Vind

- **216-m, 56,660-gt Swedish car-carrier Grande Brasilia (IMO 9198123), built 2000, allided with jetty at the entrance of the Northern lock in Bremerhaven on Sept. 29 at 1100LT. The vessel hit with its starboard side, thereby damaging the jetty and causing a light mast to collapse. The allision was caused by a misjudgement of wind and current. The vessel suffered a dent of 3 square meters and scratches. (Wed. Oct. 1 2008). http://www.cargolaw.com**

Maersk Wave

- **Carcarrier M/V Maersk Wave -- broke lose from her mooring at the "Old Banana" in Bremerhaven due to the storm Jan. 11 -- drifted across the basin against the opposite berth. Both quay & ship were damaged, the quay on a length of 20mt. -- 3 tugs towed M/V Maersk Wave back to her original berth. (Sat.. Jan.13 2007)**

Windarea - forces

$$D = \frac{1}{2}\rho V^2 A C_D$$

$$\frac{kg \times m^2 m^2}{m^3 \times s^2} = \frac{kg \times m}{s^2} = N$$

$$D = \frac{1{,}2 \times V^2 \times A \times 0{,}85}{2 \times 1000 \times 9{,}81}$$

$$D = \frac{0{,}52 \times V^2 \times A}{10000} = (ton)$$

$$D = \frac{1025 \times V^2 \times A \times 0{,}65}{2 \times 1000 \times 9{,}81}$$

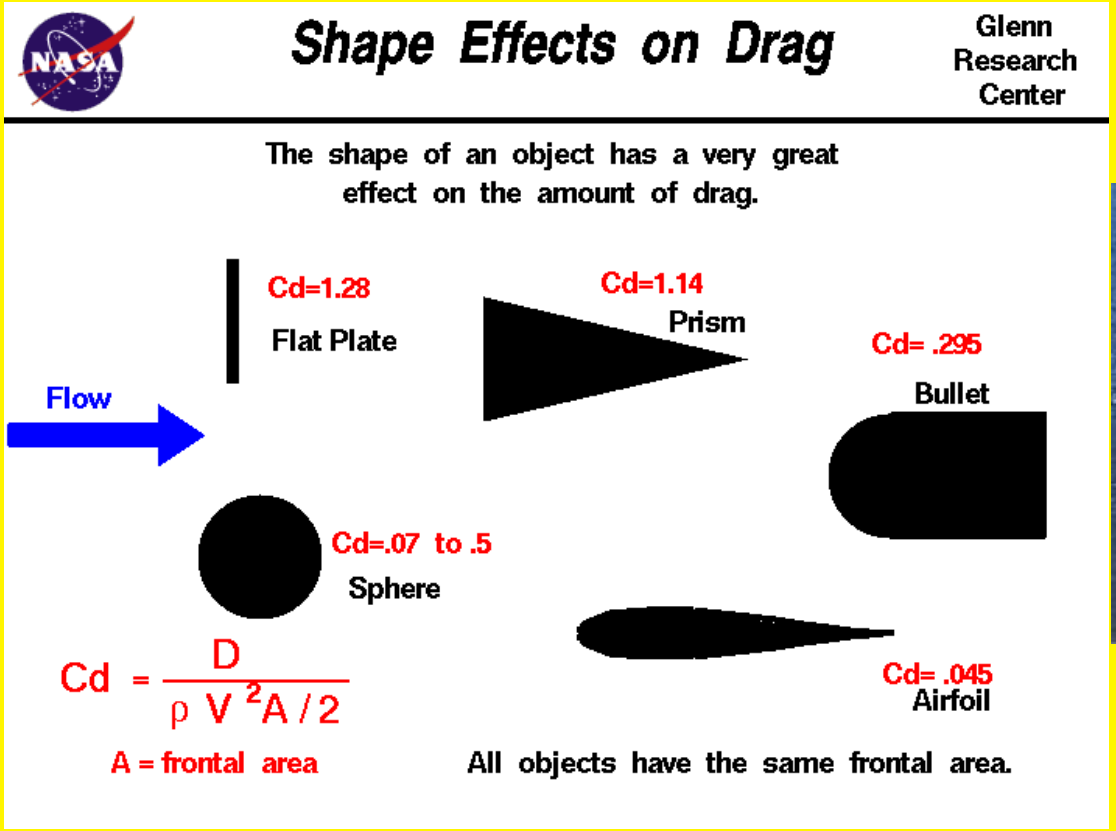
$$D = 0{,}034 \times V^2 \times A \times f = (ton)$$

C_D = the coefficient of drag

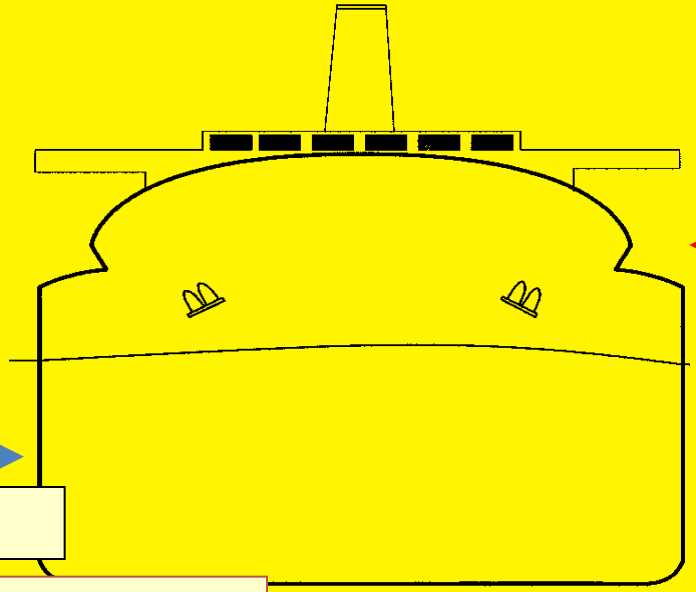
- **0,8-0,9 for air,**
- **0,6 - 0,7 for water**

In the Det Norske Veritas rules the values of C_D should be found from model tests.

Cd Coefficient of drag



WINDFORCE calculation



Wind force

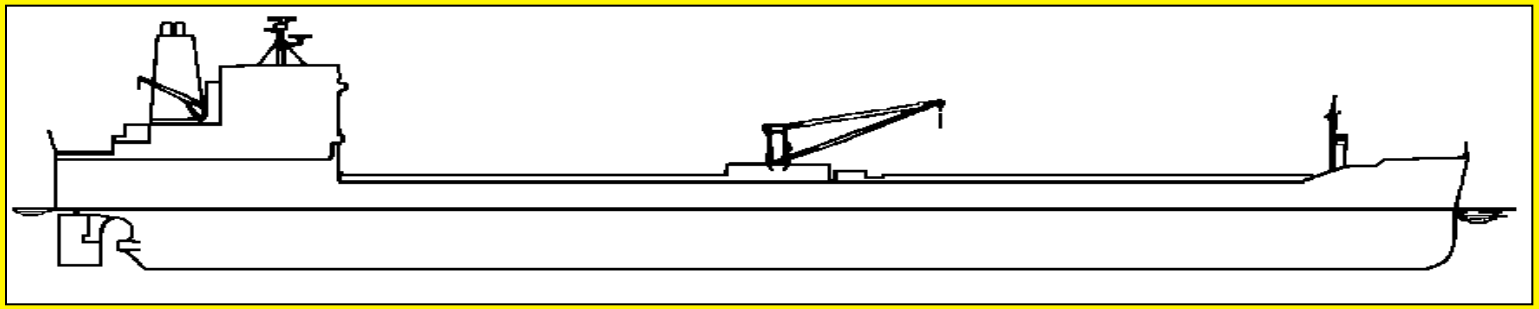
$$K_v = \frac{0{,}52 \times A_v \times V_v^2}{10.000}$$

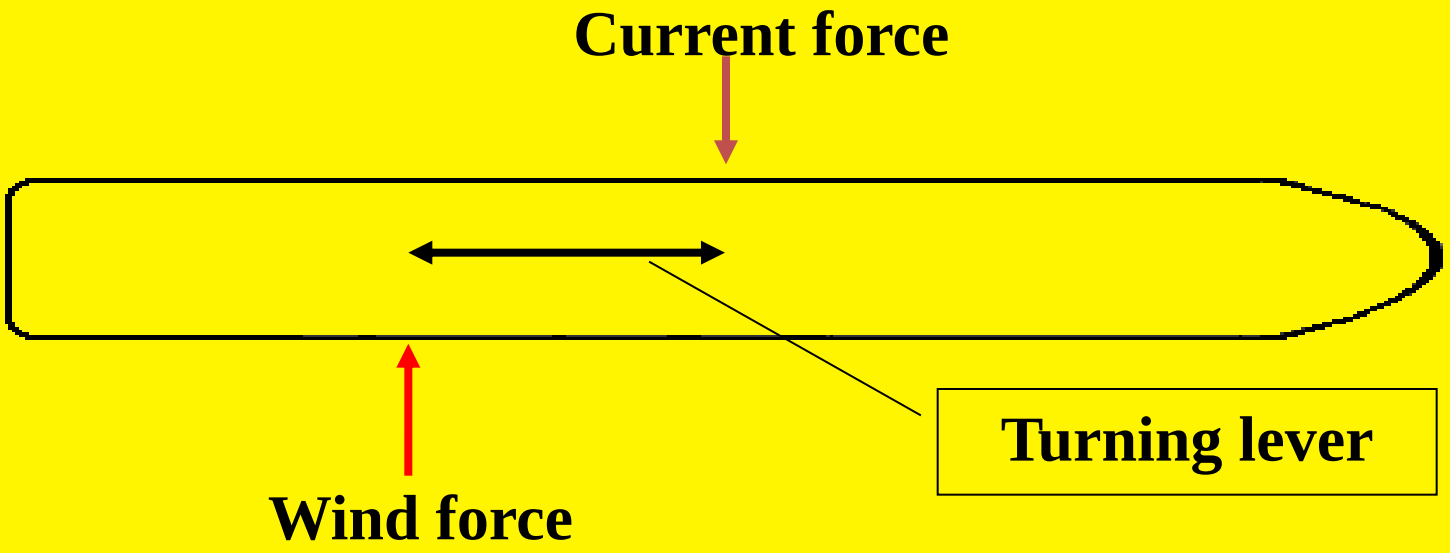
Current force

$$K_s = 0{,}033 \times f \times A_s \times V_s^2$$

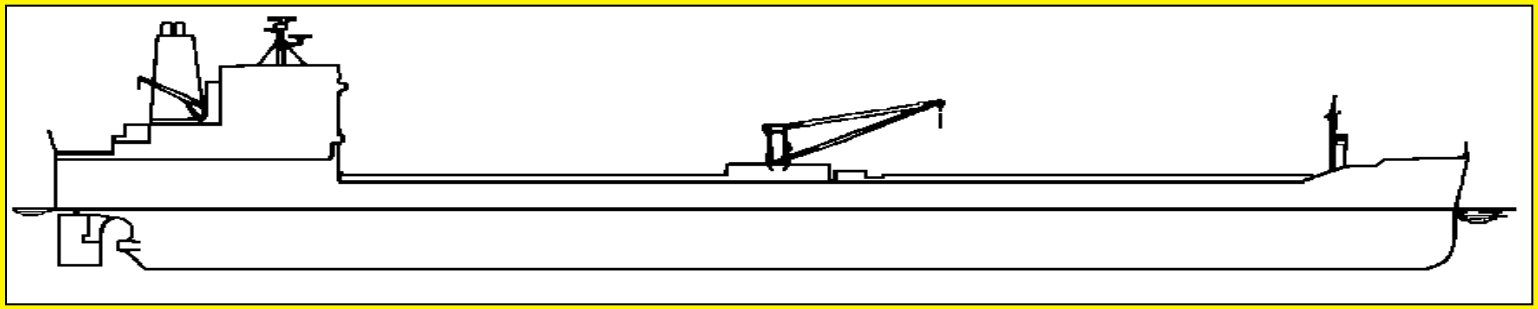
A_v = exposed wind area (m^2)
V_v = wind speed (m/s)
A_s = exposed current area (m^2)
V_s = current speed (m/s)
f = factor depending on draft and water depth.
Water depth 6 x draft f = 1.

WINDFORCE





WINDFORCE



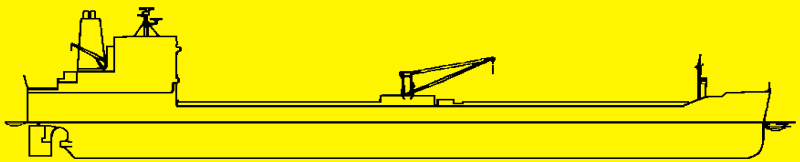
A ship dead in the water affected by wind :

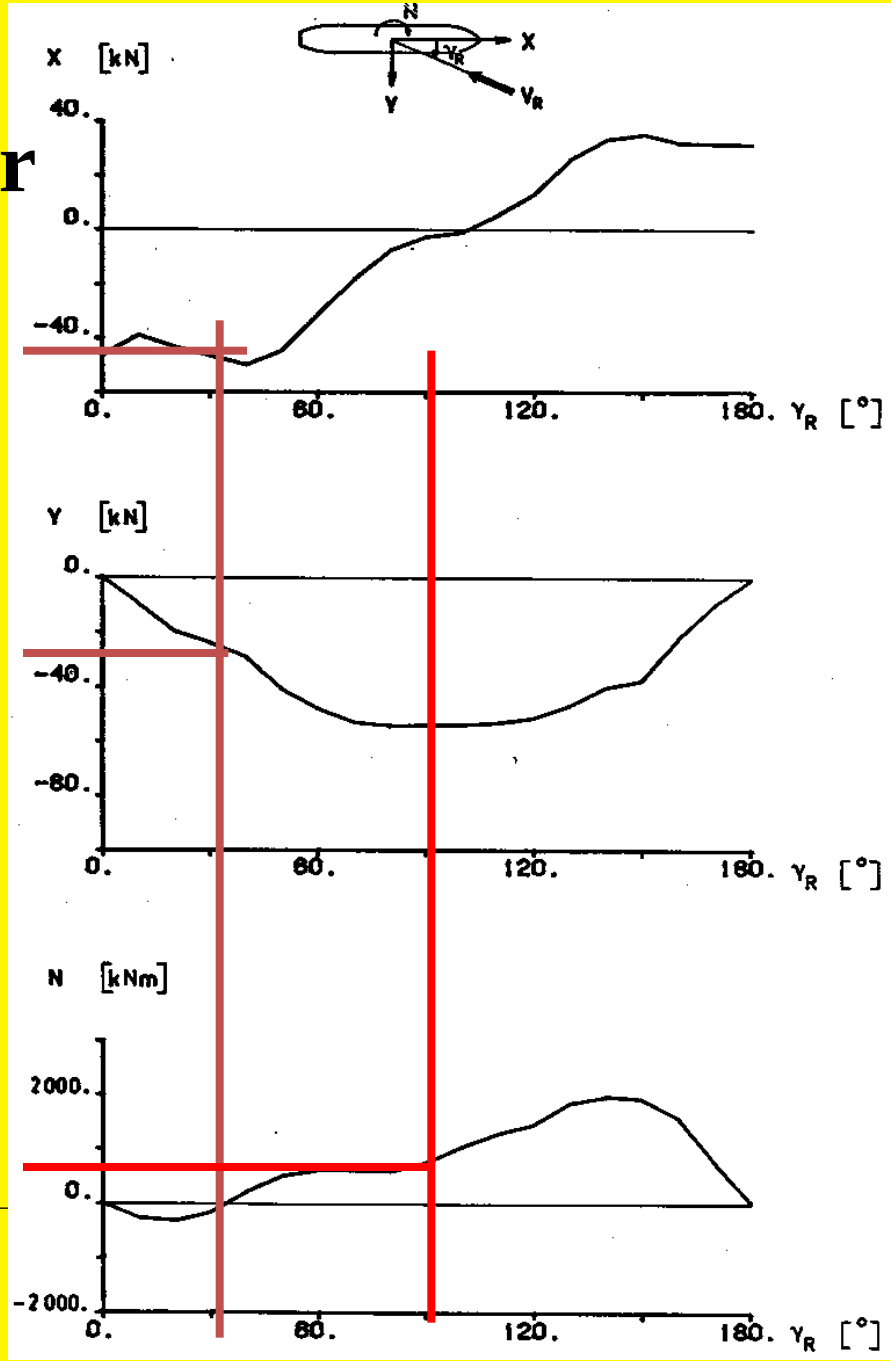
Kv = Ks

Ks = the drift speed for the vessel.

Testing windload

WINDFORCE, tanker





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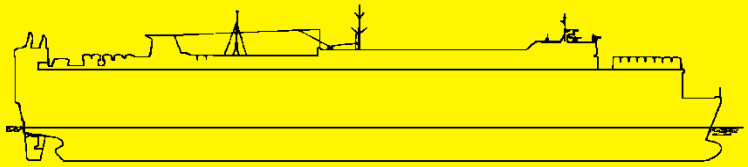
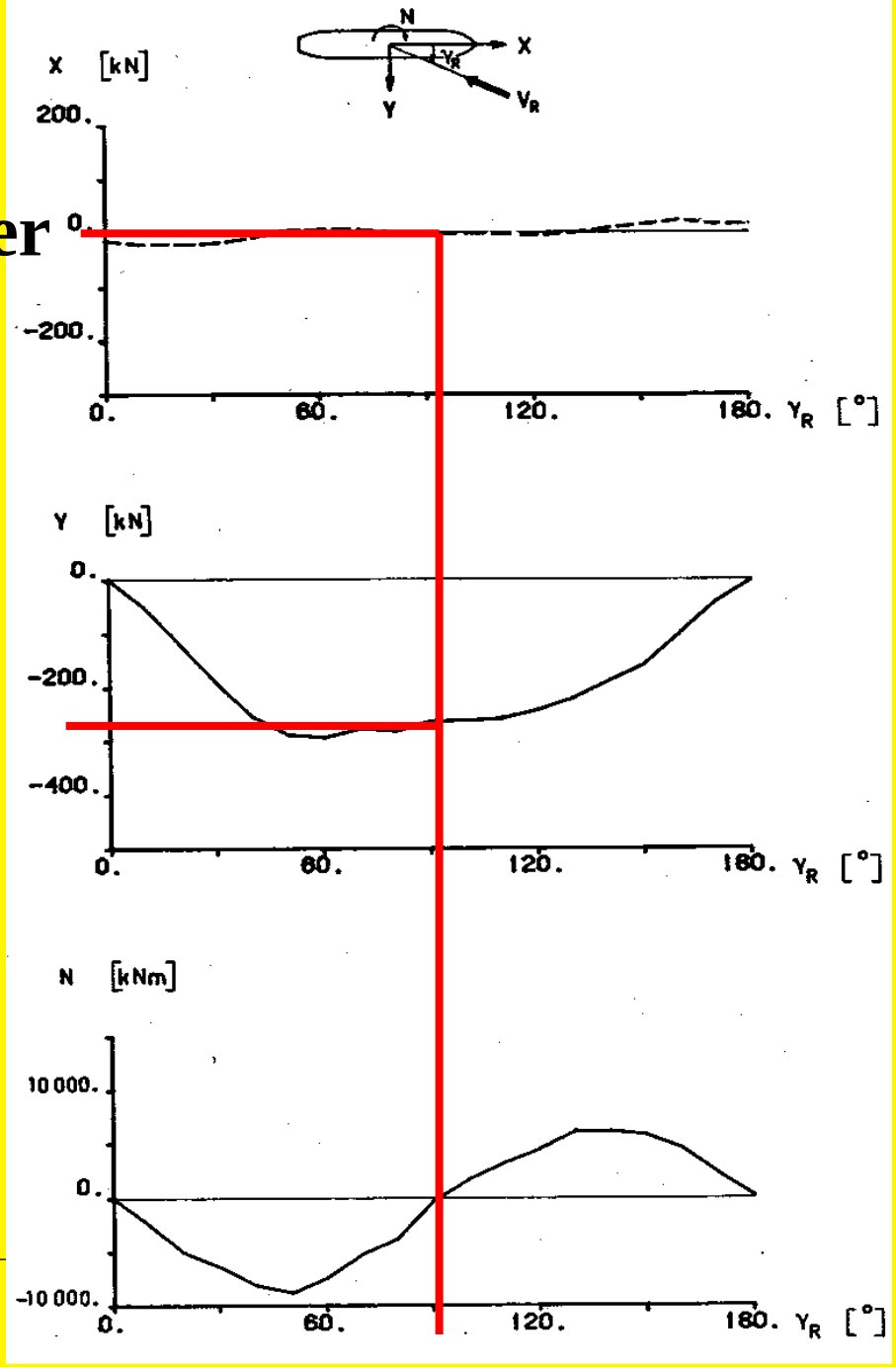
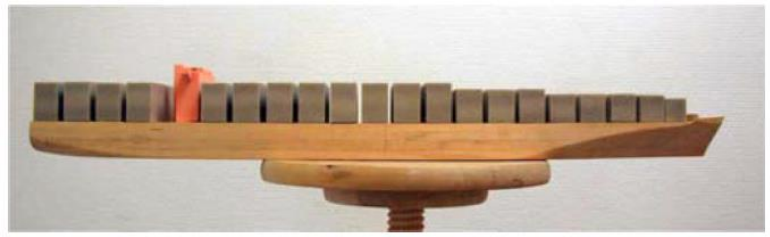
Sjöfartshögskolan

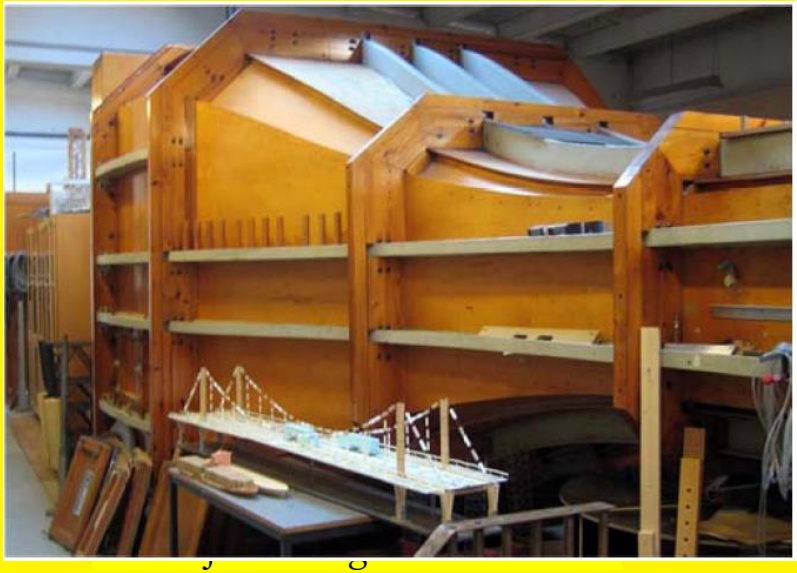
WINDFORCE, car/carrier

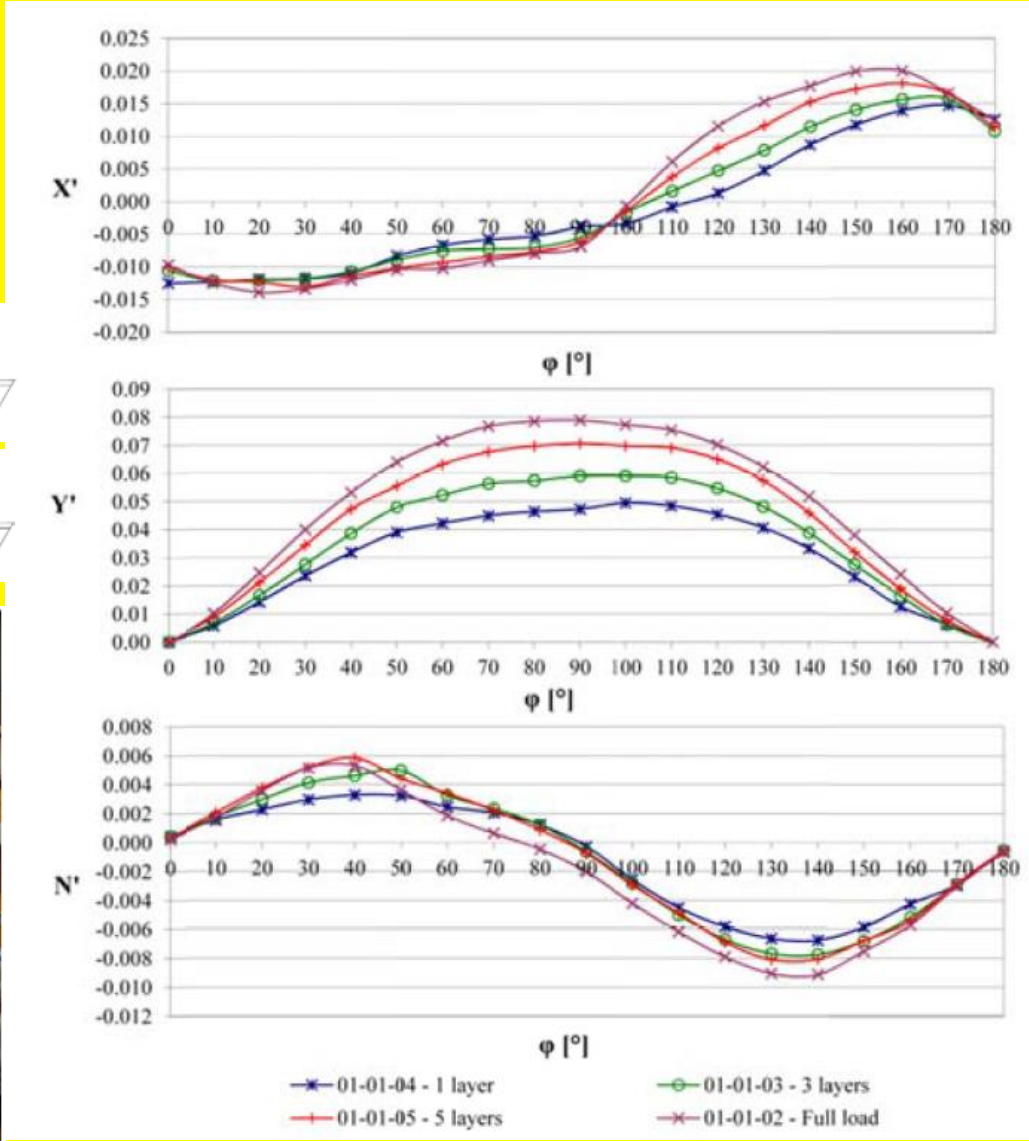




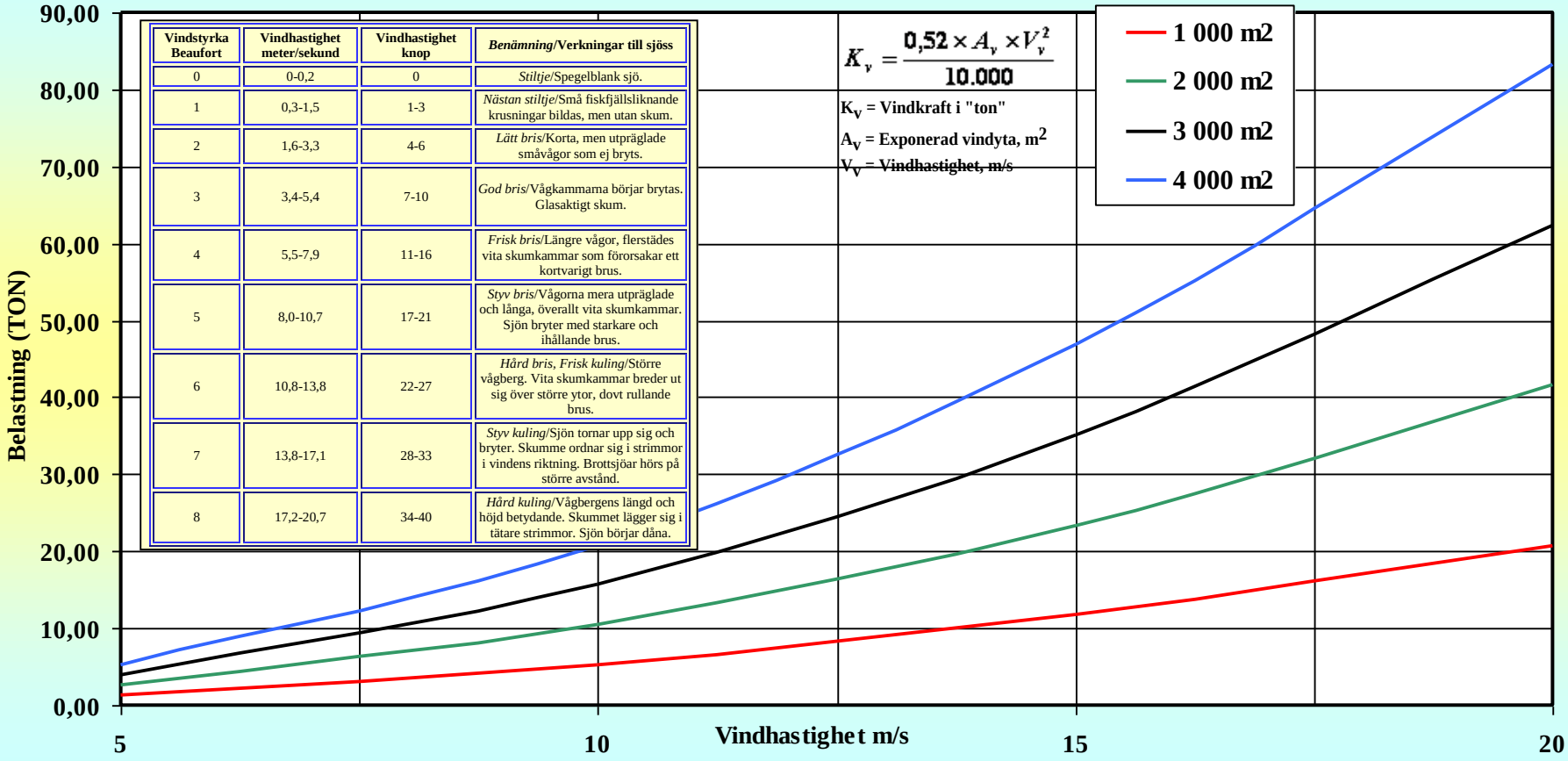
Wind load on a container ship





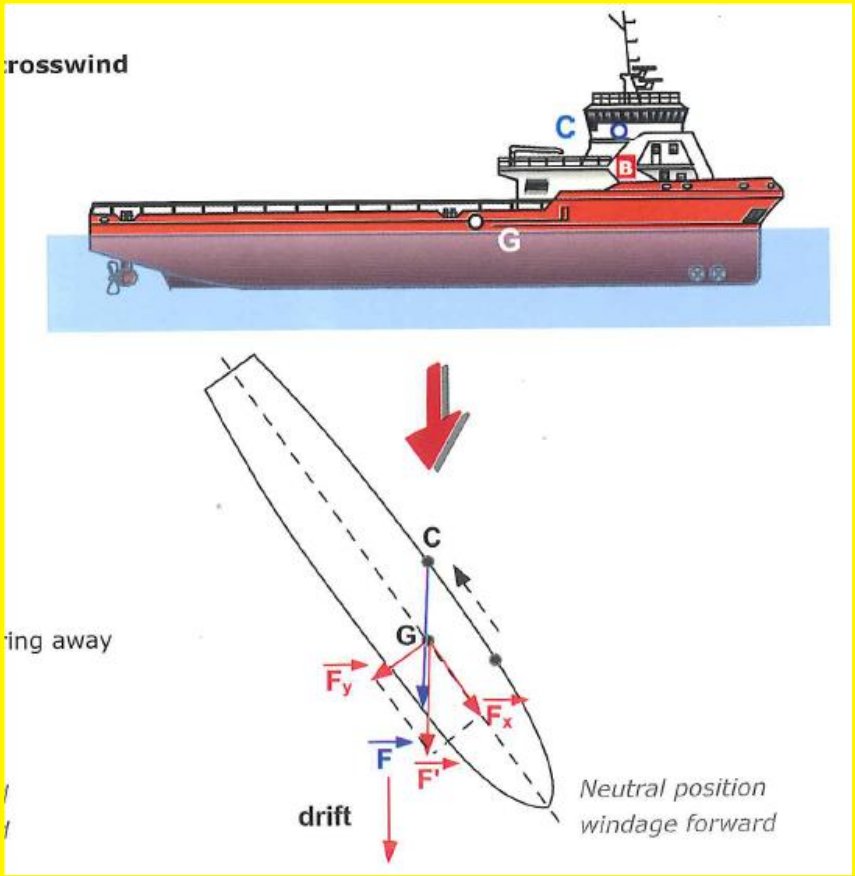


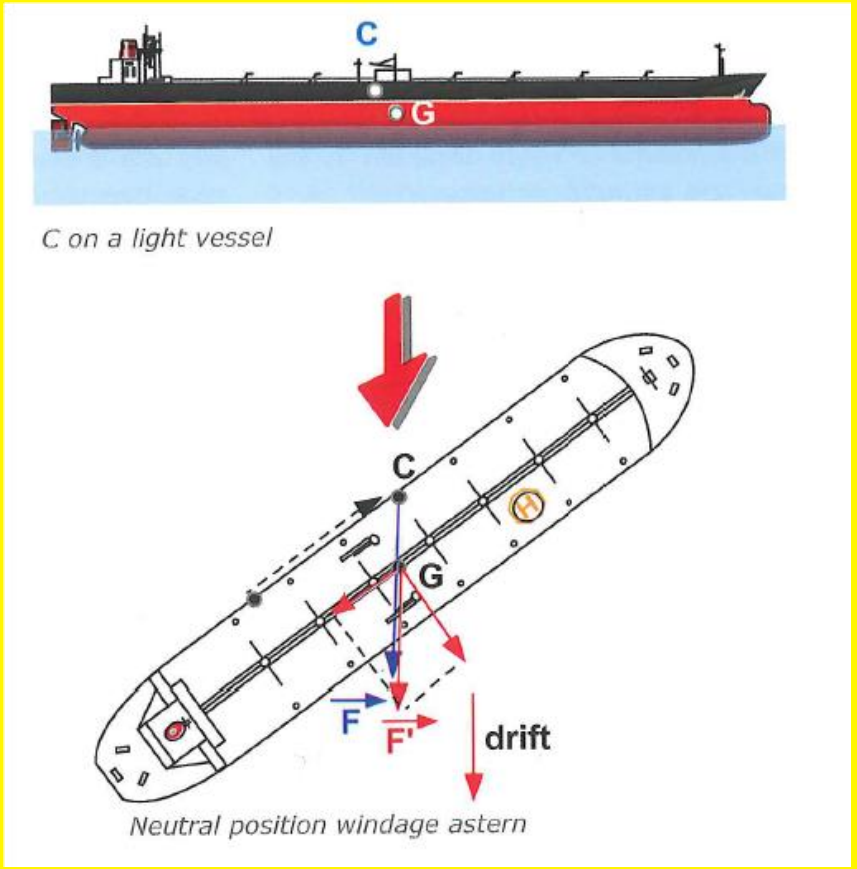
VINDBELASTNING (TON)



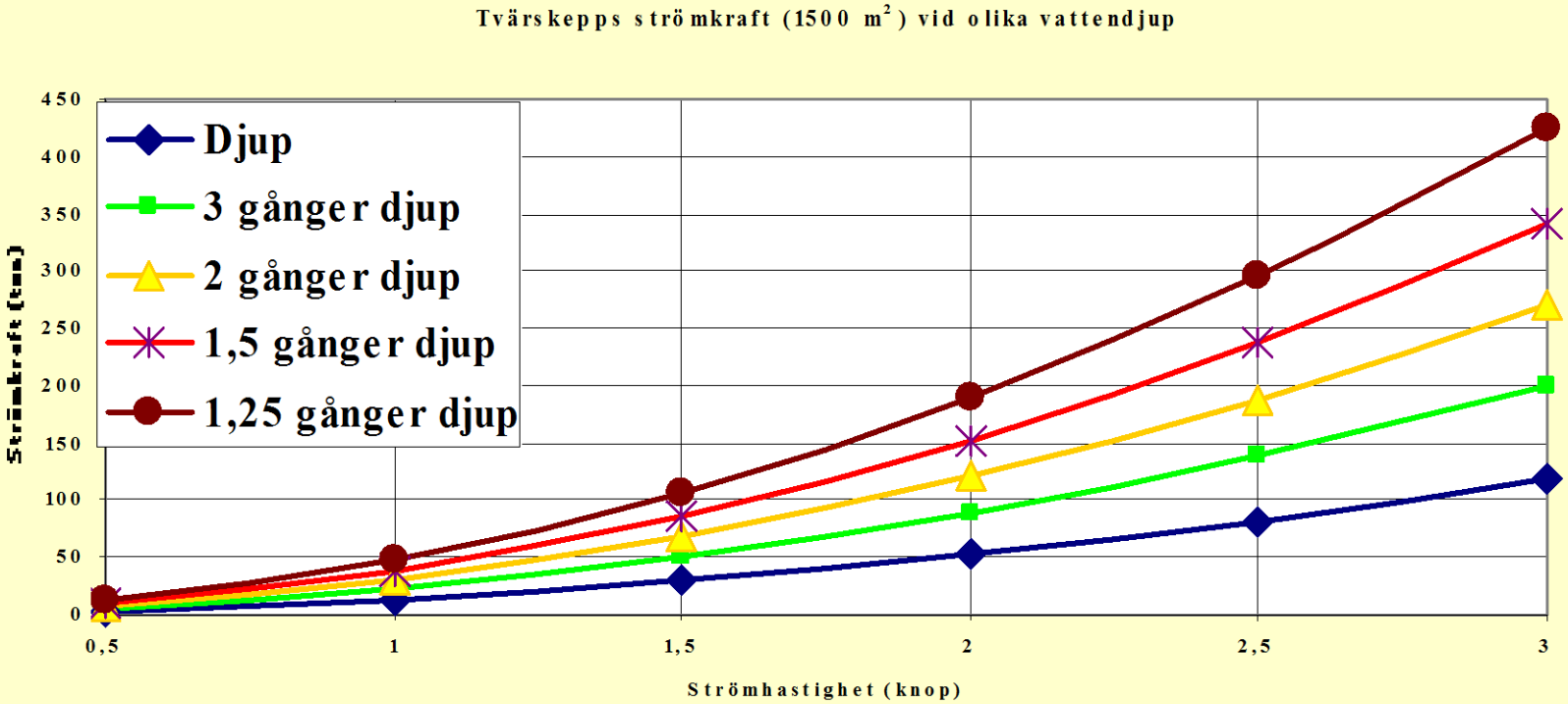
Vindstyrka Beaufort	Vindhastighet meter/sekund	Vindhastighet knop	*Benämning*/Verkningar till sjöss
0	0-0,2	0	*Stiltje*/Spegelblank sjö.
1	0,3-1,5	1-3	*Nästan stiltje*/Små fiskfjällsliknande krusningar bildas, men utan skum.
2	1,6-3,3	4-6	*Lätt bris*/Korta, men utpräglade småvågor som ej bryts.
3	3,4-5,4	7-10	*God bris*/Vågkammarna börjar brytas. Glasaktigt skum.
4	5,5-7,9	11-16	*Frisk bris*/Längre vågor, flerstädes vita skumkammar som förorsakar ett kortvarigt brus.
5	8,0-10,7	17-21	*Styv bris*/Vågorna mera utpräglade och långa, överallt vita skumkammar. Sjön bryter med starkare och ihållande brus.
6	10,8-13,8	22-27	*Hård bris, Frisk kuling*/Större vågberg. Vita skumkammar breder ut sig över större ytor, dovt rullande brus.
7	13,8-17,1	28-33	*Styv kuling*/Sjön tornar upp sig och bryter. Skumme ordnar sig i strimmor i vindens riktning. Brottsjöar hörs på större avstånd.
8	17,2-20,7	34-40	*Hård kuling*/Vågbergens längd och höjd betydande. Skummet lägger sig i tätare strimmor. Sjön börjar dåna.

Jämvikt vid vind





Strömkraft

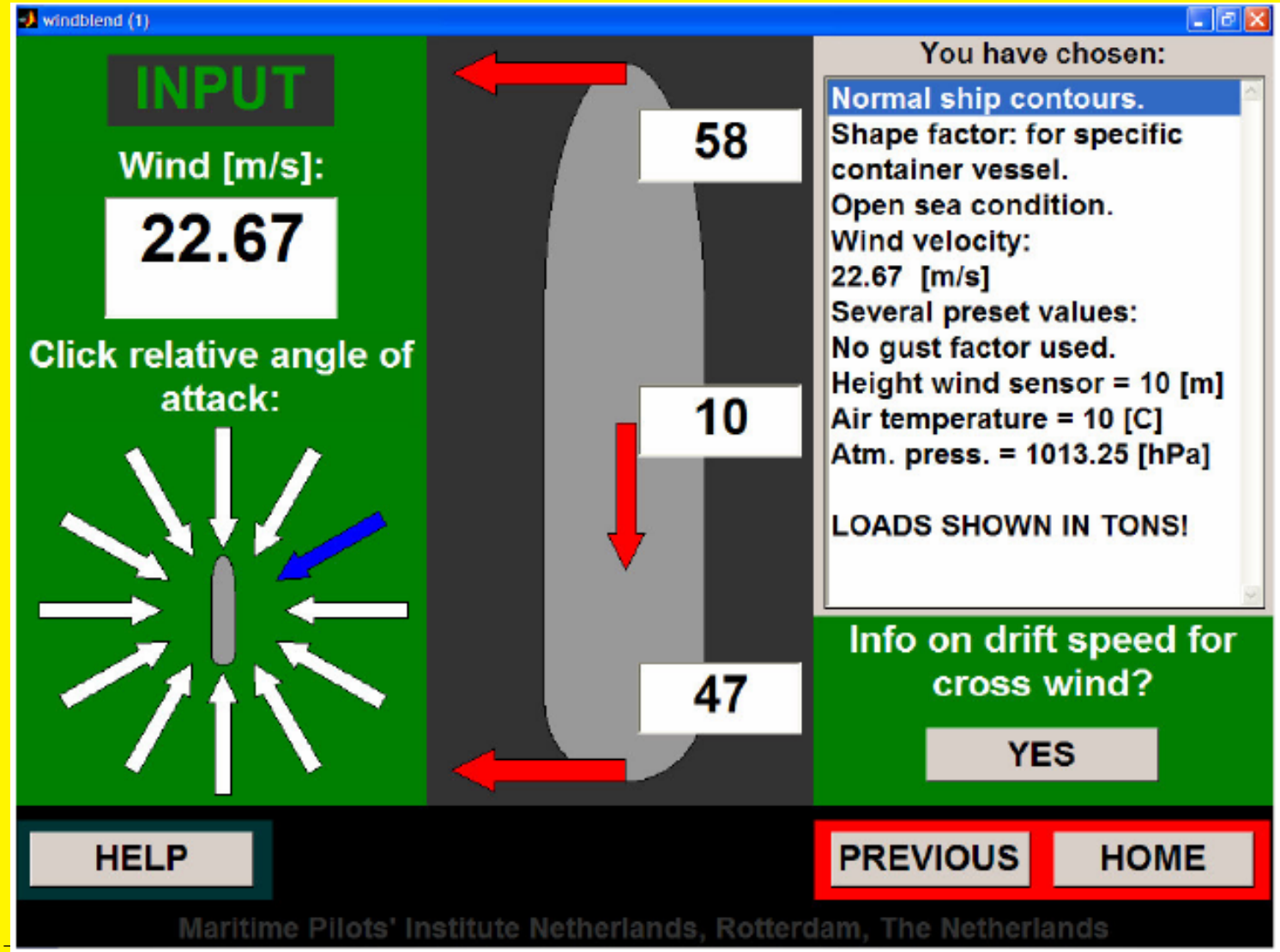

Tvärskepps strömkraft (1500 m²) vid olika vattendjup
Strömkraft (ton)
450
400
350
300
250
200
150
100
50
0
0,5
1
1,5
2
2,5
3
Strömhastighet (knop)
Djup
3 gånger djup
2 gånger djup
1,5 gånger djup
1,25 gånger djup

Port Regulation

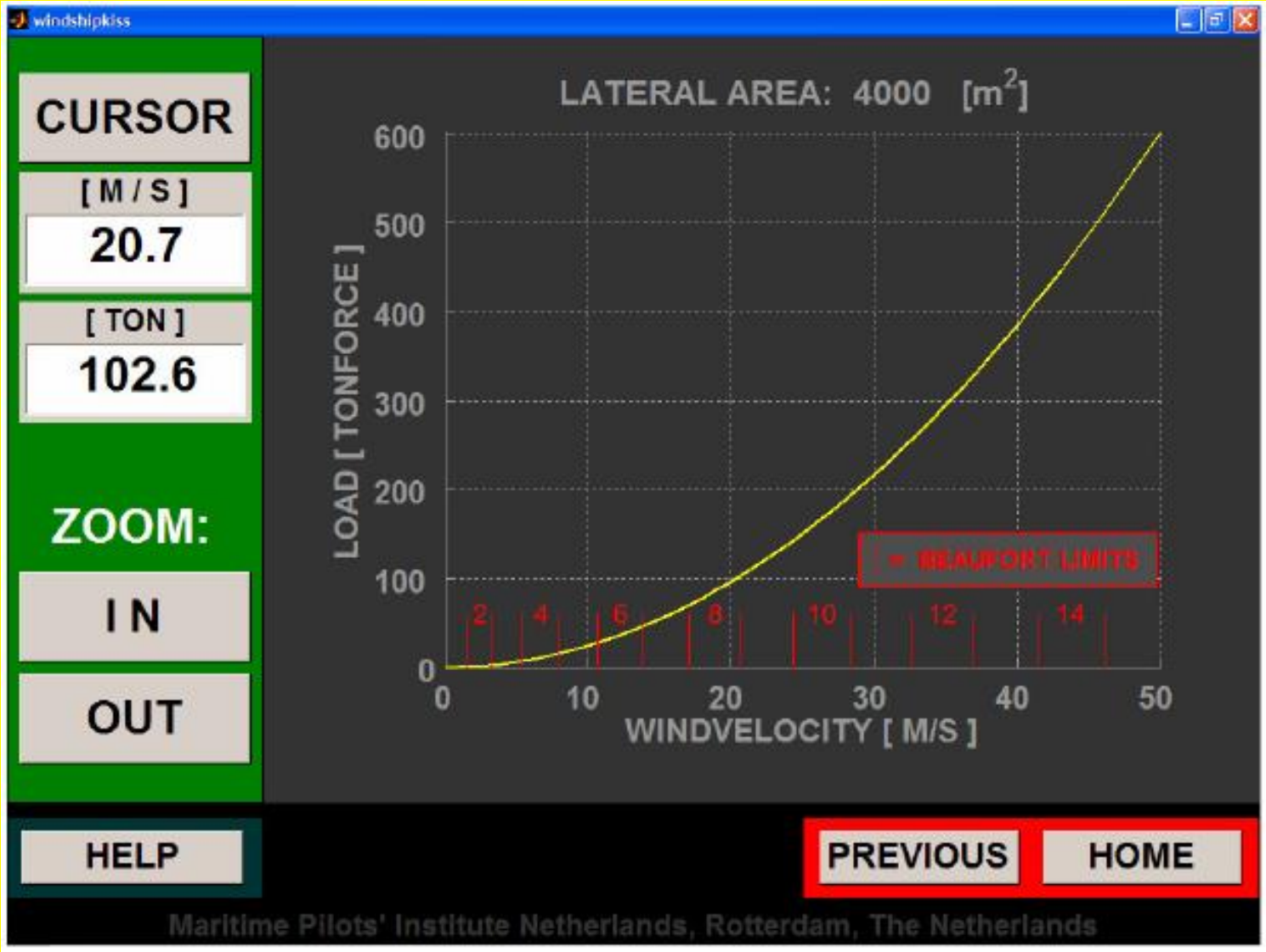
- **Vessels with large windage areas will be subject to a wind restriction on berthing.**

Wind restriction on berthing Vessel	
windage (square metres)	Wind restriction (knots)
Up to 6,000	30
6,001-6,700	25
More than 6,700	20

Windforce


windblend (1)
INPUT
Wind [m/s]:
22.67
Click relative angle of attack:
58
10
47
You have chosen:
Normal ship contours.
Shape factor: for specific container vessel.
Open sea condition.
Wind velocity:
22.67 [m/s]
Several preset values:
No gust factor used.
Height wind sensor = 10 [m]
Air temperature = 10 [C]
Atm. press. = 1013.25 [hPa]
LOADS SHOWN IN TONS!
Info on drift speed for cross wind?
YES
HELP
PREVIOUS
HOME
Maritime Pilots' Institute Netherlands, Rotterdam, The Netherlands

Windload


windshipkiss
CURSOR
[M / S]
20.7
[TON]
102.6
ZOOM:
I N
OUT
HELP
LATERAL AREA: 4000 [m2]
LOAD [TONFORCE]
600
500
400
300
200
100
0
0
10
20
30
40
50
WINDVELOCITY [M/S]
= BEAUFORT LIMITS
2
4
6
8
10
12
14
PREVIOUS
HOME
Maritime Pilots' Institute Netherlands, Rotterdam, The Netherlands

Fartygsdata:	
Lpp	200 m
B	30 m
Djupgående	ca 7 m
Vindarea	4000 m^2
Undervattenskropp area	1400 m^2
Vindhastighet	15 m/s
Fartygets hastighet	10 knop

$$V^2 \times 0{,}033 \times 1400 = \frac{0{,}52 \times 4000 \times 15^2}{10.000} \Rightarrow v = 1m/s = 1{,}9knop$$

$$\tan\alpha = \frac{1{,}9}{10} \Rightarrow \alpha = 10{,}7^\circ$$

$$\tan 10{,}7 = \frac{x}{200} \Rightarrow X = 38m$$