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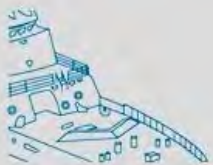


Move Forward with Confidence

Inland navigation from waterways to restricted maritime areas

BUREAU VERITAS – Inland Navigation Management

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Connection between hinterland and maritime harbours

- Development of transportation by inland waterways implies **efficient connection between hinterland and maritime harbours**, i.e. to connect operational hubs both in sheltered maritime areas and fluvial terminals.
- Inland navigation vessels must be designed to withstand more severe weather conditions than purely fluvial vessels.
- Bureau Veritas group registers more than **3000 inland vessels** distributed among 50 countries - in addition to the 11000 sea-going ships (105 M GT) - and is keen at sharing its experience with “river-sea vessels”



Advantages of inland water transport system

Inland water transport systems provide enormous advantages compared to land and air modes.

- **Cheaper capital cost** (Nature did the initial engineering work).
The cost of developing an inland waterway is 5-10% of the cost developing an equivalent railway or a four-lane expressway
- **Cheap maintenance cost** (around 20% of the maintenance cost of an equivalent roadway)
- **Greater fuel efficiency** implying lower cost of transportation.
It is estimated that 1 litre of fuel can move 105 ton-km by inland water transport whereas the same amount of fuel can move only 85 ton-km by rail and 24 ton-km by road. By air, it is even less.
- **Environmentally friendly** (1 standard vessel or convoy may replace hundreds of trucks)
- **Integration with sea transport.** Hence, it reduces the extra cost required for land-sea or air-sea transport interface infrastructure development.

Classification & Regulations

- The Bureau Veritas **Rules for classification** of inland navigation vessels include notations with regard to the maximum **significant wave height**.
For usual inland vessels, 0.60 m is the value commonly adopted. Higher values may be assigned for vessels operated on other stretches of water where stronger waves can develop (**up to 2 m**).
- Additionally to the Class Rules, there is need of suitable regulations for specific areas. Most of the IMO regulations applicable to ocean vessels are not appropriate for domestic vessels operated alongside the coastline in restricted maritime areas.



Categorization of waters

Each State must classify its waters according to the international law.

- **Internal waters** are defined landward of the baseline (the low-water line along the coast) and the State has complete sovereignty (waterways, lakes and even small bays).
- **State's territorial sea** extends up to 12 NM from the baseline. The coastal nation is free to set laws and to regulate any use, like on its own territory and its internal waters.
- Foreign vessels have no right of passage within internal waters while the law of the sea gives right of innocent passage in the territorial waters.
- Inland waterways are used to be classified for the purpose of suitable requirements consistent with the risk level depending on the severity of the wave/weather conditions. Same may be done for some zones of the territorial waters which are not open to the high seas or benefit of protection of island, archipelago, reef, delta or any other natural conditions of the coastline.
- National requirements for vessel's safety could depend on the actual characteristics of a given area of operation, categorized from "**open areas**" to "**sheltered area**", instead of considering merely locations seaward or landward of a fictive demarcation line.

Connecting maritime harbours and waterways

- Some major places such as **Antwerp** (Belgium) and **Rotterdam** (Netherlands), respectively second and first European harbours, allow **connecting efficiently maritime and fluvial harbours**.
→ 50% of the sea tonnage is carried by inland shipping
- They are key hubs for international trade across the oceans and open also to the European fluvial network giving access to all capitals and major cities from the English Channel to the Baltic Sea and the Black Sea.
- Elsewhere, inland navigation vessels must sail through **short maritime area** to reach the main maritime terminals, such as in Shanghai (China), Le Havre (France), Goa and Kakinada / Visakhapatnam (India) for instance.



Two different ways to rule in between two areas

- **Inland navigation**: smooth stretches of water with very limited waves.
- **In estuaries or maritime areas**:
 - Higher waves and swell entail more stresses to the hull and its appendages.
 - Shipping water: overload on deck and superstructures, risk of water ingress or flooding, exposure of the crew.
 - Stability and weathertightness to be reconsidered
 - Needs for becoming more autonomous (e.g. bilge system, fire protection, navigational equipment, qualification of crew, etc.).
- It is up to the national authorities to rule the access of inland navigation vessels in maritime or semi-maritime areas.

The national authorities may give exemptions regarding IMO regulations taking **restricted domestic trade** into account associated with limitations in terms of wave height and areas of operation. Also, weather forecast is reliable for a short period of time therefore the vessels must be not exposed to severe conditions.

Two different ways to rule in between two areas

Vessels operated in restricted domestic maritime areas may be considered either as “**upgraded inland navigation vessels**” or “**downgraded sea-going ships**”.

- For **inland navigation vessels**, the European Directive 2006/87/EC, for instance, allows to classify the waterways into zones 1, 2, 3, 4. As per Resolution 61 of UNECE (United Nations Economic Commission for Europe), maximum wave height is 2.0 m for zone 1, 1.20 m for zone 2 and 0.60 m for zone 3.
 - **Zones 1 and 2** are subject to **additional technical requirements** such as:
 - stability (notably for passenger vessels and container vessels),
 - structure reinforcement,
 - freeboard and safety clearance,
 - watertightness,
 - anchors and chains,
 - navigation lights and navigational equipment (compass, radar, etc.),
 - life-saving equipment,
 - visibility from wheelhouse
 - pusher connection for convoys.

Two different ways to rule in between two areas

- For **sea-going ships**, there are for instance, also in Europe, the Directive 2009/45/EC for passenger vessels sailing in the territorial waters of a Member State.

The lightest category is “**class D**” for: “*domestic voyages in sea areas where the probability of exceeding 1,5 meter significant wave height is smaller than 10 % over a one-year period for all-year-round operation [...] in the course of which it is at no time more than 6 miles from a place of refuge, nor more than 3 miles from the line of coast, where shipwrecked persons can land, corresponding to the medium tide height*”.

The requirements are those from Solas but with derogations and adaptations due to the restrictions in operation.

Also, some countries may have input additional restricted areas, continuing to downgrade the original maritime requirements (e.g. “class E” in Sweden).

For ship other than passenger vessels, maritime regulation would be adapted on a case by case basis.

- ▶ Due to very different origin of each regulation (i.e. Rhine Rules and Solas), it may result that the overlap is not consistent, notably for hull structure, stability, auxiliaries and equipment.

National regulations

- Some countries such as Belgium, France, India, Russia and China laid down **national regulations** applicable to inland navigation vessels intended for operation alongside the coastline in domestic maritime areas.
- Elsewhere, it is examined on a case by case basis by the flag Authorities (e.g. Brazil, Tanzania, Kuwait, etc.) taking restricted domestic trade into account, also depending on type of vessels and considering the **actual conditions of navigation**, possible refuges, marine traffic, etc. and fixing also limitations in terms of wave height, duration of voyages and route.



National regulations - Belgium

Royal Decree dated March 8, 2007 governs the **cargo vessels** sailing in the maritime area **between Antwerp (West-Scheldt) and Nieuwpoort (North Sea)** at maximum distance of 5 NM from the coast.

To obtain the required certificate, specific requirements are applicable additionally to the compliance with the regulation for inland navigation vessels. The vessels must be assigned the **highest class notation** from a recognised classification society. Also, like for sea-going ships, an **annual survey** is mandatory.



National regulations - Belgium

There are **additional requirements** for fire safety (structural protection, detection and fire fighting), intact stability (referring to IMO), lashing of containers, bilge arrangement, emergency power source, bulwark / handrails, anchors and life-saving appliances.

The vessels must comply with **Colreg convention** and there are also requirements regarding **radio communication** and **navigational equipment**. Tanker vessels must comply with **Marpol convention Annex I** regarding double hull, tanks arrangement and damage stability.

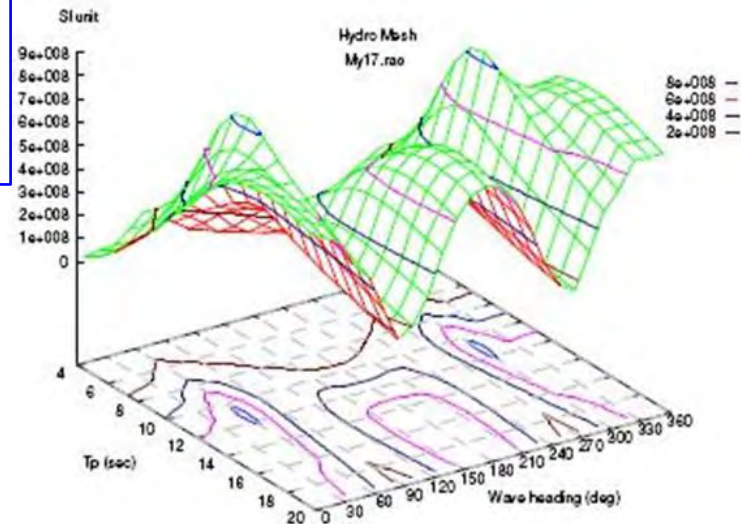
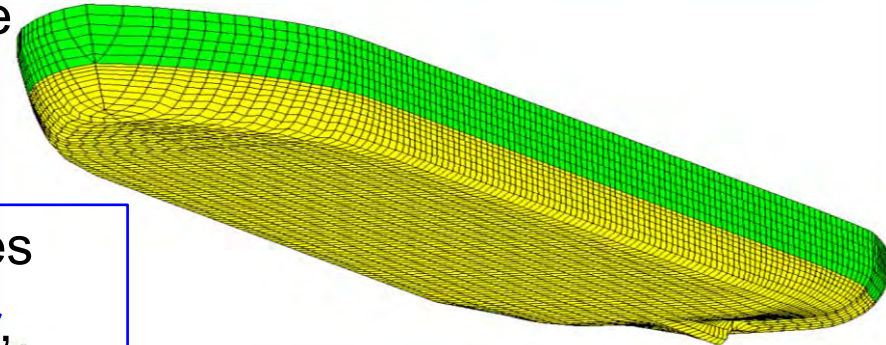


National regulations - Belgium

- A **hydrodynamic study** must be carried out.
 Behaviour at sea: forces induced by the waves and motions of the vessel in response to waves.

Assessment of risks of **slamming**, waves crashing on deck and **shipping of water**, **excessive bending moment** or excessive values of **lateral acceleration** when sailing in that given maritime area.

- The allowable **significant wave height** must be higher than **1.20 m** till **2.00 m**
- **300** return voyages per year.
 Lifetime: **20 years**



National regulations - Belgium

► Occurences:

- Once a year: slamming
- Once in the lifetime: shipping of water, roll angle ($67\% \theta_f$ or G_{zmax}), bending moment and lateral acceleration

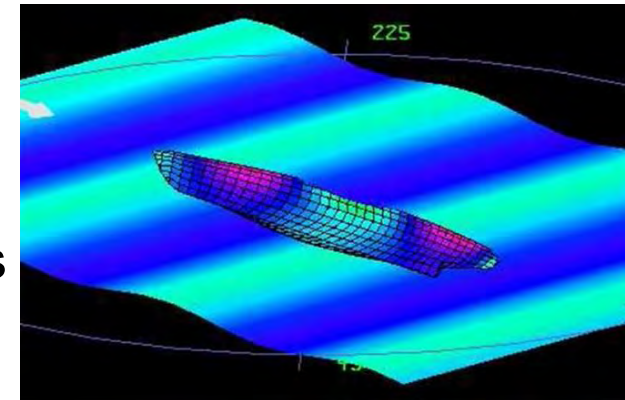
► Computation for several different loading conditions.

► Location of the non-weathertight openings plays very important role in determining the limits of exploitation for the ship.

► Roll angle proves to be a crucial factor which can threaten the stability of the ship during its coastal navigation.

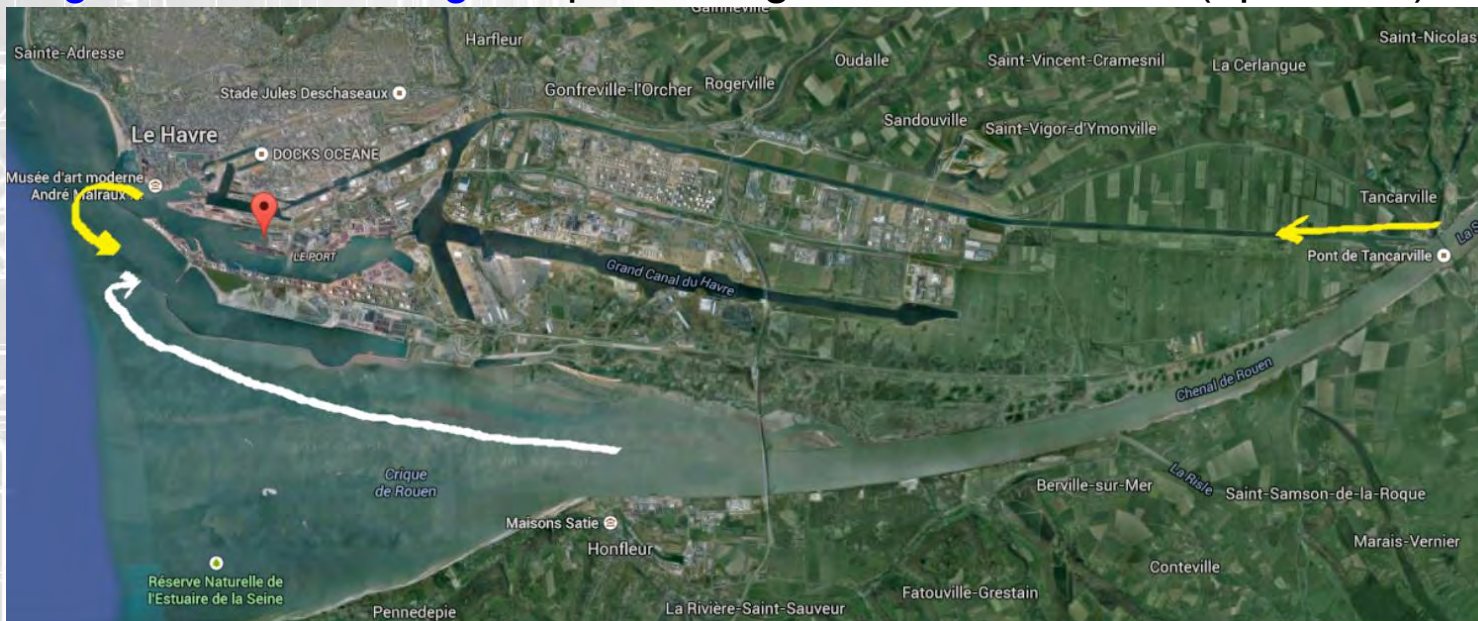
► Structural strength is checked considering the excessive vertical wave bending moment coming from the risk analysis.

According to the feedback from the operators, approval for wave height of 2 m must allow the ship to operate 97% of the time.



National regulations - France

- French Decree dated Dec.15, 2014 applicable to the **container vessels** calling at “Port 2000” (**Le Havre**) or **Honfleur** from the Seine River.
- The vessels must comply with the European regulation for the carriage of dangerous goods (**ADN**) whatever they are intended to be laden with such cargo or not. It implies double-hull vessels, damage stability study and several other requirements related to machinery installations and safety matters.
- The hull must be classed by a recognised classification society for **significant wave height** equal to or greater than 1.20 m (up to 2 m).



National regulations - France

- The **specific requirements** are related to minimum freeboard, freeing ports, intact stability (IMO criteria with special consideration for the flooding angle θ_f), bilge system, life-saving appliances, navigation lights as per Colreg convention, and navigational equipment.
- At least two means of propulsion are required.
- A lashing manual must be approved by the classification society.
- A **hydrodynamic study** must be carried out following the same principle as in Belgium taking the wave's particulars of that area into account. The vessels must meet similar criteria although the assumptions regarding number of voyages per year (**100**) and **occurrences** are different (**once a year** for all except bending moment and lateral acceleration which **once in the lifetime**).
- Sailing downstream the Seine River, the vessels must also comply with the specific French requirements for **zone 2** of the European Directive.



National regulations - India

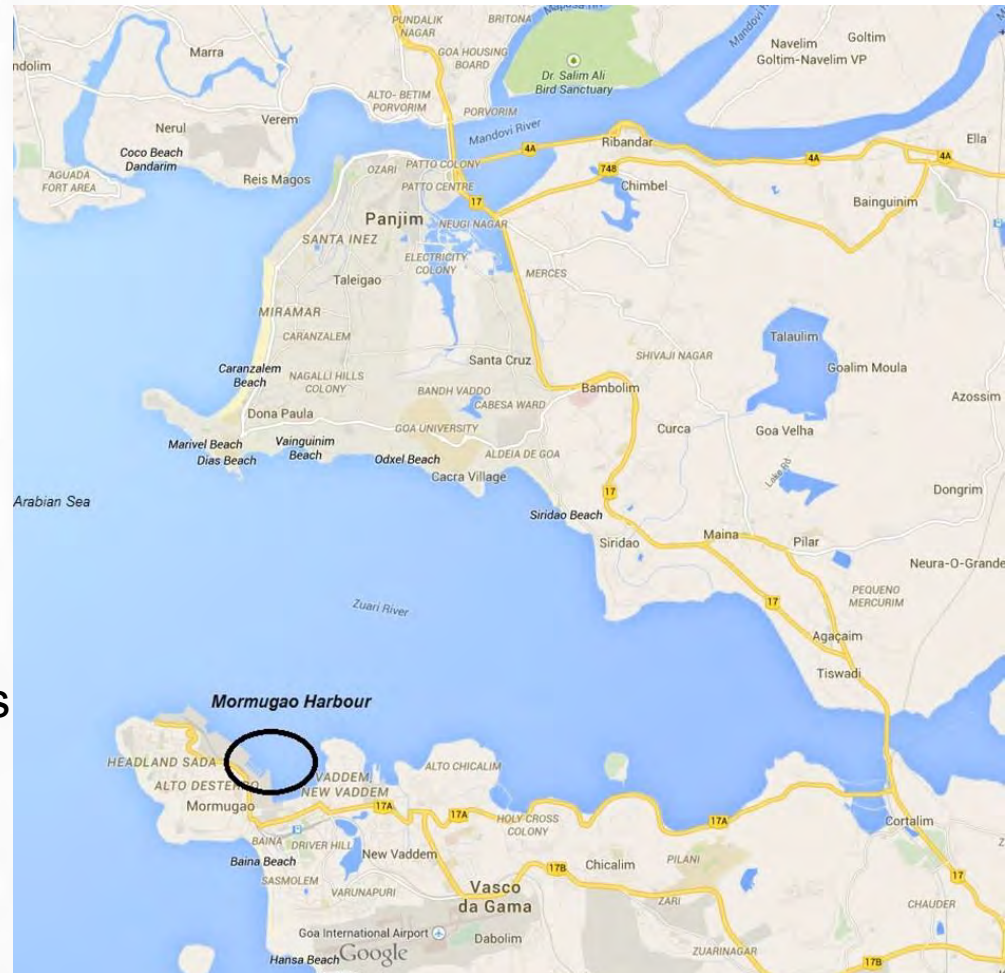
- Specific regulation (DG Shipping order 18 of 2013) for so-called “**River-Sea vessels**” carrying **dry cargo** or **oil products** and **dredgers**. It is not applicable to vessels intended for chemical products in bulk or gas and for transport of passengers.
- There are **four types** of River-Sea Vessels allowed to sail along the Indian coast:
 - **Type 1**, “ship-to-shore service” for operations at ports in the territorial waters beyond inland water limits
 - **Type 2**, “nearby ports service” for operations between ports in daylight hours
 - **Type 3**, “restricted coastal service” for operations between ports, voyages limited to 48 hours in the territorial waters
 - **Type 4**, “unrestricted coastal service” for operations between ports during all-weather conditions, at all times in the territorial waters.

Types 1, 2 and 3 must be operated in **fair weather** and favourable weather forecast.

- Maximum length of those vessels is limited to 150m.
Types 1 and 2 may be considered as **improved inland navigation vessels** while types 3 and 4 are treated as sea-going ships which benefit by derogations from the conventions.

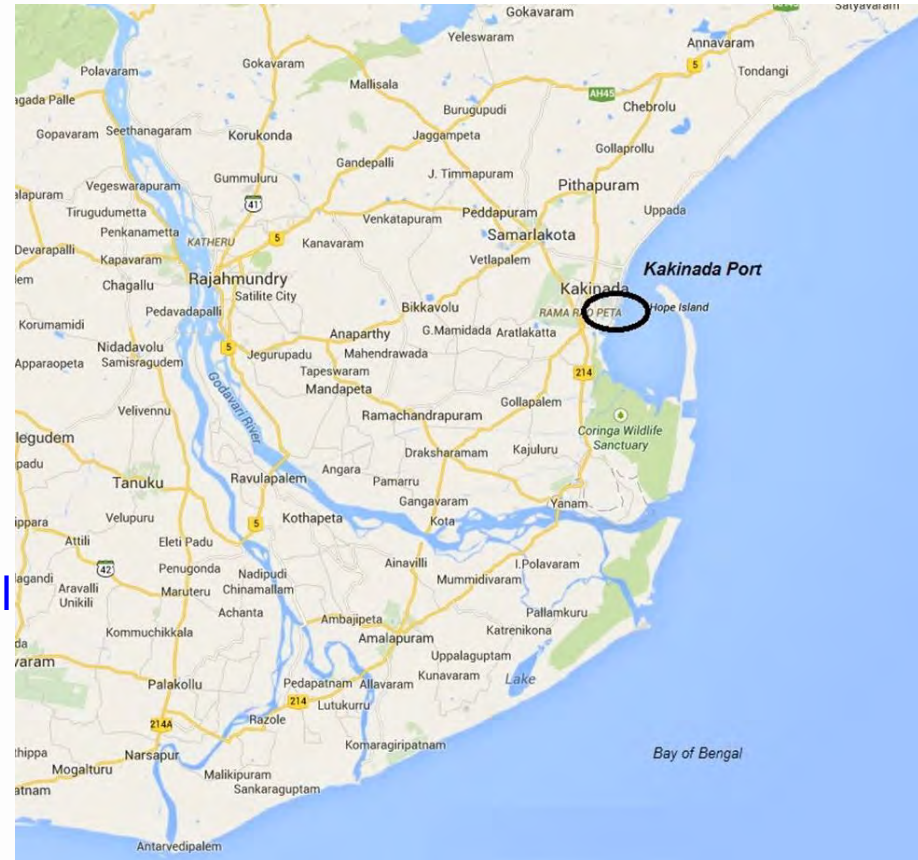
National regulations - India

- Types 1 and 2 River-Sea vessels must be designed for **minimum significant wave height of 2 m**.
- A minimum **section modulus** is required.
- When there is no hatch cover:
 - **hatch coaming** must satisfy minimum height above deck and above waterline
 - requirement for **minimum bow height**
 - For ships longer than 80m, the **hold** must be divided in two parts
- Requirements related to intact stability, bilge pumping capacity, minimum freeboard, structural fire protection and fire fighting equipment.



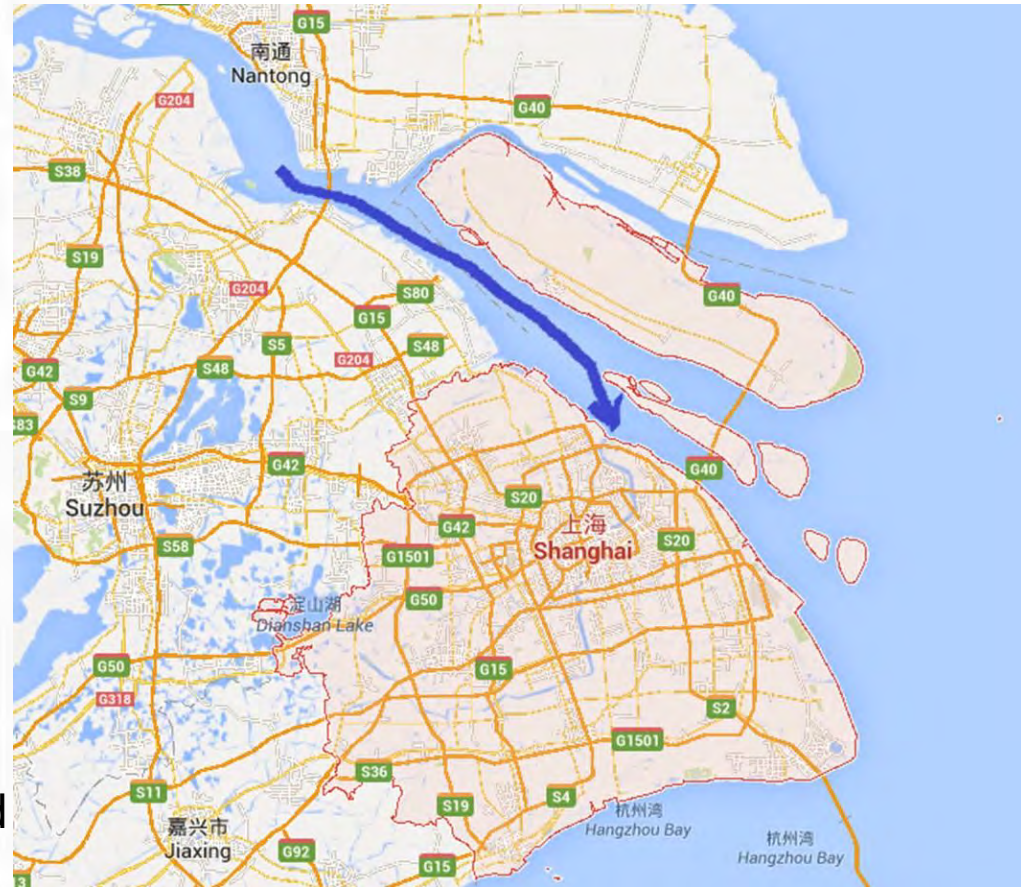
National regulations - India

- **Colreg** convention is applicable
- Crew must be certified as per **STCW**.
- Requirements regarding equipment for sailing at sea, such as life-saving appliances, radio, and navigational equipment.
- A **safety management system** is also required in compliance with a national code.
- For tanker vessels, it is referred to **Marpol** convention, notably to **Annex I** related to double hull, tanks arrangement and damage stability.
- River-Sea vessels must be inspected every year.



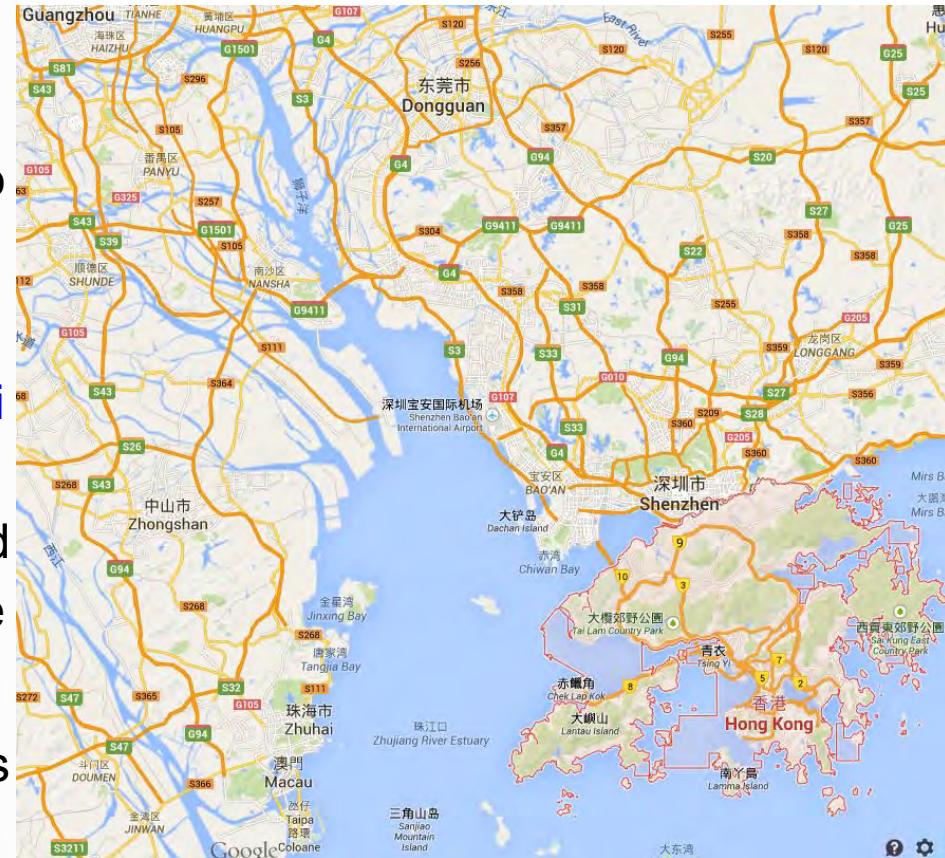
National regulations - China

- There are regulations for inland vessels which aim at ruling access to maritime harbours of **Shanghai** and **Hong Kong**.
- Inland navigation vessels are graded as per **three categories**:
 - Service **Category A** where the significant wave height can be up to 2.5 m
 - Service **Category B** where the significant wave height is maximum 1.5 m
 - Service **Category C** where the significant wave height is limited to 0.5 m



National regulations - China

- Regulations for ships allowed to sail for **longer voyages between ports** within the territorial waters: they are sea-going ships which benefit from derogations from **IMO conventions** and adaptation to the actual navigation conditions.
- Only inland vessels complying with Service **Category A** can call at **Shanghai** harbour when sailing down the Yangtze River or also to connect **Guangzhou** and **Hong Kong** or **Macao** provided the route is not farther from the shore than **5 km**.
- The applicable regulations are the Rules of the **Chinese Class Society (CCS)** complete with **MSA regulation** (Maritime Safety Administration of China).



National regulations - Russia

- There is a comprehensive regulation covering **all types of inland and river-sea vessels**.
- **Water basins** including regions with sea navigation conditions are classed on **four categories** due to their **wind-and-wave conditions** on the basis of the maximum normative wave height of respectively 0.60m, 1.20m, 2.0m (probability 1%) and 3 m (probability 3%).
Sea regions are classed on three categories due to their wind-and-wave conditions and availability of the places of refuge.
- Regions with sea navigation conditions begin from the inland waterway boundary.
- **Lists of inland water basins of Russia** in accordance with their categories, as well as sea regions where allowed for operation of river-sea navigation ships, and conditions of ships' operation are stated by the regulation.

NORMATIVE WAVE HEIGHT VALUES CORRESPONDING TO THE MAIN CLASS NOTATION

	IN				SG		
Main class notation	Л	Р	О	М	О-ПП	М-ПП	М-СП
Normative wave height, m	0.6	1.2	2.0	3.0	2.0	2.5	3.5
Wave height probability, %	1	1	1	3	3	3	3

National regulations - Russia

- Each category of water basin determines the design features of a vessel in order to be allowed for operation.
- An inland navigation vessel in a proper technical condition may be considered as suitable for **occasional navigation** (no-regular service) in a basin of higher category provided that additional design, freeboard, equipment and outfit requirements as well as restrictions for the navigation area, wind-and-wave conditions, seasonality, ice conditions etc. are met.



Classification matters

- The **Range of Navigation** indicates the admissible roughness conditions of waters.
- Upgrading the range of navigation implies specific study regarding **hull structural strength** i.e. hull scantlings, longitudinal strength of hull girder and transverse strength, and scantlings of appendages such as rudder stock.
- For Range of Navigation **IN(1.2) and above**, the **wave bending moment** is significantly higher than the value considered for usual notation IN(0.6) since it is supposed that wave length can be equal to the vessel's length.
Typically, the wave bending moment considered for the notation IN(1.2) is approximately equal to the still water bending moment (SWBM) while for IN(0.6) it is typically equal to only 10% of the SWBM.
Dynamic effects of cargo (**acceleration**) must be considered in addition to the static load. Lateral **wind pressure** must be considered for vessels with large superstructure.
- For notation IN(1.2) and above, the **hull integrity** is examined considering arrangements for hull openings with minimum values for **freeboard** and **safety distances**. **Intact stability** must be calculated taking **wind heeling moment**.
- The additional class notation “annual survey” may be required when a vessel is operated mainly in maritime area.

Regional regulations complete with vessel's classification

- The BV Rules offer **additional class notations** such as:
 - “Damage stability” when not required as per the service notation
 - “Cleanvessel”: requirements embracing notably wastes management, exhaust gas and anti-fouling with also other optional notations for instance with regard to wastewater treatment plant.
 - Comfort notations give requirements for noise and vibrations with different permissible levels which may be selected either for crew or passengers.
 - Ice notations
- Those additional class notations may be required by the relevant administration depending on vessel' service.
- Bureau Veritas can assist the flag administration in defining the assumptions, parameters, criteria and condition assessment for giving right to inland navigation vessels for sailing in maritime areas.

Conclusion

- To go with needs for **improved connection** between maritime harbours and large cities or terminals, there is a solution by using **inland navigation vessels** when they are suitably upgraded to withstand **maritime environment**.
- Each state is free to set laws to **facilitate access** of inland navigation vessels to the territory waters restricted to sheltered semi-maritime and maritime areas.
- **Classification** of inland navigation vessels is part of the solution to ascertain vessel's suitability and proper safety level.
- **Vessels can be optimized** for a given area when hydrodynamic study is carried out to assess vessel's behaviour at sea and to mitigate risk of shipping waters.
- **Bureau Veritas** has a dedicated self-standing organization to take care of inland navigation vessels.



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Thanks for your attention!

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