Angle of Loll of a Ship with Negative GM

Angle of loll of a wall-sided ship with negative initial metacentric height, and the effective GM at that angle, from the negative GM and the metacentric radius BM.

Method: Wall-sided formula for the angle of loll

Input parameters

Unit system: SI

Parameter	Value	Unit
Initial metacentric height (negative)	-0.12000	m
Transverse metacentric radius	5.5000	m

Calculated results

Parameter	Value	Unit
Angle of loll	11.799	°
Effective GM at the angle of loll 2|GM|/cos φ	0.24518	m
Tangent of the loll angle	0.20889	

Notes for this case

• Wall-sided formula GZ = sin φ (GM + ½BM tan²φ) = 0 gives tan φ = √(−2GM/BM). The ship lolls to either side; correct by lowering G (fill low tanks, starting on the low side only after the high side is weighed), not by shifting weight across.

Formula and method

$$GZ = \sin\phi\left(GM + \frac{1}{2}BM\tan^2\phi\right) = 0 \;\Rightarrow\; \tan\phi_{loll} = \sqrt{\frac{-2GM}{BM}}, \quad GM_{loll} = \frac{2|GM|}{\cos\phi_{loll}}$$

Variables

GM	Initial metacentric height (negative)	m
BM	Transverse metacentric radius	m
ϕ_{loll}	Angle of loll	rad
GM_{loll}	Effective GM at the angle of loll 2	GM
$\tan\phi$	Tangent of the loll angle	-

Method and standards

Wall-sided stability.

Assumptions and limits

- Wall-sided ship in the range of heel considered.

References

Wall-sided formula for the angle of loll

Report details

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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/angle-of-loll

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.