Heel Angle of a Ship in a Steady Turn

Heel angle of a ship turning at speed from the centrifugal heeling moment, the height of G above the centre of lateral resistance and the GM.

Method: Heel due to turning

Input parameters

Unit system: SI

Parameter	Value	Unit
Speed in the turn	18.000	kn
Turning radius	600.00	m
Centre of gravity above the keel	9.5000	m
Draught	8.0000	m
Metacentric height (corrected for free surface)	1.2000	m

Calculated results

Parameter	Value	Unit
Centripetal acceleration	0.14291	m/s²
Heeling lever arm KG − T/2	5.5000	m
Tangent of the heel angle	0.066793	
Heel angle	3.8213	°

Notes for this case

• Heeling moment Δ(V²/gR)(KG − T/2) balanced by ΔGM sin φ (small angles; outward heel, the centre of lateral resistance taken at half draught).

Formula and method

$$\tan\phi = \frac{V^2\left(KG - \frac{T}{2}\right)}{gRGM}$$

Variables

V	Speed in the turn	m/s
R	Turning radius	m
KG	Centre of gravity above the keel	m
T	Draught	m
GM	Metacentric height (corrected for free surface)	m
V^2/R	Centripetal acceleration	m/s²
h	Heeling lever arm KG − T/2	m
$\tan\phi$	Tangent of the heel angle	-
ϕ	Heel angle	rad

Method and standards

Steady turning heel.

Assumptions and limits

- Steady turn, small angles, centre of lateral resistance at half draught.

References

Heel due to turning

Report details

Report reference	FCC-RM94-6GQC (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/marine/ship-heel-in-turn

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.