

Yacht Safety and the Green Book



Kim Klaka

The Green Book: what is it?

- A set of minimum recommendations about safety of the boat and crew
- Based on the racing Blue Book and the work of Royal Prince Alfred Yacht Club, NSW
- It's on the FSC website. Go to Sections->Cruising->useful stuff, then scroll down to Safety

What the Green Book is not:

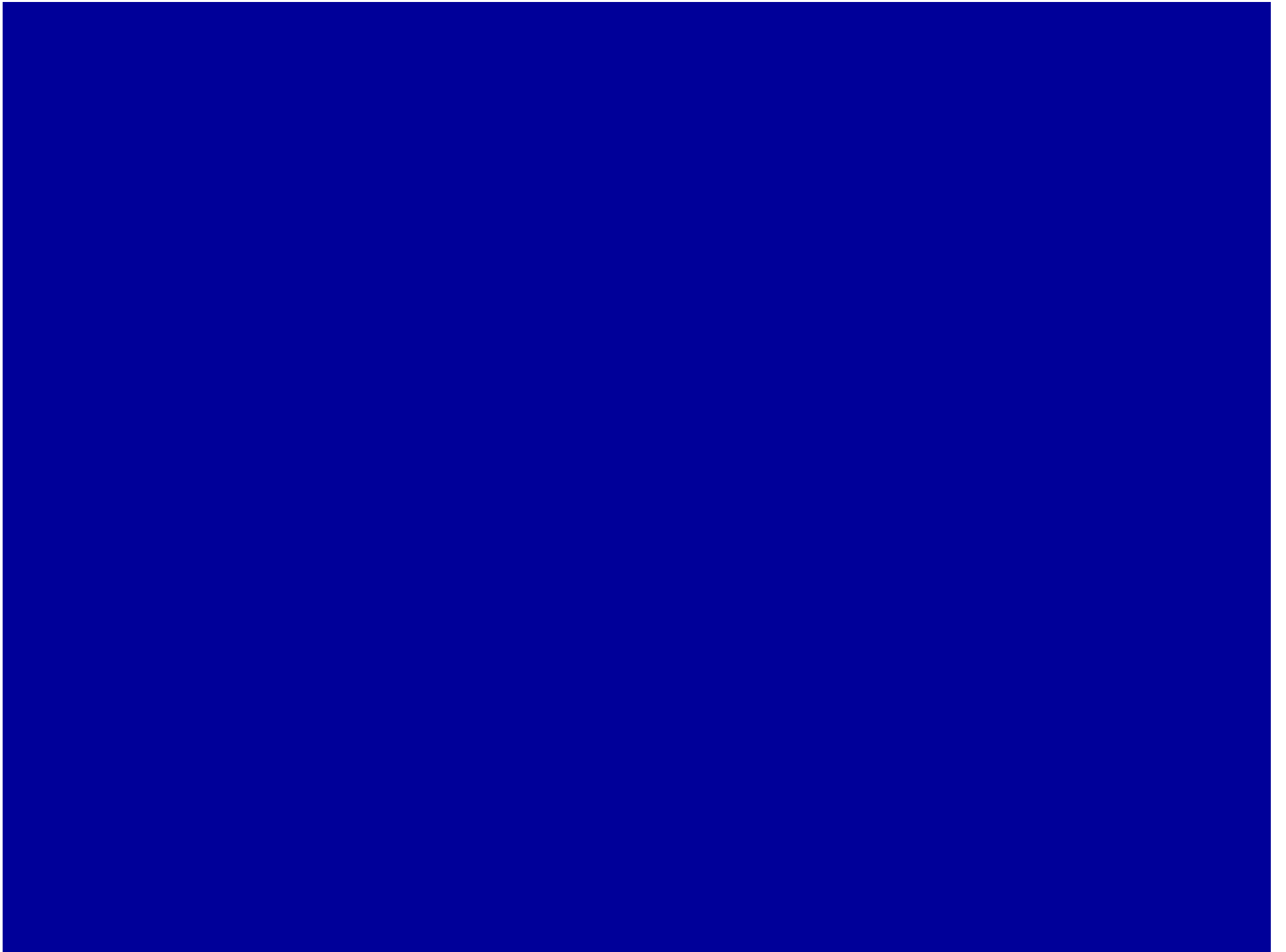
- Not a set of rules or regulations
- Does not tell you if your boat is seaworthy
- Does not absolve an owner from their *sole and inescapable responsibility for safety*

What does the Green Book cover?

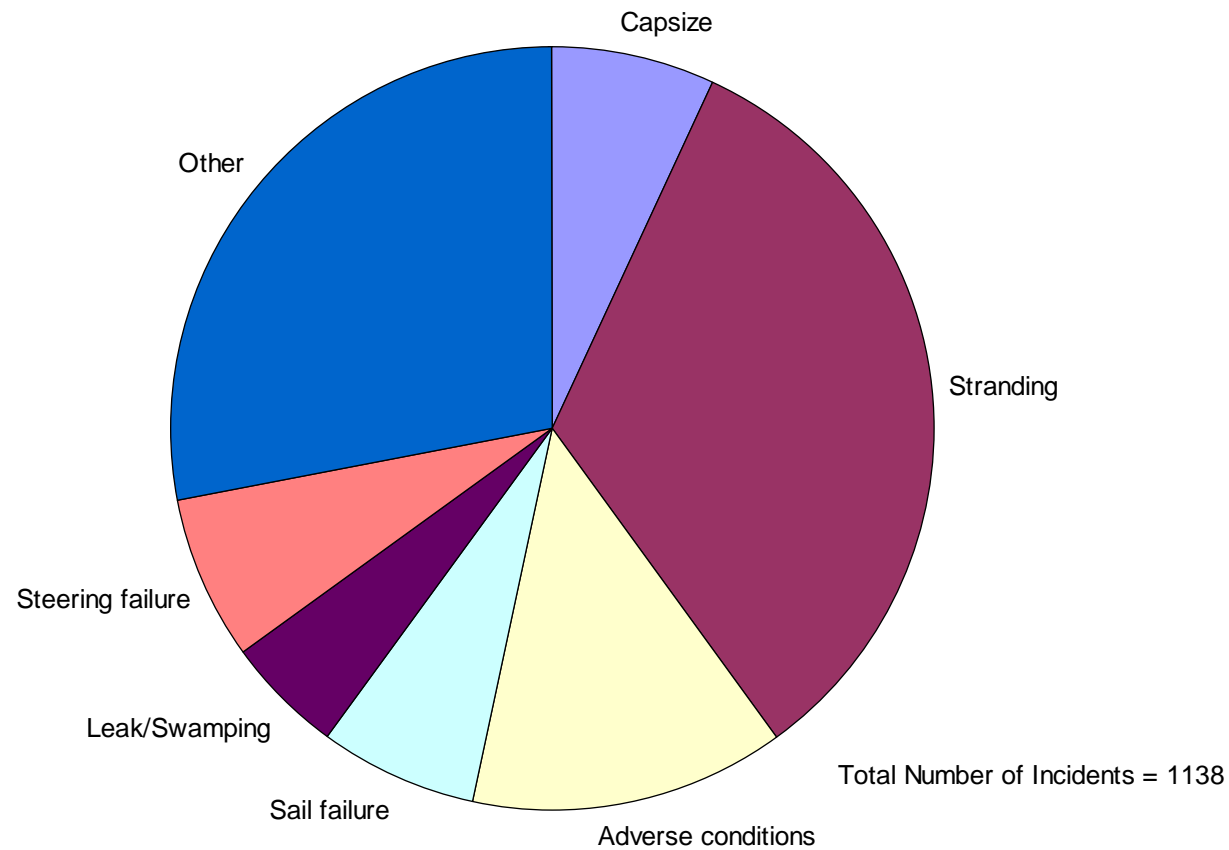
1. Scope, responsibility and definitions
2. Training and experience
3. Structure, stability, and fixed equipment
4. Portable equipment and supplies
5. Personal equipment
6. Medical

How does it work?

- Main part is for coastal sailing (Quindalup to Geraldton), with appendices for ocean sailing and multihulls
- No item is compulsory – you might have an alternative that works better
- Most FSC cruises require you to tick a box confirming you comply with the Green Book



Monohull - Casualty Statistics



RNLi lifeboat launches (5 year period)



What is stability?

- Normal sailing:

Stability = power to carry sail

- Extreme conditions:

Stability = ability to resist capsize

Stability in the green book

- **3.5.1. A yacht should be designed and built to resist capsize.**
- **3.5.2. Attention is drawn to ISO 12217-2 [Small craft -- Stability and buoyancy assessment and categorization - Part 2: Sailing boats of hull length greater than or equal to 6 m]. *Category B is relevant.***

EC-ISO classification:

- Class A: Off-shore i.e. extended sailing on open sea with waves up to 10m and wind up to 55knots. (STIX > 32)
- Class B: Coastal (within 500 nm from the coast waves up to 4m and wind up to 34 knots (STIX > 23)
- Class C: Inshore (STIX > 14)
- Class D: Protected waters (STIX > 5)

The STIX number combines:

- Length
- Length/mass
- Beam/mass
- Wind heel moment
- Angle of Vanishing Stability (AVS)
- Energy required to capsize
- Downflooding angle

STIX number

EU category	Min STIX
A	32
B	23
C	14
D	5

make	length	STIX	size	angle
OCEANIS	361		32	120
SUNFAST	37		32	
CONTESSA	32		33	155
HANSE	411		33	128
SUN ODYSSEY	37		33	
SUNFAST	35		33	127
FIRST	36.7		34	126
OCEANIS	343		34	134
OCEANIS	44CC		34	110
FIRST	42.7		35	118
HANSE	371		35	122
HANSE	461		35	
OCEANIS	351		35	125
OCEANIS	36CC		35	126
VANCOUVER	34P		35	166
BAVARIA	42		36	
CATALINA	34 MK11		36	
OCEANIS	373		36	132
SWAN	40		36	112
VANCOUVER	28		36	170
VANCOUVER	34C		36	139
FIRST	40.7		37	126
OCEANIS	411		37	114

Guidelines for selecting a design

“good” features for resisting capsizes:

- Long
- Heavy
- Narrow

“good” features for speed, comfort and cost:

- Short
- Light
- Wide

Guidelines for selecting a design

- Decide type of sailing (coastal, offshore, ocean, extreme)
- Obtain stability curve, STIX or similar design data
- Compare with known designs
- Decide if OK (you choose, or consult a naval architect)

Guidelines when modifying a boat

- Avoid adding weight high up (e.g. in-mast furlers, radar, thicker deck plating)
- Avoid adding weight to keel without reviewing strength
- Avoid adding weight!
- Do not add tanks without lateral baffles
- Do not add off-centre openings (hatches, breathers, ventilators)

Summary: do not change designer's specs

The End: questions?

Downflooding angle

Heel angle at which water starts to enter boat:

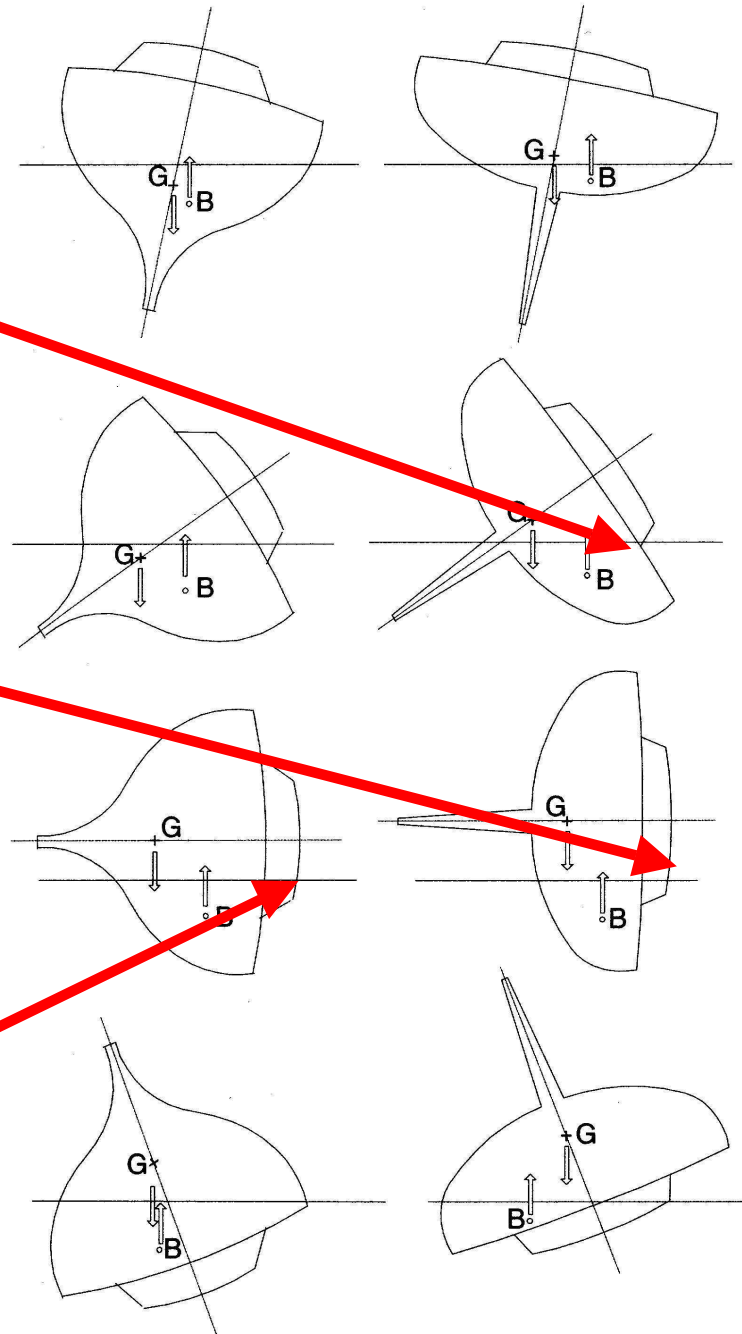
- Open hatch
- Ventilator
- Tank breather
- Cockpit locker lid

Stability curve after downflooding angle
becomes irrelevant!

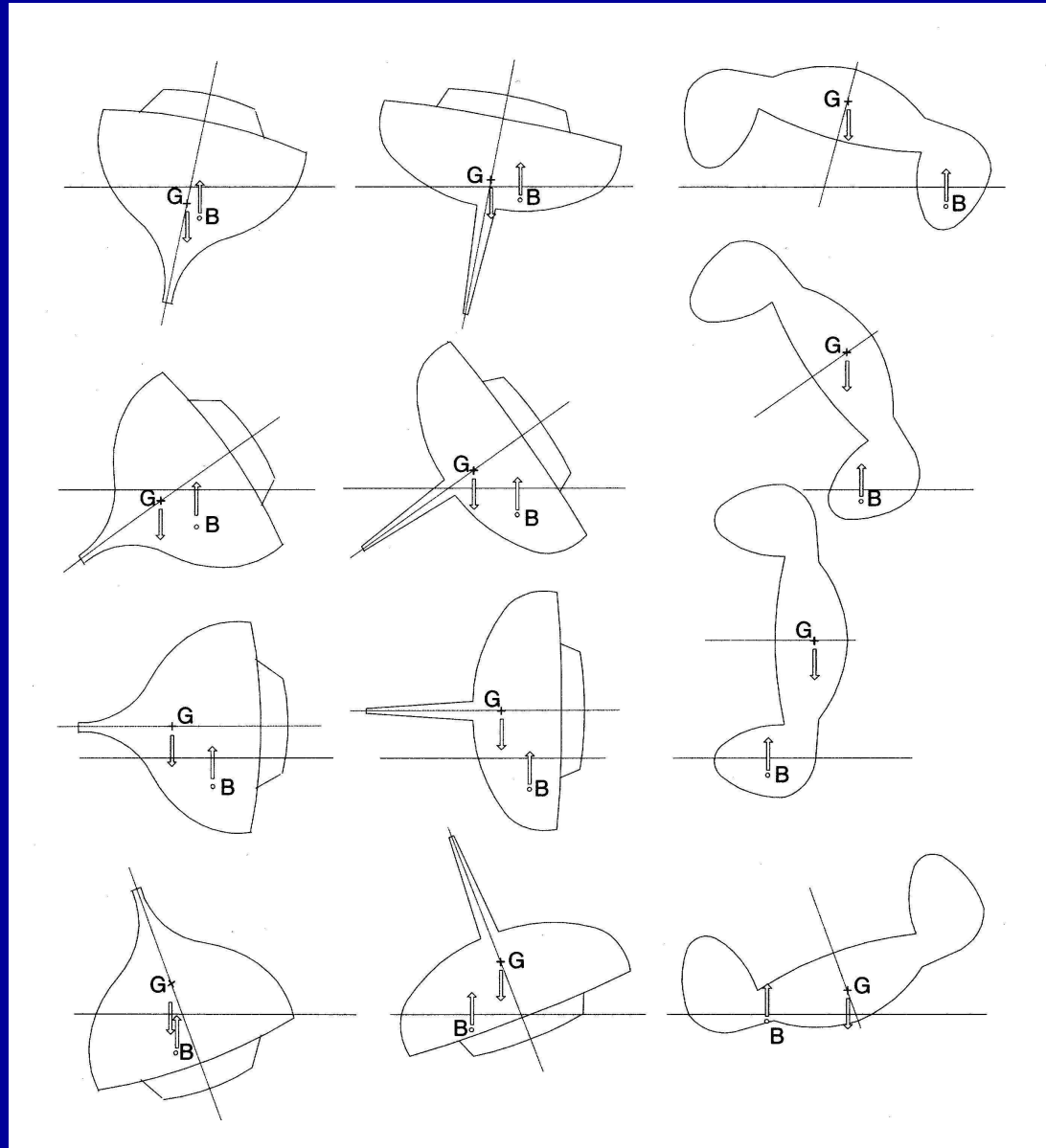
Cockpit locker

ventilator

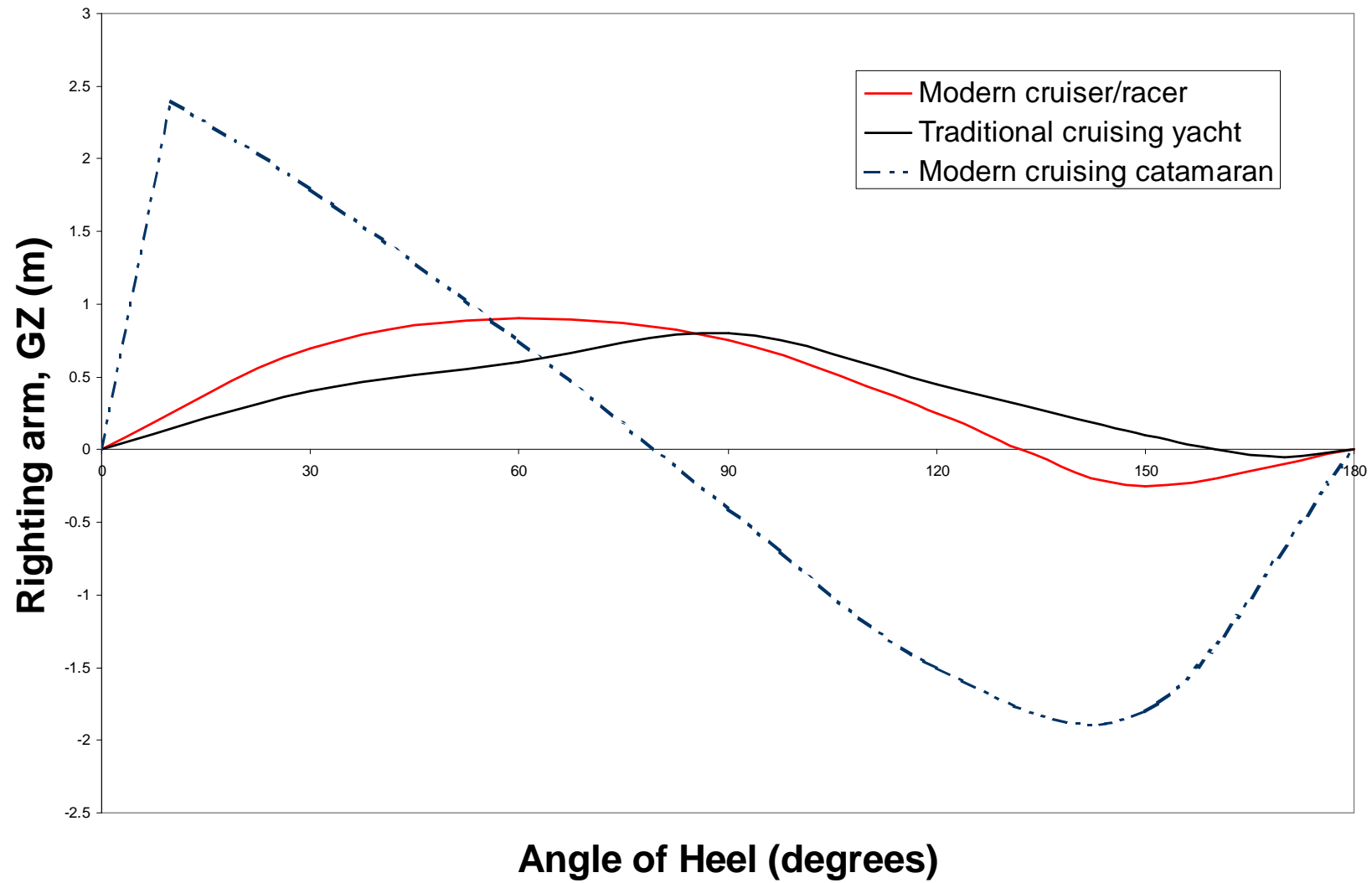
Main hatch



Different Hull Forms

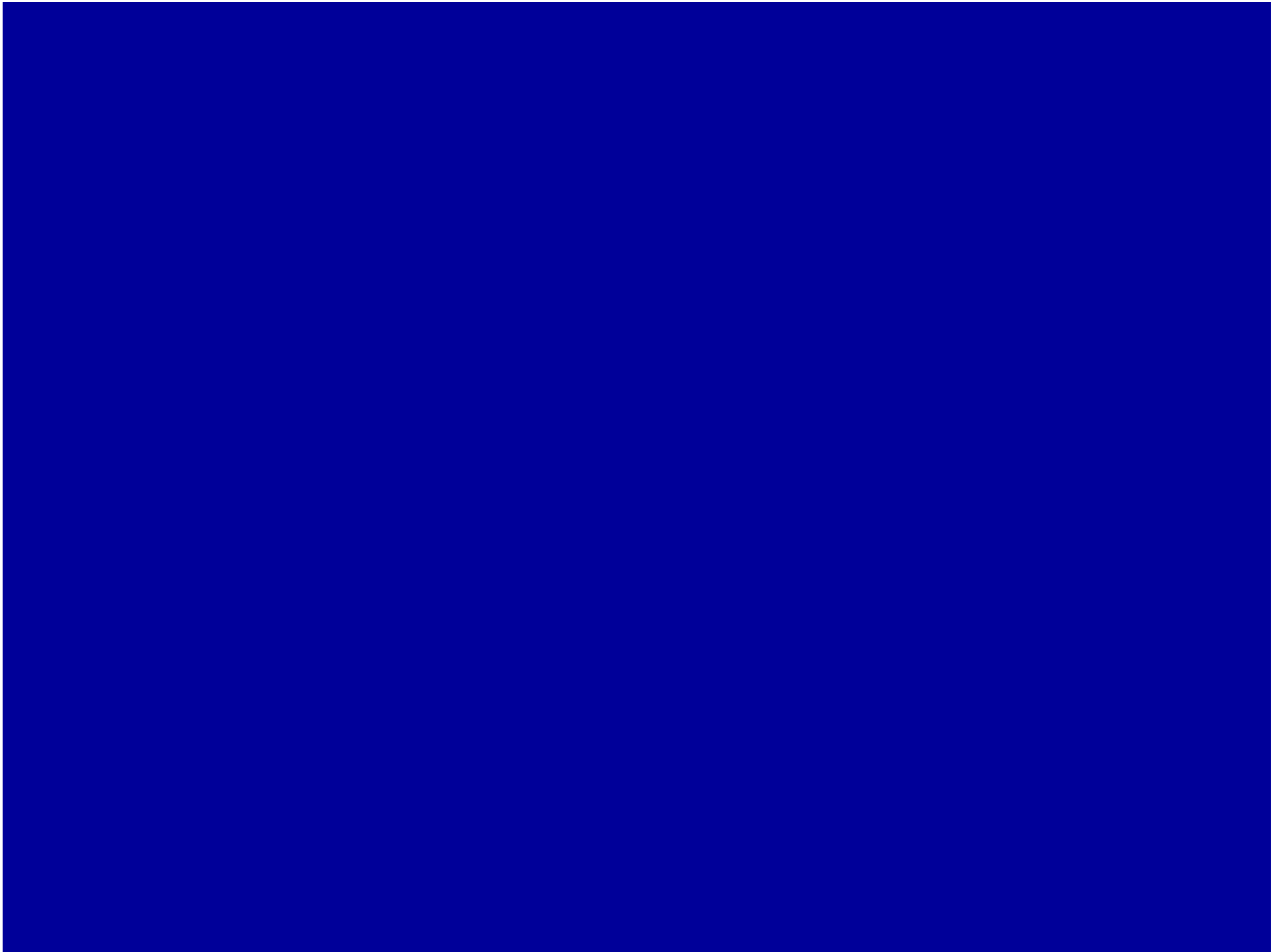


GZ curves for different Yachts

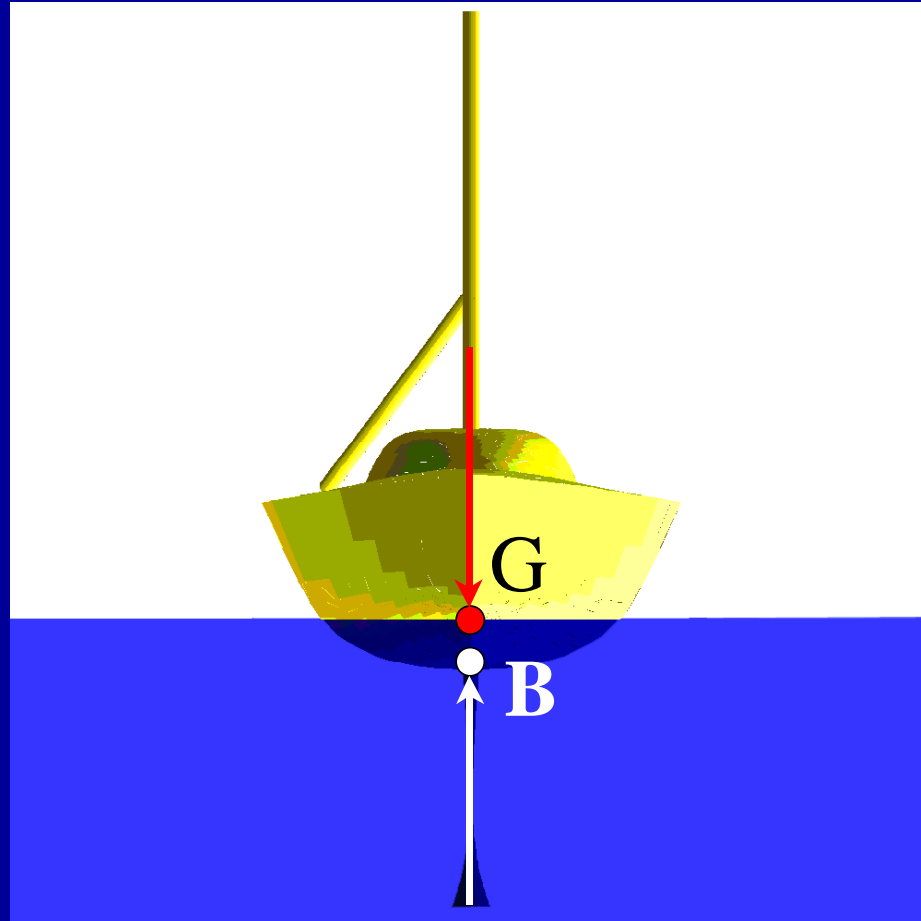








Generation of Righting Moment



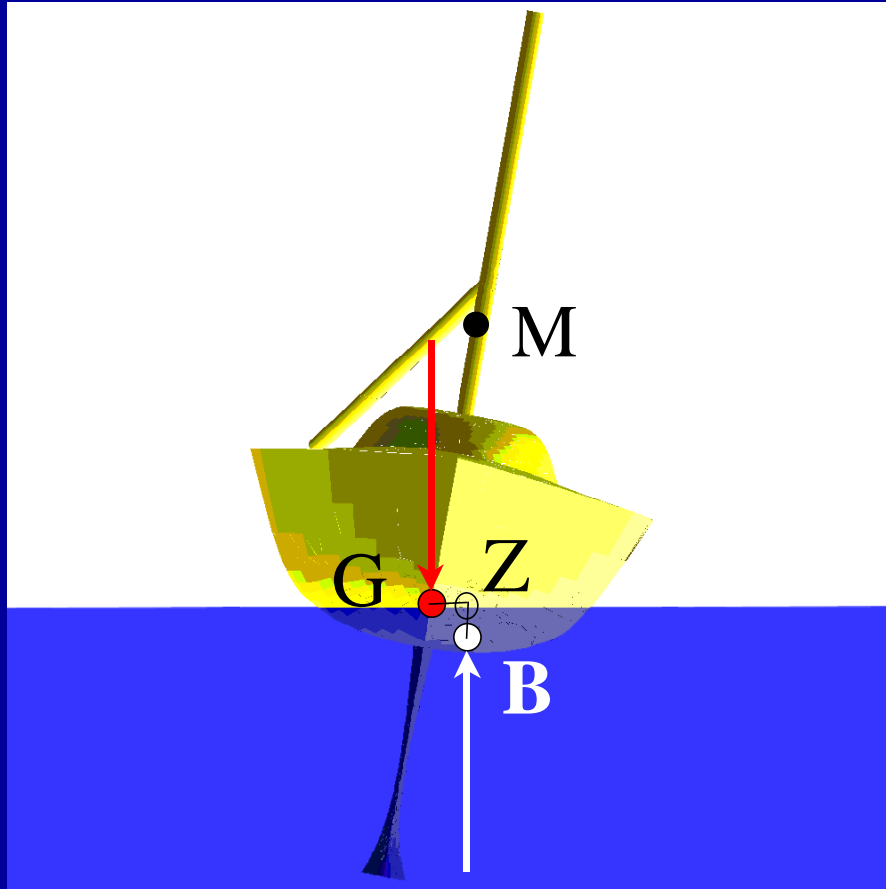
Yacht upright & in equilibrium

Mass of yacht in air is equal to
mass of fluid displaced

Buoyancy force acts upwards

Displacement force acts
downwards

Generation of Righting Moment



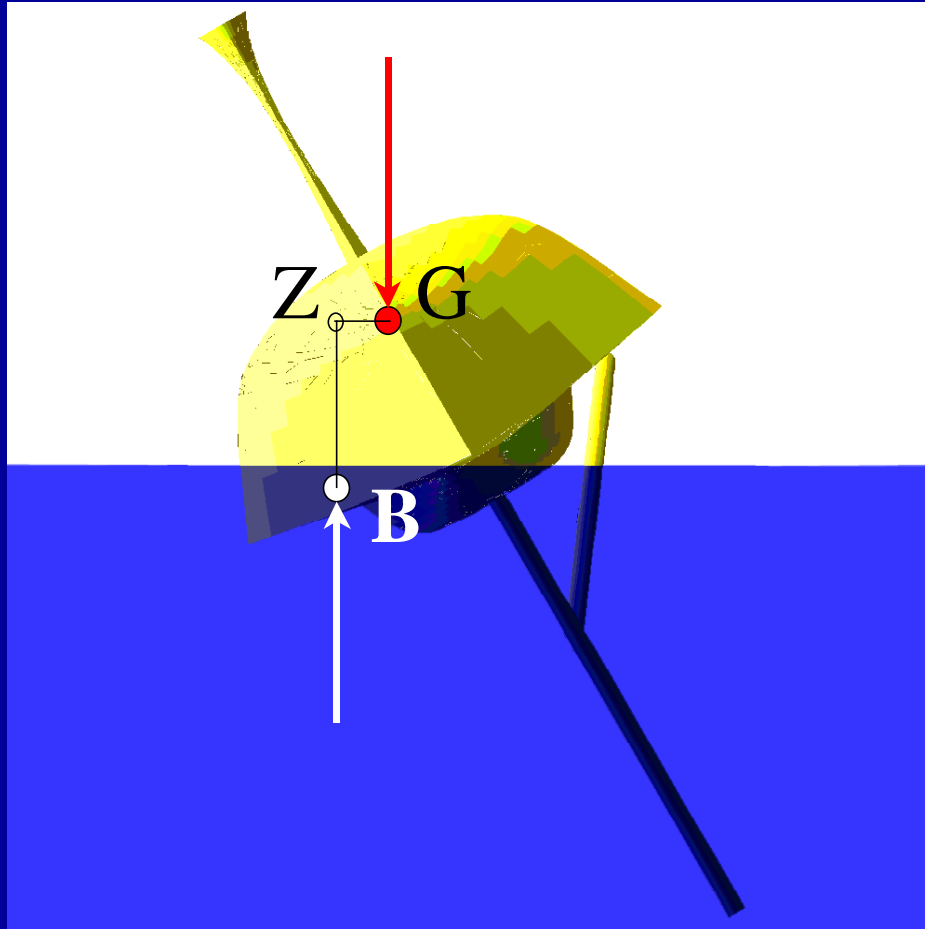
Yacht heels & B moves to one side

G remains in constant position

Intersection of B line of action and centreline is Metacentre

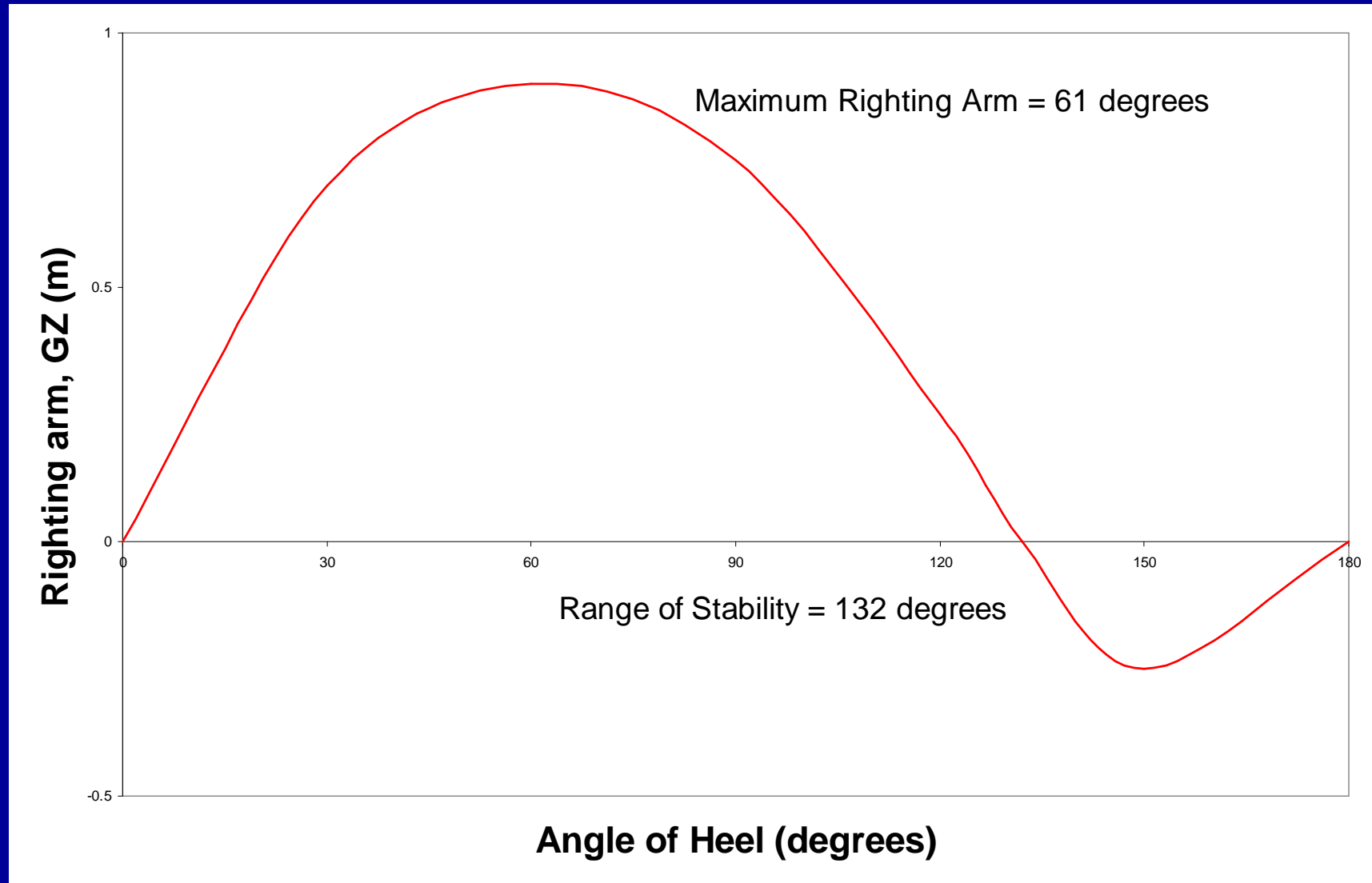
Yacht will return to upright since GZ , righting moment, is positive

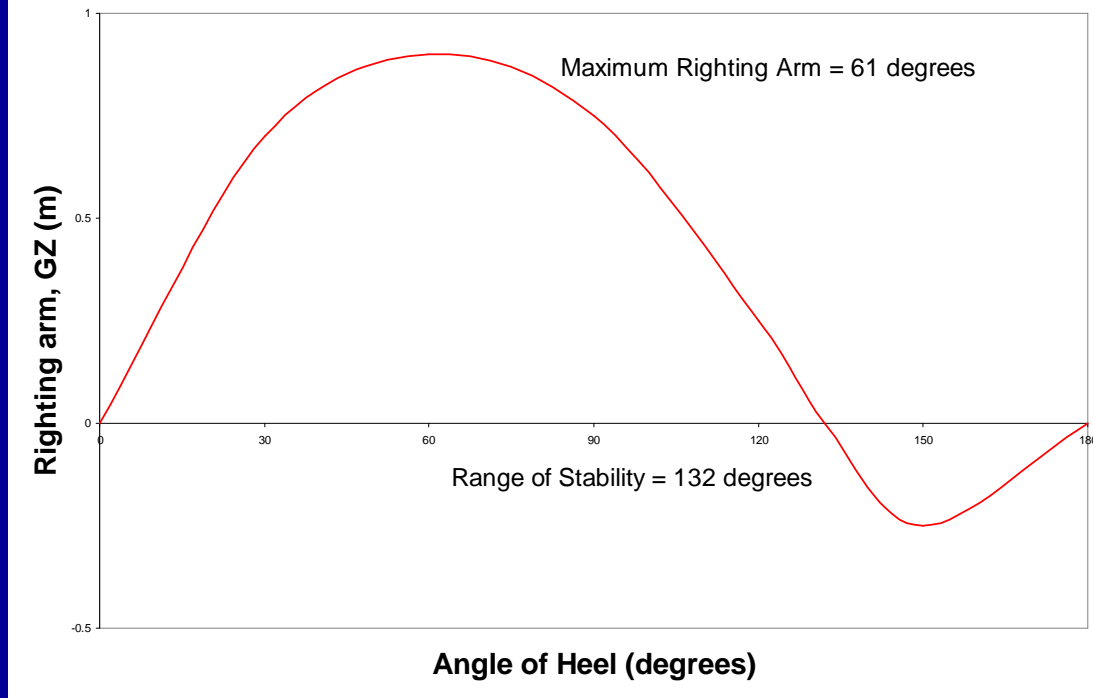
Generation of Righting Moment



GZ is negative & yacht will continue to roll and will capsize

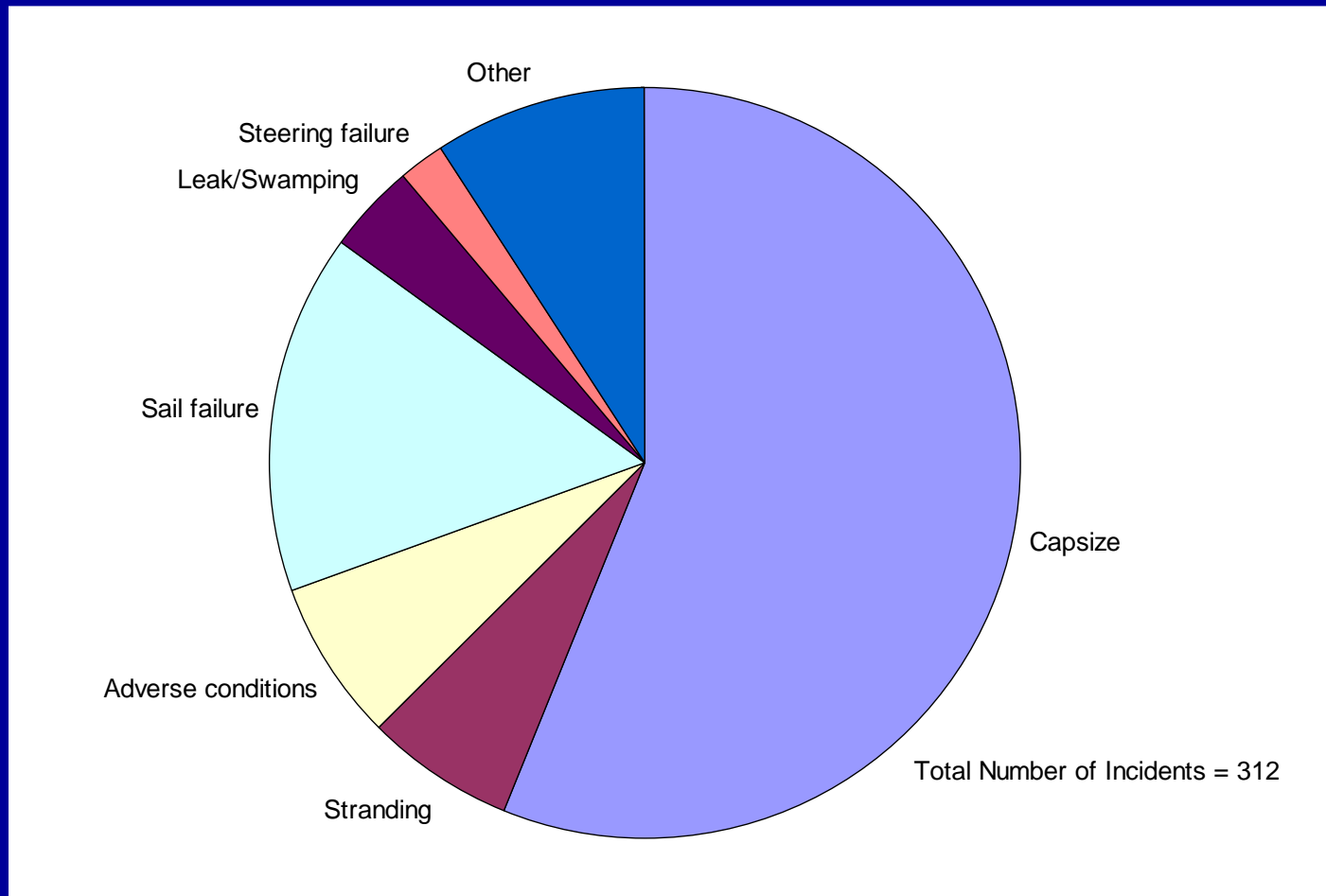
Righting Arm or GZ curve





- as heel angle increases, G & B separation increases to maximum
- GZ then reduces to zero at limit of positive stability
- If yacht released at angle less than limit it will return to upright
- If yacht released at angle greater than limit it will capsize
- If range of stability 180 degrees, it is self-righting
- GZ curve used to compare designs and assess against regulations

Multihull - Casualty Statistics



RNLi lifeboat launches (5 year period)

Session Contents

- Guidelines when building a boat
- What is stability?
- Basic concepts –righting moment and “GZ curve”
- Large angle stability
- Things that affect stability
- Guidelines for choosing a design
- Guidelines when building a boat