

Dinghy 13 investigation with hull bi-convex option

Rev. 6 : Convex-hard-concav-hard chine , with a lower hard transition, and comparison with the previous versions (from Rev. 5)

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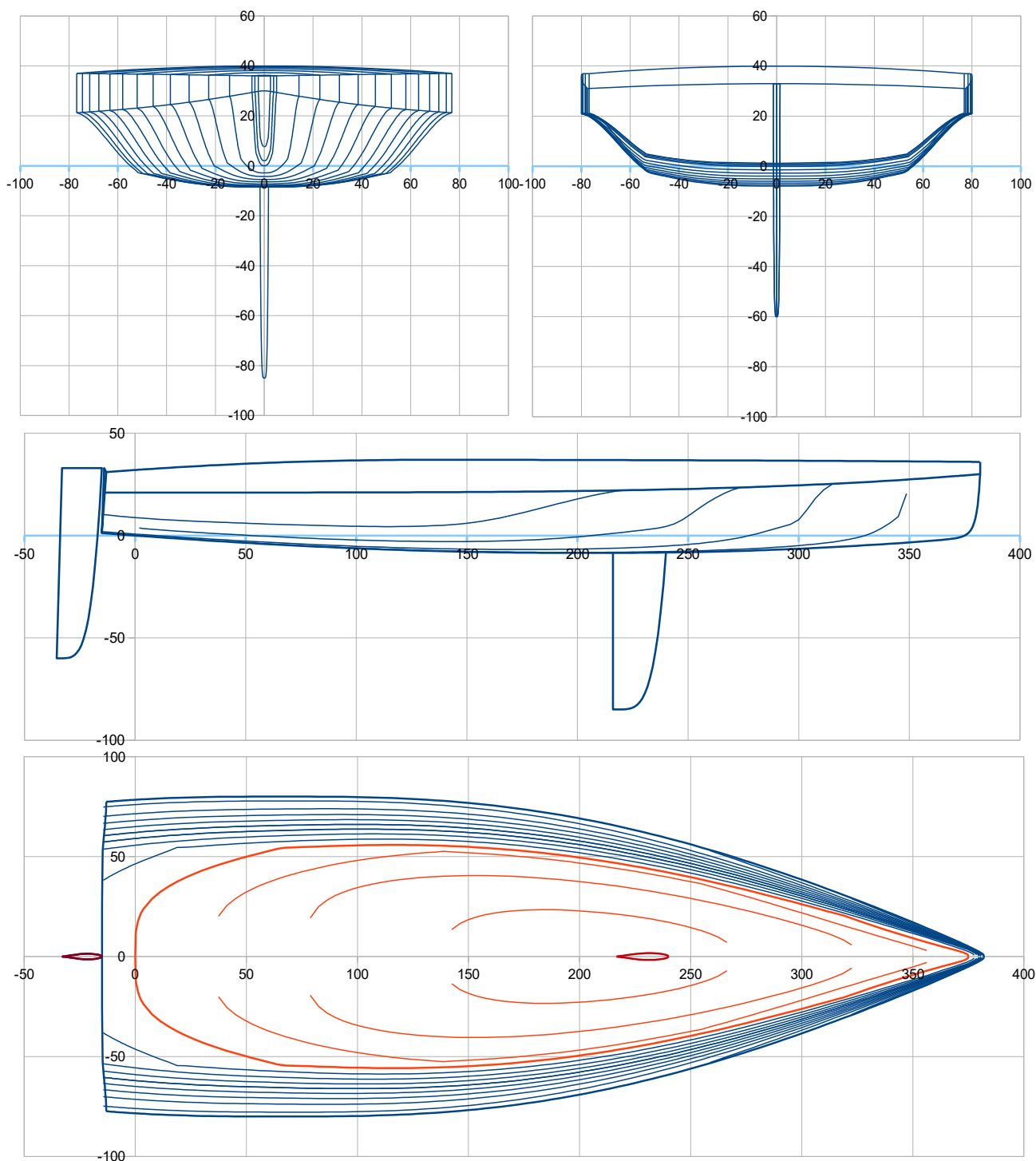
I eventually explore also this version including a lower hard chine transition between the convex and the concav shape of the sections.

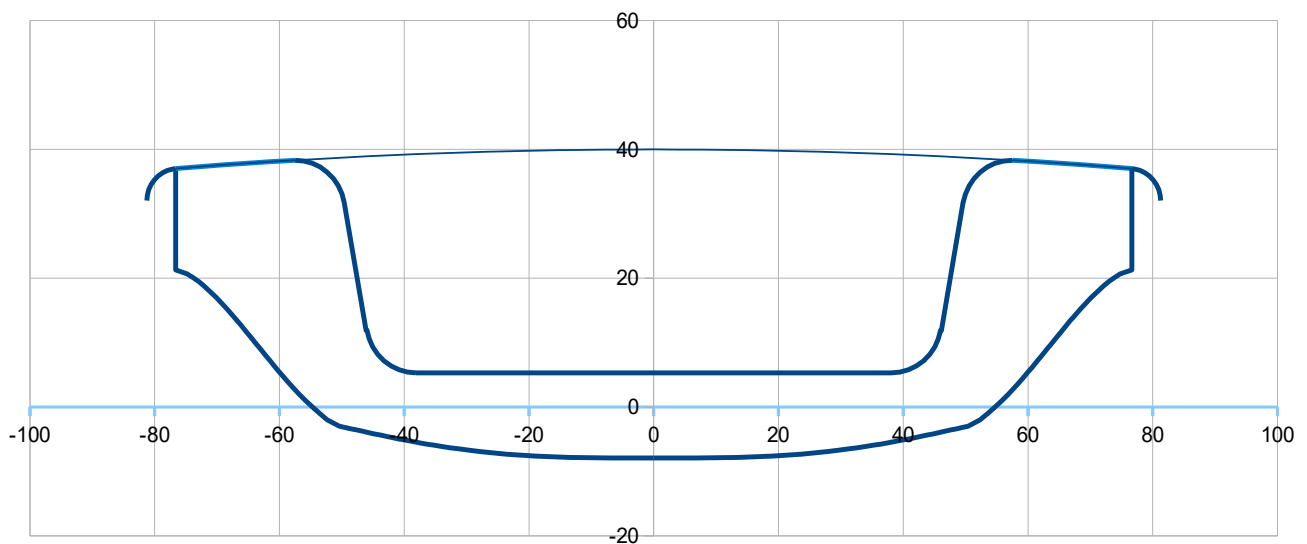
Common data : Lhull : 3,97 m (13 ft) ; Bhull : 1,60 m (at sheer line) , 1,70 m (overall, with the roudned benches to ease the hiking posture) ; Light weight assumed ~ 59 kg (with a 8 m2 sail)

Convex-hard-concav-hard chine : with the design « payload » 95 kg (a heavy helmsman case) :

Lwl : 3,75 m ; **Bwl : 1,12 m** ; Cp : 56,6 % ; LCB : 46,6 % Lwl ; Total Sw (at 10° heel) : 3,18 m2

Stability (with payload 95 kg at center) : **GM0,1° = 93,9 cm** ; GZ at 20° heel = 12,3 cm

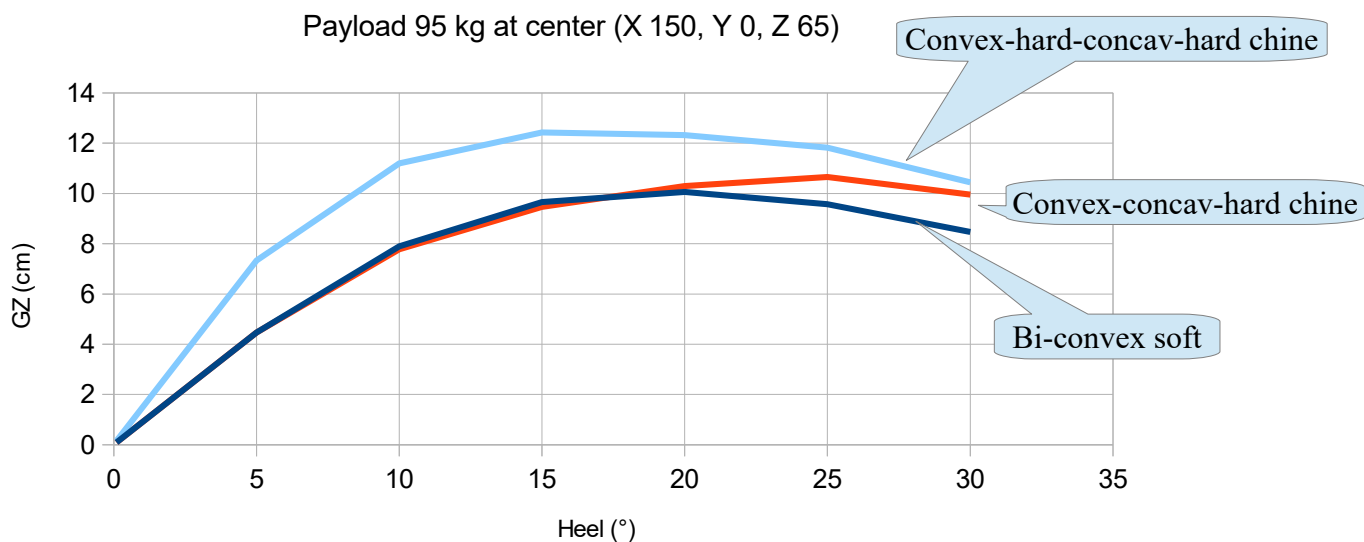




Stability issue when considering the « payload » in the center :

e.g. the (heavy) helmsman (95 kg) squatted in the boat center under the boom, with his center of gravity at Z +65 cm. It is typically the tack or gybe configuration. Here for the stability comparison it is assumed that the helmsman is (temporarily) fixed like a statue in the center of the boat. and we look at the righting arm GZ evolution for heel up to 25°, due to external action (waves, dynamics of a manoeuvre) and/or due to a transversal offset of the payload.

GZ versus Heel



Initial stability >>> GM (0,1°) comparison :

Convex-hard-concav-hard chine : 93,9 cm >>> + 75% / Convex-concav-hard chine : 53,8 cm & Bi-convex soft : 53,6 cm

Reserve stability >>> Area under GZ for 0°-25° comparison :

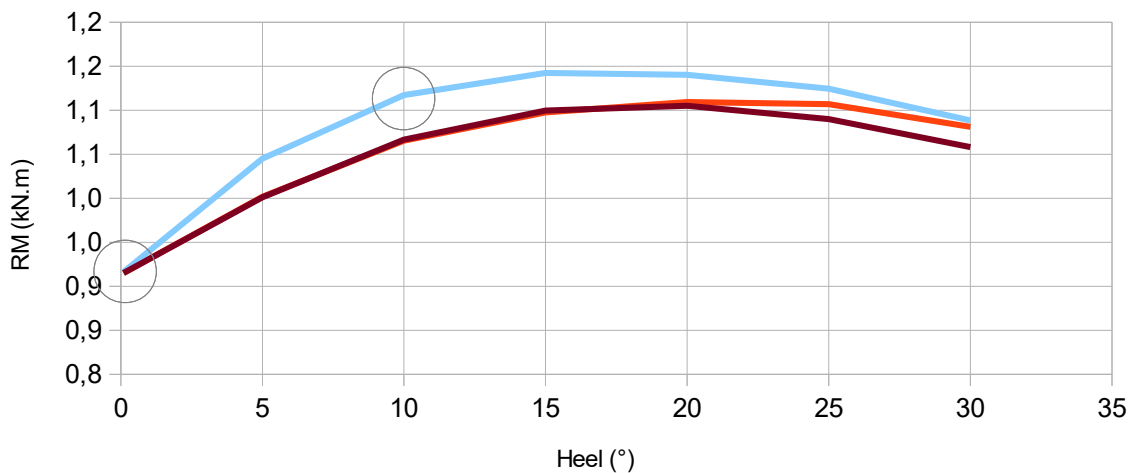
Convex-hard-concav-hard chine : 246,0 cm.° >>> + 32% / Convex-concav-hard chine : 186,7 cm.° & Bi-convex soft : 184,3 cm.°

Righting moment when the « payload » is hiking at windward :

e.g. the helmsman is hiking with its center of gravity estimated at about $Y = B/2 + 15$ cm and $Z = 35$ cm (and X still at 150 cm)

RM versus Heel

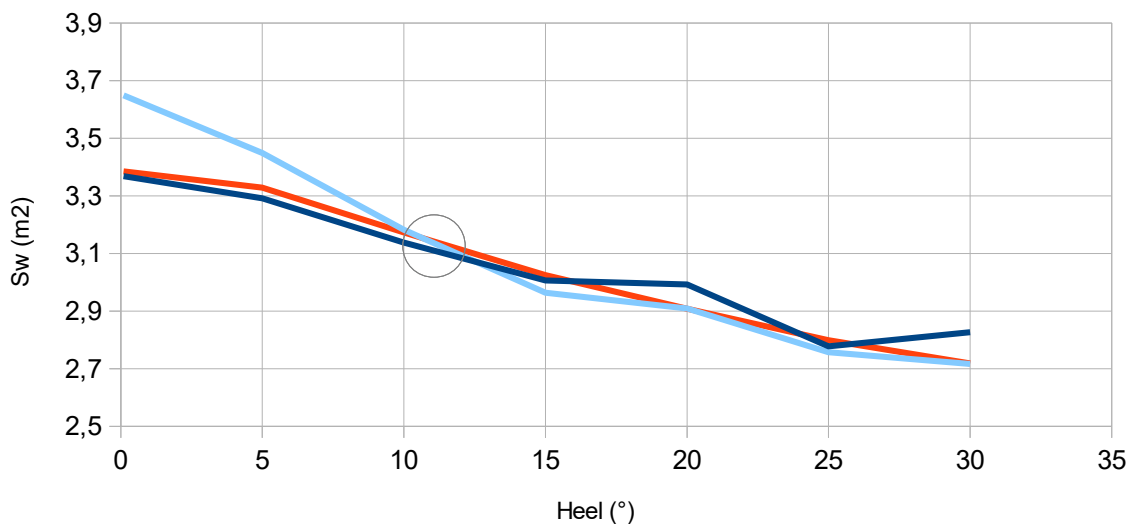
Payload 95kg in hiking position (X 150, Y 98, Z 35)



>>> at 10° heel angle, this version hull provides + 22% RM / +16% for the 2 previous versions.

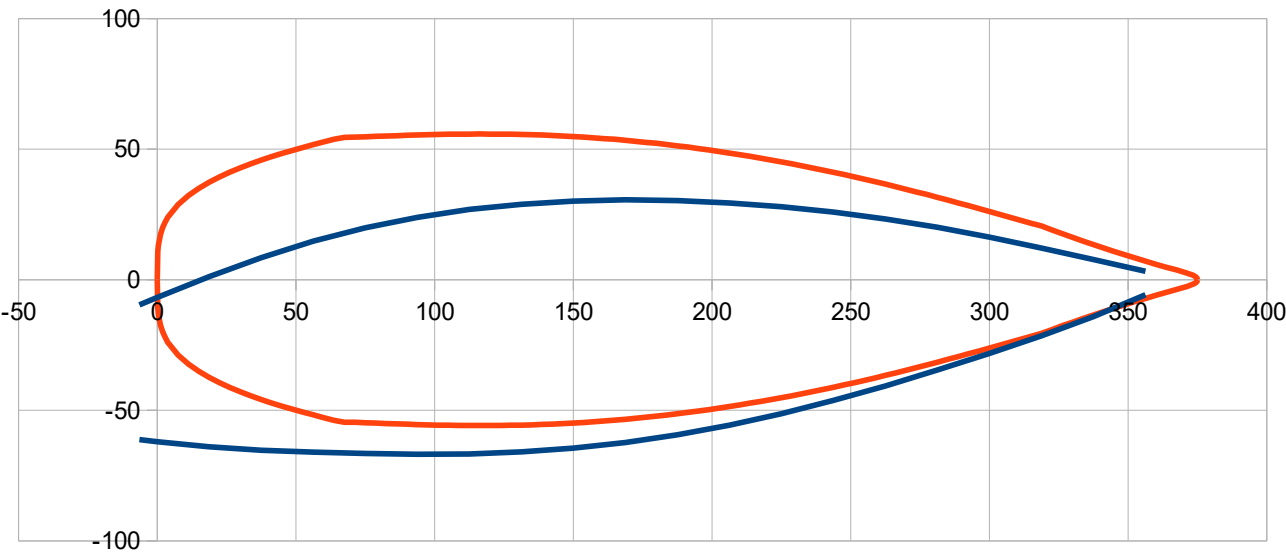
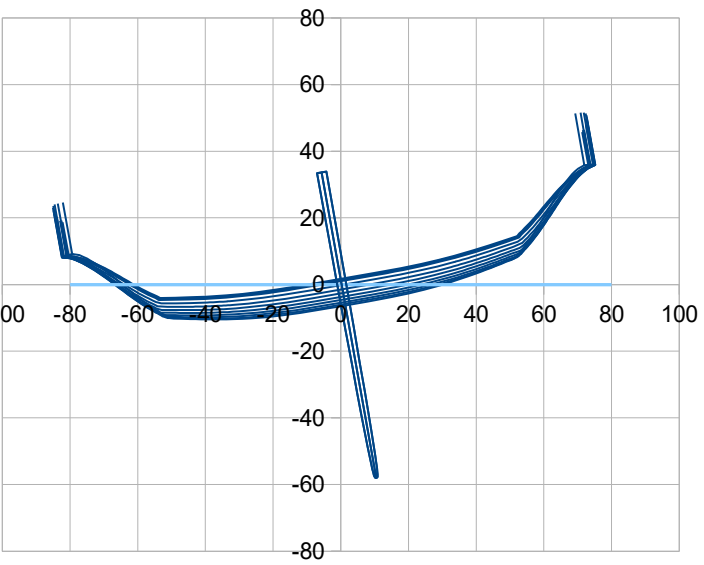
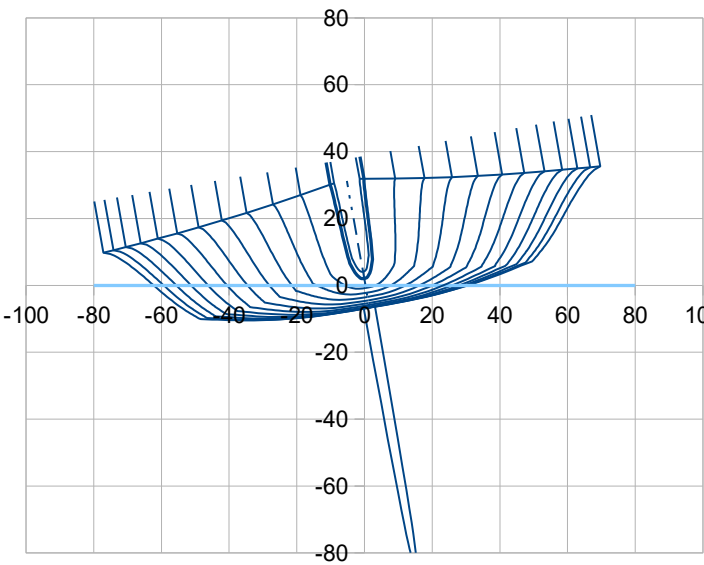
Wetted surface

Wetted surface S_w versus Heel

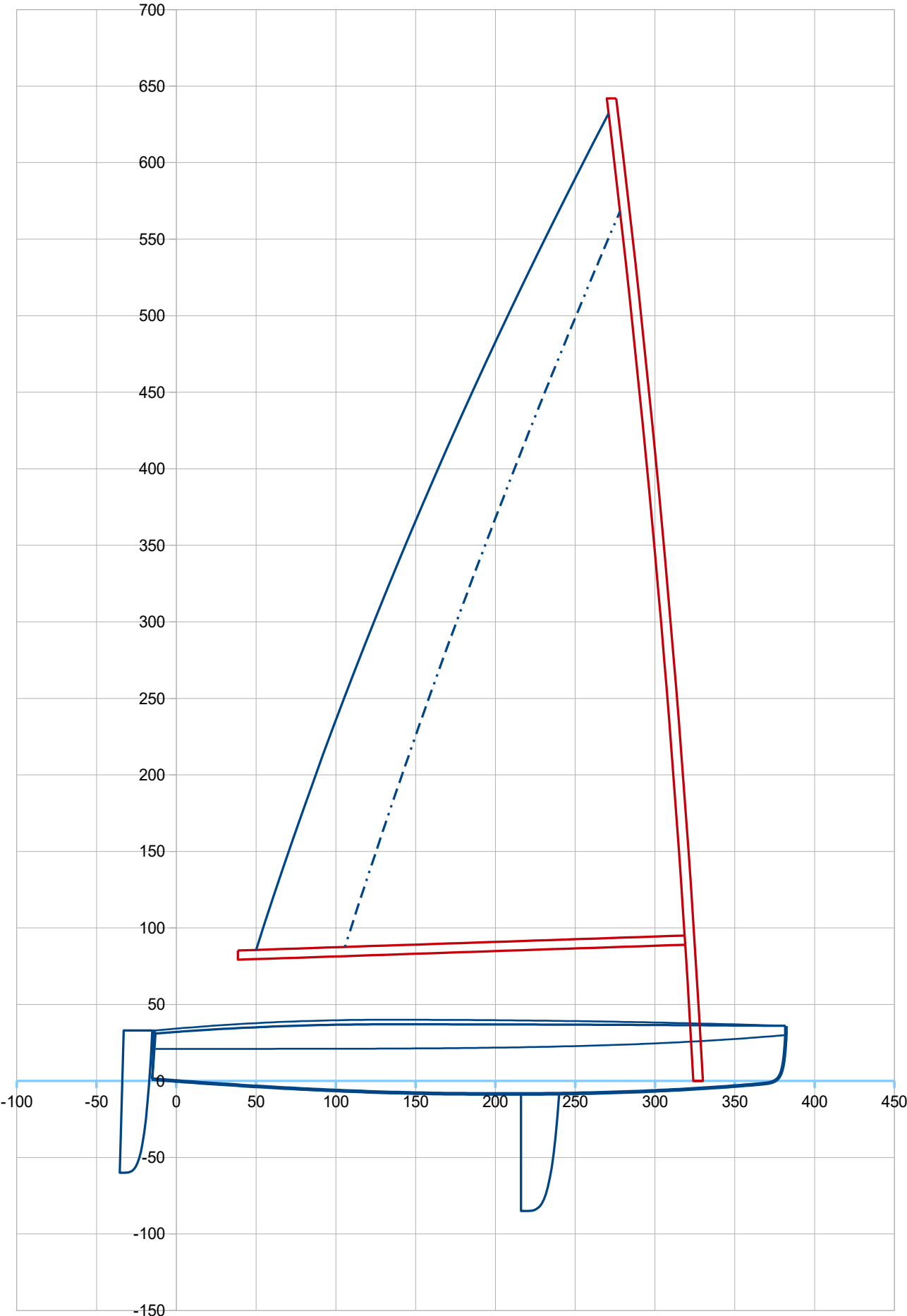


>>> Although the wetted surface at 0° heel is higher for this version, but at 10°-12° heel angle (which can be easy to manage by the helmsman on a dinghy by light winds) the wetted surfaces are equal.

At 10° heel angle :



Bi-convex soft - Sailplan (with sail 8 m2 and small sail option 6 m2)



Hydrostatics (upright, displacement with payload 95 kg) :

2.1 Hull

Loa (m)	3,97	Lwl (m)	3,75	>Hull speed	4,7	(at Fn 0,4)		
>> ft	13,02		12,30					
B (m)	1,60	at X (% Lwl)	18,0					
>> ft	5,25							
Bwl (m)	1,12	at X (% Lwl)	31,0	> Bwl / B	0,698			
>> ft	3,66							
Tc (m)	0,085	at X (%Lwl)	50					
>> ft	0,28							
Displacement at H0 (m3)	0,14601	at Xc (m)	1,747	Xc (%Lwl)	46,59			
>> lbs	330	w. seawater	1025	kg/m3				
Disp at h (cm)	-0,334646253	at Xc (m)	1,758	Xc (%Lwl)	46,88			
Disp at h (cm)	0,334646253	at Xc (m)	1,735	Xc (%Lwl)	46,28			
Cp (%)	56,62							
Sf (m2)	3,00	at Xf (m)	1,573	Xf (%Lwl)	41,94	>>> Xc – Xf (%Lwl)	4,65	
>> ft2	32,24	>> ft	5,16					
Angle immersed sheer li (°)	25,7	at section C4 (40% Lwl)						
Sw (m2)	3,03	>Sw/D^(2/3)	10,93					
>> ft2	32,61							
Shull (m2)	6,81	at X (m)	1,604	Z (m)	0,064			
>> ft2	73,26	>> ft	5,26	>> ft	0,21			
Sdeck (m2)	4,76	at X (m)	1,445					
>> ft2	51,28	>> ft	4,74					

2.2 Daggerboard

Volume (m3)	0,00281	at X (m)	2,281	X (%Lwl)	60,83	Z (m)	-0,39	
Draft oa (m)	0,85	Sw (m2)	0,31			Sxz (m2)	0,15	
>> ft	2,79	>> ft2	3,36			>> ft2	1,62	
CLR (m)	2,340	CLR (%Lwl)	62,40	method : keel profile extended to the waterline, 25% c at 45% draft oa				
>> ft	7,68							

2.3 Rudder(s)

Number	1							
Volume (m3)	0,00143	at X (m)	-0,246	X (%Lwl)	-6,57	Z (m)	-0,054	
Sw (m2)	0,18	>> ft	-0,81			Sxz (m2)	0,09	per rudder
>> ft2	1,92					>> ft2	0,92	

2.4 Hull + Daggerboard + Rudder(s)

Displacement at H0 (m3)	0,15025	at Xc (m)	1,738	Xc (%Lwl)	46,35	Zc (m)	-0,037	
Disp. (kg)	154,0	>> ft	0,53			>> ft	-0,12	
>> lbs	340							
Sw (m2)	3,52	>Sw/D^(2/3)	12,46	Lwl/D^(1/3)	7,05			
>> ft2	37,89			DLR	81	$M(lbs/2240)/(Lwl(ft)/100)^3$		

2.5 Data from the mass spreadsheet

Boat with payload	M(kg)	154,0	at Xg (m)	1,561	Xc (%Lwl)	41,62	at Zg (m)	0,583
Light boat		59,0		1,659				0,474