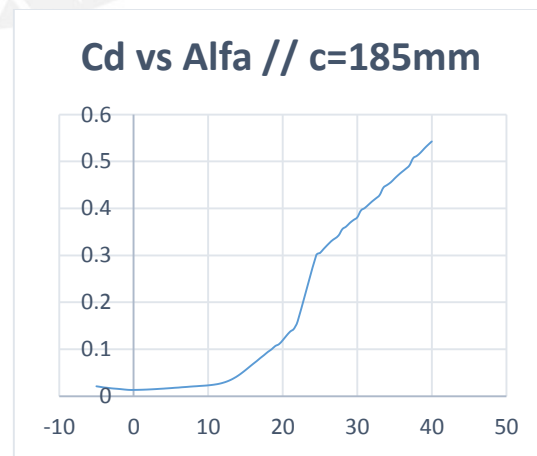
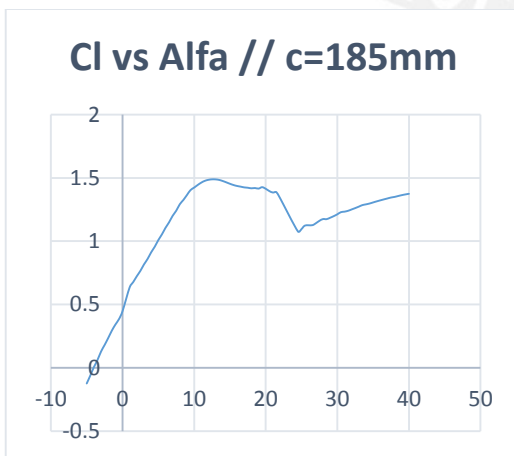
Estación 6: C=225 mm // Re≈198 000



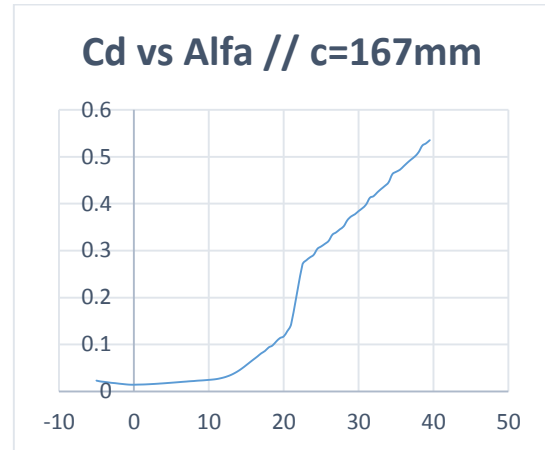
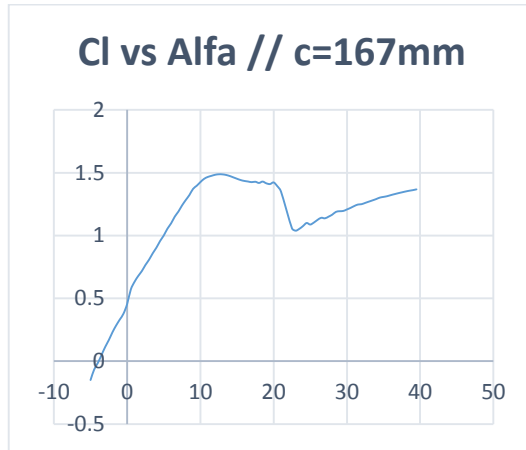
Estación 7: C=205 mm // Re≈180 000



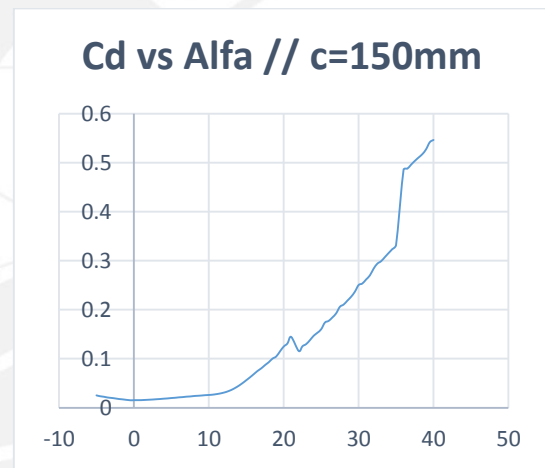
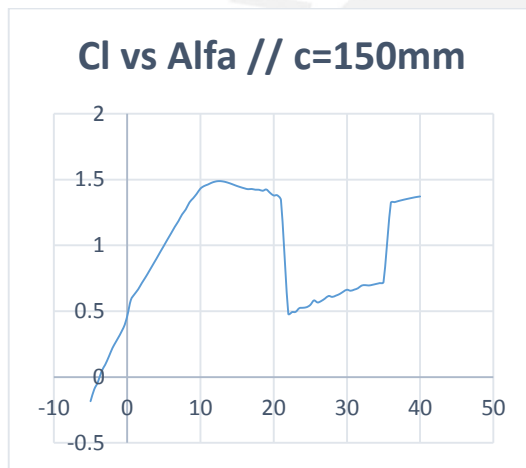
Estación 8: C=185 mm // Re≈163 000



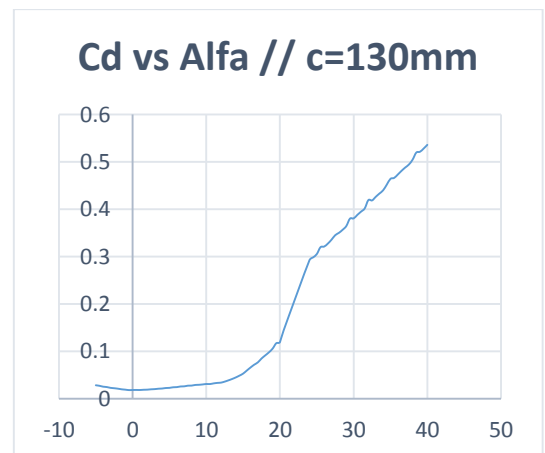
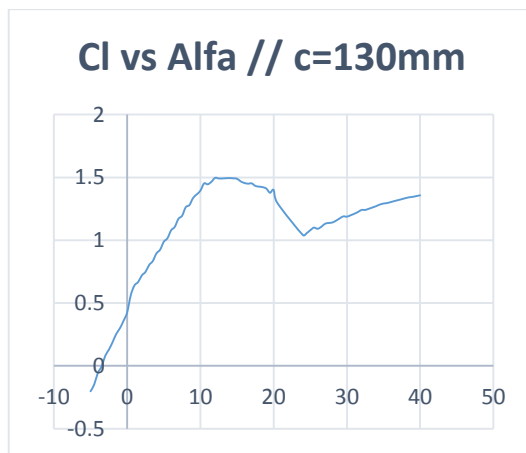
Estación 9: C=167 mm // Re≈147 000



Estación 10: C=150 mm // Re≈106 000



Estación 11: C=130 mm // Re≈92 000

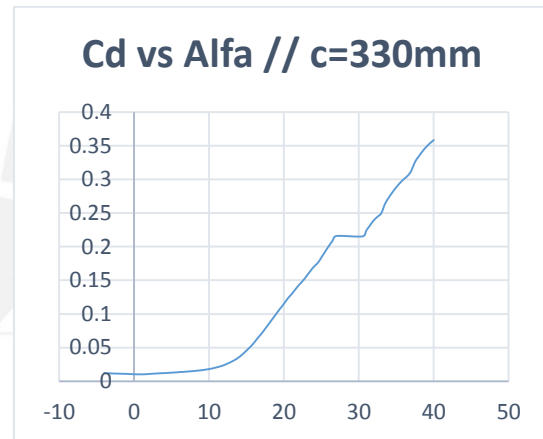
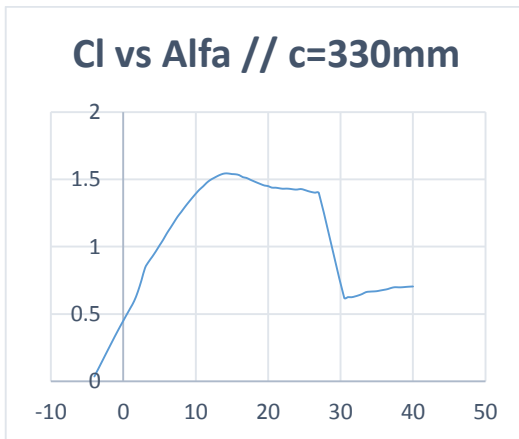


Caso:

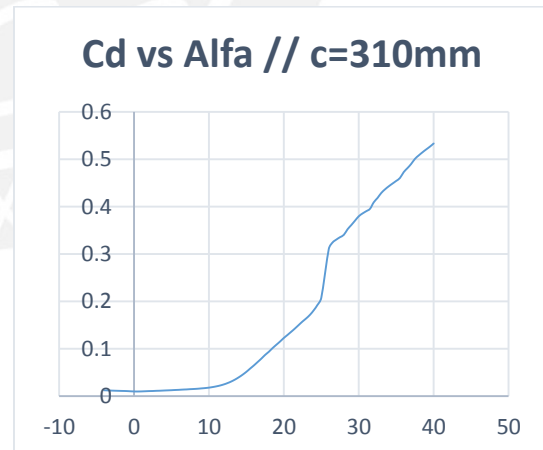
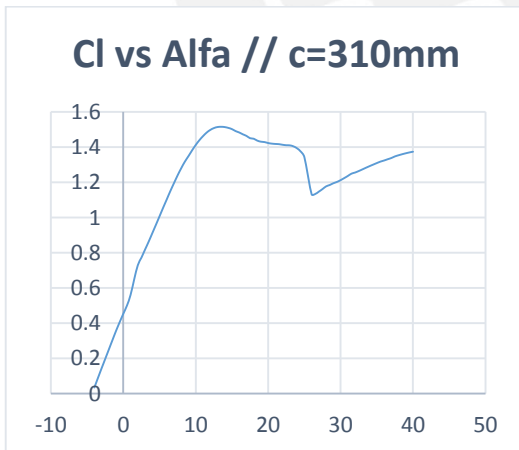
Velocidad del aire = 15m/s

Velocidad angular del rotor = 300 RPM // 400 RPM // 500RPM

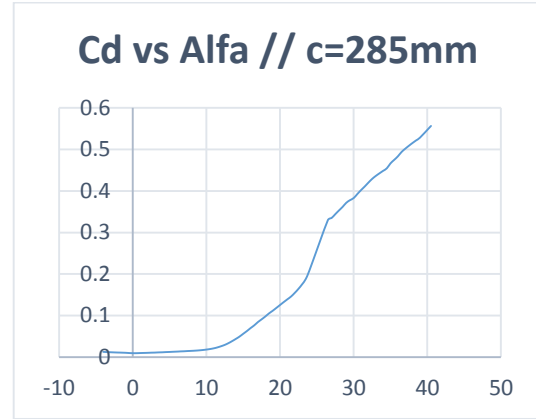
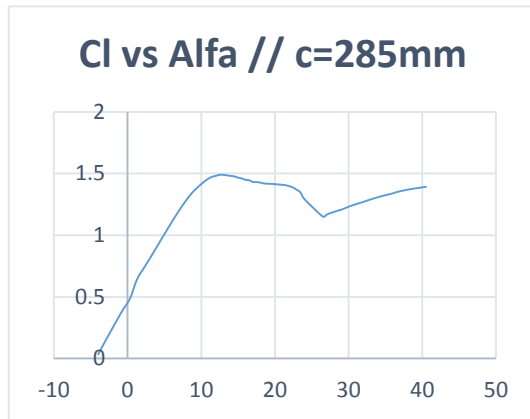
Estación 1: C=330 mm // Re≈348 000



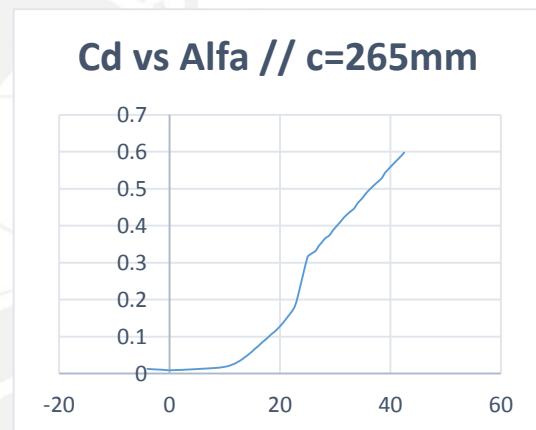
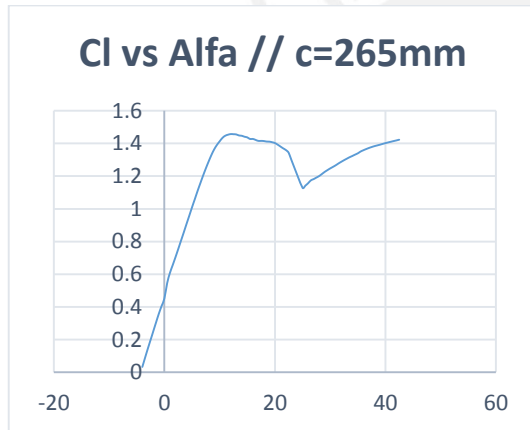
Estación 2: C=310 mm // Re≈327 000



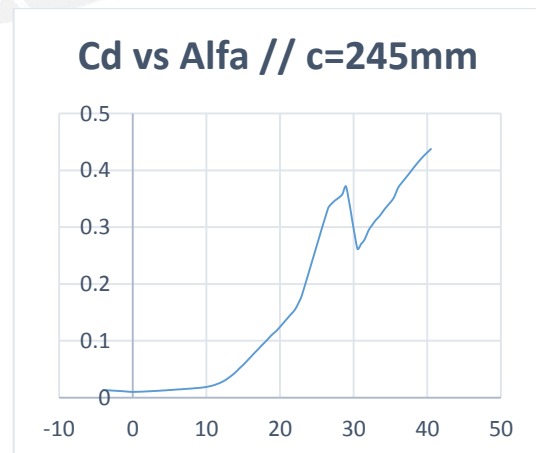
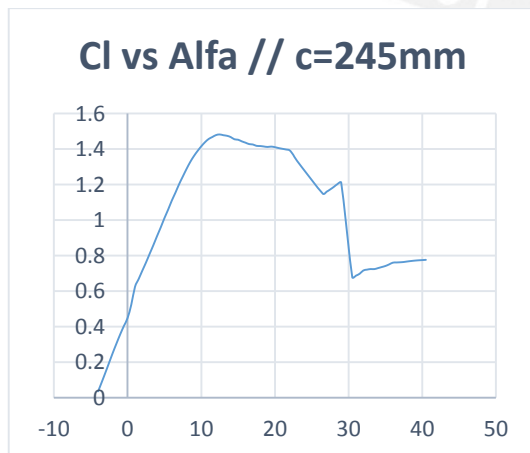
Estación 3: C=285 mm // Re≈301 000



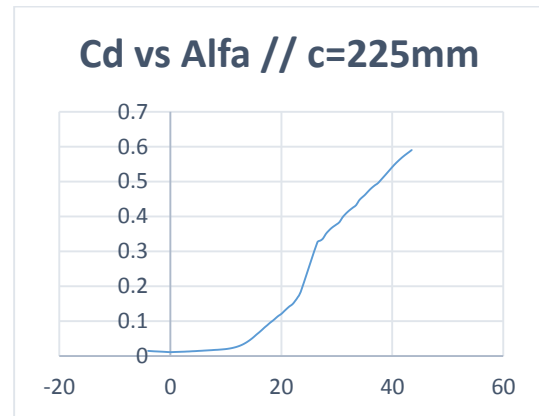
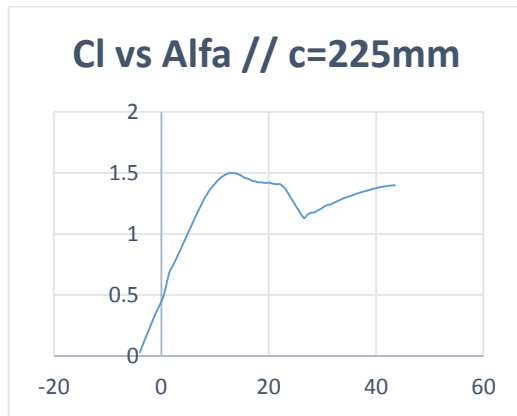
Estación 4: C=265 mm // Re≈280 000



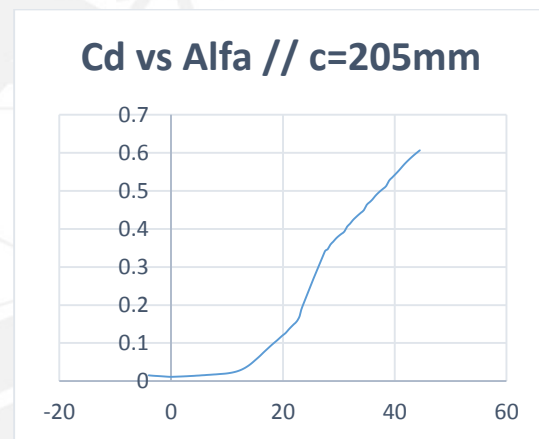
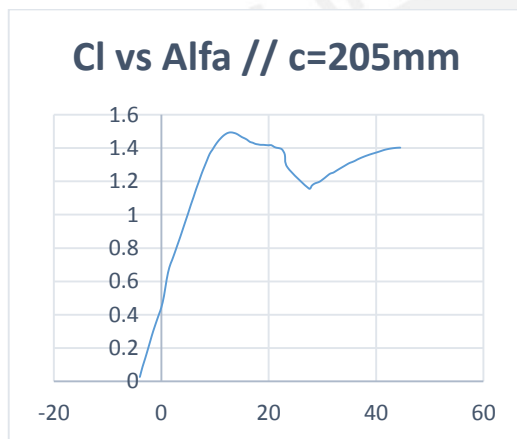
Estación 5: C=245 mm // Re≈259 000



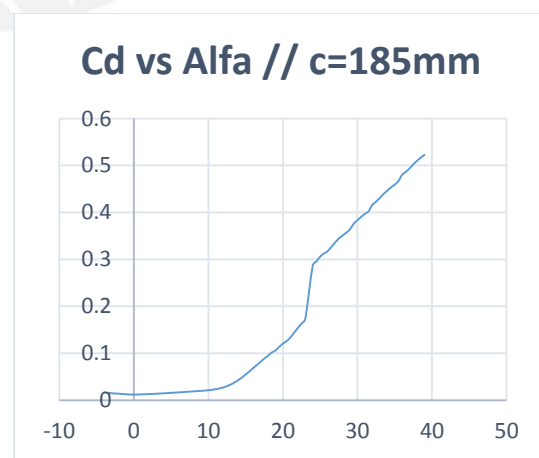
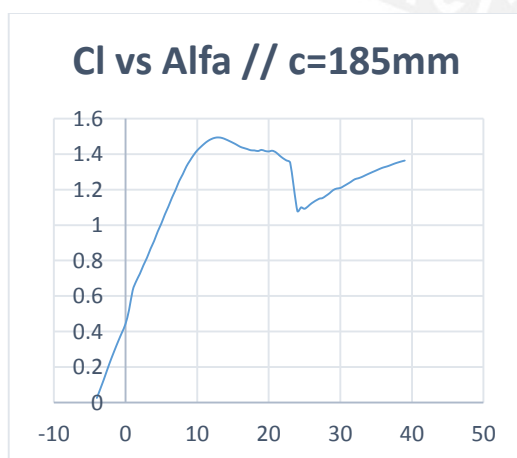
Estación 6: C=225 mm // Re≈238 000



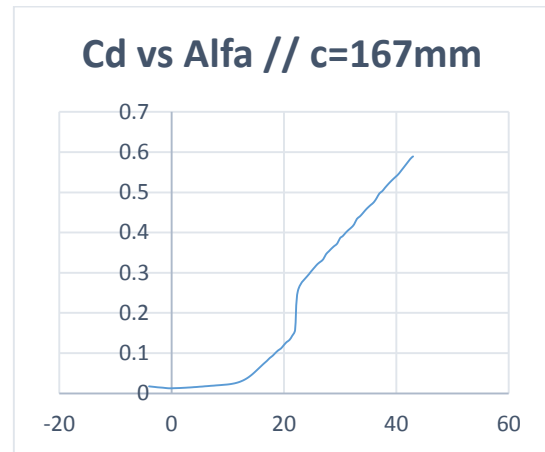
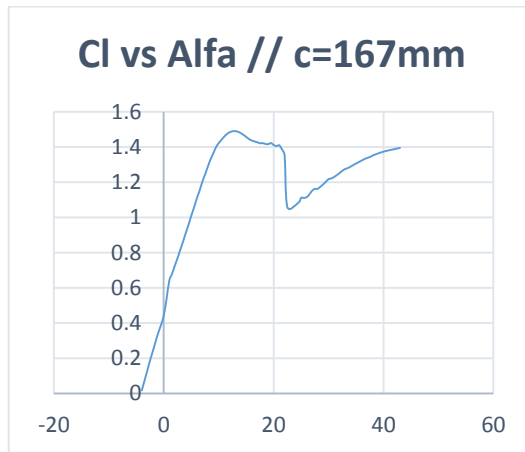
Estación 7: C=205 mm // Re≈216 000



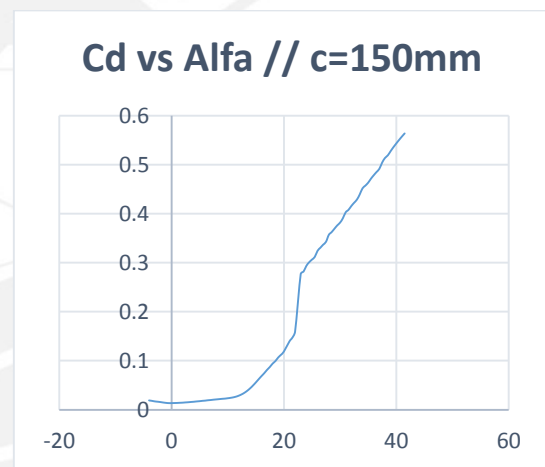
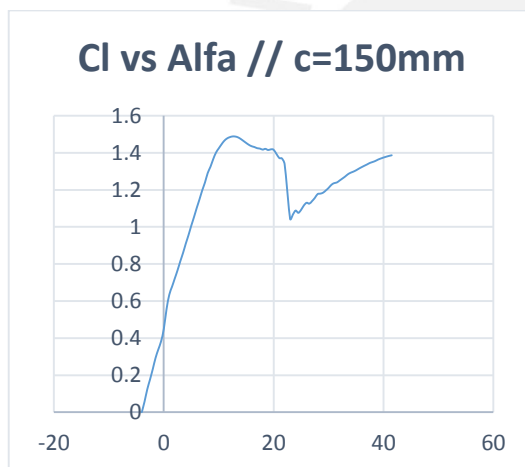
Estación 8: C=185 mm // Re≈195 000



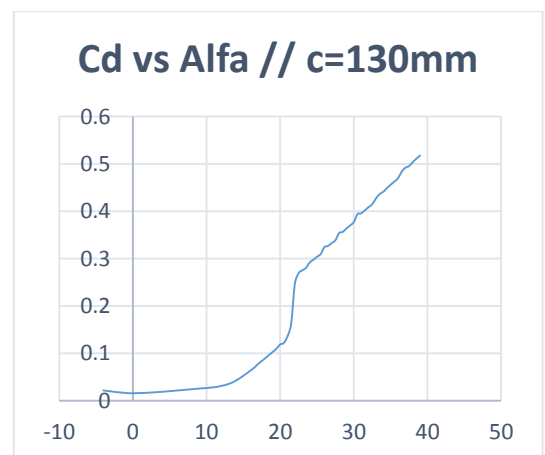
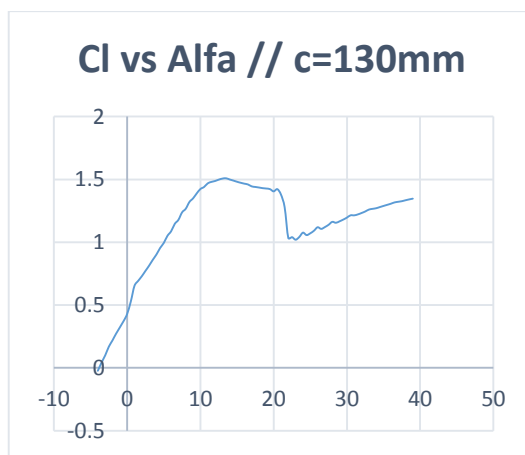
Estación 9: C=167 mm // Re≈176 000



Estación 10: C=150 mm // Re≈158 000



Estación 11: C=130 mm // Re≈137 000



B. Coordenadas de los puntos que forman el perfil para cada estación

Estación 1: C=330 mm

Coordenadas de perfil para C=330 // r=300mm

x (mm)	y (mm)	z (mm)
-214.34	123.75	300
-210.60	123.02	300
-199.59	120.77	300
-181.95	116.82	300
-158.67	110.99	300
-130.99	103.12	300
-100.35	93.17	300
-68.29	81.21	300
-36.43	67.40	300
-6.40	51.94	300
20.05	34.73	300
41.78	16.56	300
58.08	-1.39	300
68.52	-17.79	300
72.98	-31.38	300
71.45	-41.25	300
64.38	-46.28	300
52.36	-45.78	300
35.79	-39.99	300
15.21	-29.46	300
-8.70	-15.08	300
-35.23	2.01	300
-63.47	20.57	300
-92.12	39.93	300
-120.04	59.06	300
-146.09	76.96	300
-169.18	92.79	300
-188.28	105.86	300
-202.55	115.64	300
-211.36	121.70	300
-214.34	123.75	300

Estación 2: C=310 mm

Coordenadas de perfil para C=310 // r=500mm

x (mm)	y (mm)	z (mm)
-222.34	67.98	500
-218.78	68.04	500
-208.28	68.14	500
-191.38	67.99	500
-168.93	67.26	500
-142.04	65.55	500
-112.00	62.57	500
-80.23	58.08	500
-48.22	51.93	500
-17.51	43.98	500
10.34	33.82	500
34.12	21.95	500
52.93	9.30	500
66.10	-3.04	500
73.23	-13.96	500
74.11	-22.66	500
68.91	-28.10	500
57.98	-29.60	500
41.73	-27.33	500
20.77	-21.72	500
-4.11	-13.44	500
-31.99	-3.40	500
-61.81	7.48	500
-92.20	18.91	500
-121.89	30.20	500
-149.63	40.73	500
-174.21	49.98	500
-194.56	57.60	500
-209.77	63.27	500
-219.16	66.79	500
-222.34	67.98	500

Estación 3: C=285 mm

Coordenadas de perfil para C=285 // r=700mm

x (mm)	y (mm)	z (mm)
-209.08	44.44	700
-205.83	44.73	700
-196.26	45.52	700
-180.82	46.51	700
-160.26	47.35	700
-135.56	47.64	700
-107.87	47.01	700
-78.47	45.16	700
-48.71	41.88	700
-19.97	36.94	700
6.35	29.87	700
29.11	21.05	700
47.41	11.26	700
60.55	1.43	700
68.06	-7.50	700
69.69	-14.81	700
65.48	-19.63	700
55.70	-21.37	700
40.73	-20.19	700
21.14	-16.44	700
-2.28	-10.70	700
-28.62	-3.74	700
-56.82	3.72	700
-85.62	11.53	700
-113.78	19.22	700
-140.09	26.33	700
-163.41	32.53	700
-182.71	37.59	700
-197.14	41.34	700
-206.06	43.66	700
-209.08	44.44	700

Estación 4: C=265 mm

Coordinadas de perfil para C=265 // r=900mm

x (mm)	y (mm)	z (mm)
-196.30	31.09	900
-193.31	31.51	900
-184.46	32.66	900
-170.18	34.28	900
-151.14	35.98	900
-128.23	37.37	900
-102.51	38.04	900
-75.13	37.68	900
-47.35	36.03	900
-20.42	32.81	900
4.36	27.53	900
25.93	20.49	900
43.41	12.36	900
56.11	3.98	900
63.54	-3.80	900
65.43	-10.36	900
61.79	-14.89	900
52.81	-16.85	900
38.86	-16.37	900
20.51	-13.76	900
-1.51	-9.53	900
-26.31	-4.34	900
-52.87	1.17	900
-79.99	6.97	900
-106.52	12.66	900
-131.32	17.90	900
-153.29	22.44	900
-171.47	26.12	900
-185.06	28.85	900
-193.46	30.52	900
-196.30	31.09	900

Estación 5: C=245 mm

Coordenadas de perfil para C=245 // r=1100mm

x (mm)	y (mm)	z (mm)
-182.18	23.98	1100
-179.42	24.45	1100
-171.26	25.77	1100
-158.10	27.67	1100
-140.53	29.77	1100
-119.39	31.68	1100
-95.61	33.01	1100
-70.30	33.41	1100
-44.57	32.60	1100
-19.61	30.31	1100
3.43	26.03	1100
23.53	20.01	1100
39.87	12.85	1100
51.80	5.31	1100
58.84	-1.83	1100
60.73	-7.99	1100
57.44	-12.41	1100
49.18	-14.56	1100
36.26	-14.56	1100
19.23	-12.67	1100
-1.23	-9.33	1100
-24.27	-5.13	1100
-48.95	-0.65	1100
-74.15	4.10	1100
-98.80	8.80	1100
-121.83	13.11	1100
-142.24	16.85	1100
-159.12	19.89	1100
-171.74	22.13	1100
-179.54	23.52	1100
-182.18	23.98	1100

Estación 6: C=225 mm

Coordenadas de perfil para C=225 // r=1300mm

x (mm)	y (mm)	z (mm)
-167.83	17.64	1300
-165.30	18.16	1300
-157.84	19.64	1300
-145.78	21.82	1300
-129.70	24.32	1300
-110.31	26.74	1300
-88.50	28.69	1300
-65.25	29.81	1300
-41.60	29.80	1300
-18.62	28.36	1300
2.62	24.97	1300
21.22	19.85	1300
36.38	13.53	1300
47.48	6.68	1300
54.09	0.03	1300
55.94	-5.88	1300
53.00	-10.31	1300
45.44	-12.75	1300
33.56	-13.27	1300
17.86	-12.09	1300
-1.01	-9.59	1300
-22.27	-6.29	1300
-45.02	-2.71	1300
-68.26	1.16	1300
-90.99	5.02	1300
-112.22	8.59	1300
-131.02	11.69	1300
-146.58	14.21	1300
-158.21	16.09	1300
-165.39	17.25	1300
-167.83	17.64	1300

Estación 7: C=205 mm

Coordenadas de perfil para C=205 // r=1500mm

x (mm)	y (mm)	z (mm)
-153.16	13.40	1500
-150.87	13.92	1500
-144.10	15.39	1500
-133.15	17.56	1500
-118.54	20.09	1500
-100.91	22.61	1500
-81.08	24.73	1500
-59.92	26.12	1500
-38.37	26.48	1500
-17.42	25.53	1500
1.99	22.79	1500
19.01	18.42	1500
32.92	12.90	1500
43.15	6.84	1500
49.27	0.89	1500
51.05	-4.47	1500
48.45	-8.55	1500
41.60	-10.89	1500
30.78	-11.55	1500
16.46	-10.73	1500
-0.77	-8.75	1500
-20.18	-6.09	1500
-40.97	-3.18	1500
-62.20	-0.03	1500
-82.97	3.12	1500
-102.36	6.04	1500
-119.54	8.56	1500
-133.76	10.62	1500
-144.38	12.14	1500
-150.94	13.08	1500
-153.16	13.40	1500

Estación 8: C=185 mm

Coordenadas de perfil para C=185 // r=1700mm

x (mm)	y (mm)	z (mm)
-138.41	9.68	1700
-136.35	10.18	1700
-130.26	11.62	1700
-120.42	13.77	1700
-107.27	16.30	1700
-91.41	18.86	1700
-73.54	21.10	1700
-54.47	22.70	1700
-35.04	23.38	1700
-16.11	22.86	1700
1.45	20.69	1700
16.87	17.01	1700
29.51	12.23	1700
38.83	6.90	1700
44.45	1.60	1700
46.14	-3.23	1700
43.85	-6.98	1700
37.70	-9.22	1700
27.95	-10.01	1700
15.02	-9.50	1700
-0.56	-8.00	1700
-18.12	-5.90	1700
-36.92	-3.60	1700
-56.13	-1.08	1700
-74.92	1.45	1700
-92.46	3.79	1700
-108.00	5.81	1700
-120.86	7.45	1700
-130.47	8.67	1700
-136.40	9.42	1700
-138.41	9.68	1700

Estación 9: C=167 mm

Coordenadas de perfil para C=167 // r=1900mm

x (mm)	y (mm)	z (mm)
-125.08	6.56	1900
-123.23	7.04	1900
-117.75	8.43	1900
-108.90	10.51	1900
-97.08	12.99	1900
-82.80	15.54	1900
-66.71	17.83	1900
-49.52	19.56	1900
-31.99	20.47	1900
-14.91	20.29	1900
0.98	18.61	1900
14.96	15.54	1900
26.44	11.44	1900
34.93	6.80	1900
40.09	2.12	1900
41.69	-2.19	1900
39.69	-5.58	1900
34.18	-7.68	1900
25.39	-8.53	1900
13.71	-8.26	1900
-0.37	-7.15	1900
-16.26	-5.53	1900
-33.26	-3.76	1900
-50.64	-1.79	1900
-67.64	0.19	1900
-83.51	2.01	1900
-97.57	3.57	1900
-109.20	4.84	1900
-117.89	5.78	1900
-123.26	6.36	1900
-125.08	6.56	1900

Estación 10: C=150 mm

Coordenadas de perfil para C=150 // r=2100mm

x (mm)	y (mm)	z (mm)
-112.46	2.94	2100
-110.81	3.43	2100
-105.93	4.83	2100
-98.03	6.94	2100
-87.47	9.49	2100
-74.71	12.16	2100
-60.31	14.64	2100
-44.92	16.64	2100
-29.20	17.91	2100
-13.85	18.17	2100
0.45	17.03	2100
13.07	14.58	2100
23.48	11.12	2100
31.21	7.09	2100
35.95	2.94	2100
37.49	-0.98	2100
35.76	-4.17	2100
30.86	-6.26	2100
22.99	-7.29	2100
12.50	-7.37	2100
-0.18	-6.72	2100
-14.48	-5.65	2100
-29.79	-4.43	2100
-45.43	-3.05	2100
-60.74	-1.63	2100
-75.03	-0.32	2100
-87.69	0.81	2100
-98.16	1.71	2100
-105.99	2.39	2100
-110.83	2.80	2100
-112.46	2.94	2100

Estación 11: C=130 mm

Coordenadas de perfil para C=130 // r=2300mm

x (mm)	y (mm)	z (mm)
-97.47	2.21	2300
-96.04	2.66	2300
-91.82	3.93	2300
-84.98	5.85	2300
-75.83	8.17	2300
-64.78	10.62	2300
-52.31	12.90	2300
-38.97	14.77	2300
-25.35	15.98	2300
-12.05	16.28	2300
0.35	15.34	2300
11.30	13.21	2300
20.32	10.16	2300
27.04	6.56	2300
31.15	2.83	2300
32.49	-0.74	2300
31.00	-3.68	2300
26.76	-5.66	2300
19.94	-6.70	2300
10.84	-6.89	2300
-0.15	-6.41	2300
-12.54	-5.52	2300
-25.81	-4.48	2300
-39.38	-3.26	2300
-52.64	-1.99	2300
-65.04	-0.81	2300
-76.01	0.22	2300
-85.08	1.06	2300
-91.87	1.69	2300
-96.06	2.08	2300
-97.47	2.21	2300

Estación 12: C=113 mm

Coordenadas de perfil para C=113 // r=2500mm

x (mm)	y (mm)	z (mm)
-84.73	1.92	2500
-83.48	2.33	2500
-79.81	3.51	2500
-73.86	5.29	2500
-65.90	7.45	2500
-56.29	9.73	2500
-45.45	11.87	2500
-33.86	13.63	2500
-22.01	14.78	2500
-10.45	15.11	2500
0.32	14.29	2500
9.84	12.36	2500
17.68	9.57	2500
23.51	6.24	2500
27.08	2.74	2500
28.24	-0.64	2500
26.94	-3.48	2500
23.25	-5.45	2500
17.32	-6.56	2500
9.40	-6.87	2500
-0.15	-6.52	2500
-10.92	-5.75	2500
-22.46	-4.79	2500
-34.25	-3.62	2500
-45.78	-2.38	2500
-56.54	-1.20	2500
-66.08	-0.15	2500
-73.96	0.71	2500
-79.85	1.37	2500
-83.50	1.78	2500
-84.73	1.92	2500