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January 9, 2019

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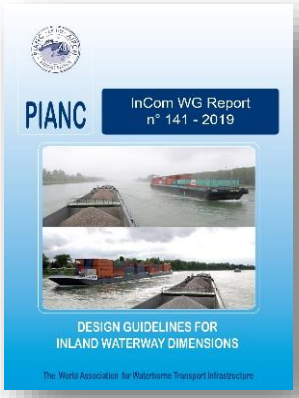

Title: **'Design Guidelines for Inland Waterway Dimensions'**

Authors: PIANC InCom Working Group 141

Price: 305 pages - € 199.00

Available at: https://www.pianc.org/publications/inland-navigation-commission/wg141-1

One of the motives for setting up PIANC InCom WG 141 – 'Design Guidelines for Inland Waterways Dimensions' was the lack of internationally accepted guidelines for inland waterway dimensions, in contrast to regulations for seagoing ships. Therefore, there is a need for adequate new guidelines, especially on minimum horizontal dimensions of fairways, lock approaches or bridge openings, to support several new waterway improvement projects. Another reason to update existing knowledge of waterway design arises from changes in the vessel fleet, especially with a growing number of longer, wider, deeper draughted and stronger powered vessels and the consequent affects on the dimensions of the design vessels. These new vessels are generally the reason why wider lock chambers, lock approaches and fairways are needed. These newer vessels are generally better equipped than traditional vessels, for example with two propellers instead of one, with twin rudders instead of single ones or with bow thrusters and passive bow rudders in some cases.

This development, combined with a general reduction in the number of ships sailing on inland waterways, provides an opportunity to potentially restrict the lateral dimensions of the navigation channels, despite the larger widths of the vessels. Also new and better information services are available such as GPS, ECDIS and AIS. Additionally, ongoing improvements in updating bathymetry data, better forecasts of hydrological conditions and the numerical modelling of rivers provide more detailed information about local velocities. This can possibly lead to more and more vessels, steered by an autopilot in the future, helping to exploit existing or restricted waterways as much as possible.

In contrast to seagoing ships, the traffic with inland vessels is generally less dangerous. For example, collisions with bank protections are more or less a normal situation when travelling in inland canals. One reason is that sea-going ships are less powered related to their water displacement and accordingly slower reacting than inland vessels but drive with comparatively high ship speeds, forcing the need for high safety standards. Thus, design standards for seagoing ships, such as those of the PIANC MarCom WG 121 ('Harbour Approach Channel Design Guidelines' – 2014), are generally not applicable to inland ships.

Constraints for using our waterways in compliance with environmental aspects, especially the Water Framework Directive in Europe, or climate change effects on free-flowing rivers might force planners and operators of waterways to narrow fairways or to increase their distance to ecologically sensitive areas. These constraints generally affect the safety of inland shipping.

All these aspects show that there is a need to specify the minimum necessary requirements on waterway dimensions, especially from the nautical point of view. This does not mean that WG 141 proposes these minimum dimensions. On the contrary, looking on the aspects of Safety and Ease of navigation (later abbreviated 'S&E') and the operational economy of shipping, the design should be generally as generous as possible. Taking into account the traffic density (prognosis), considering impacts on the environment, socio-economic aspects or the politico-economics of the waterway improvement, the design should be as narrow as necessary, but not more than that. So, it makes sense to define just these lower limits to avoid needless discussions with opponents of waterway improvement measures. This is the main task of the present PIANC InCom WG 141.

Since adequate minimum dimensions are strongly dependent on the local boundary conditions, the currently generally accepted design approach, which is the basis of existing guidelines, may not give fruitful results. This approach will be called 'Concept Design Method'. It is quite possible that the special aspects under consideration are far away from the design cases covered by the guidelines and that applicable limits of existing design formulae are reached. Some of the special aspects are:

- Fairway conditions (curvature, depth, navigable width, flow velocities and their direction, turbulence, water level slope, bank course, training structures, etc.).
- Hydrologic conditions and weather (visibility, wind, raising or falling water level, low or high water).
- Vessel type, steering and instrumentation (with or without bow thrusters, single or twin rudders, single or twin propellers, powering, Radar, GPS, ECDIS, AIS, auto piloting).
- Actual or aimed load and speed (deep draught, empty/ballasted, cargo type, fast or moderate ship speed).
- Driving situation and traffic (single-lane or two-way, meeting, overtaking, weak or strong traffic).

Therefore, WG 141 proposes a more generalised approach, based on the review of existing guidelines and the corresponding Concept Design Method, reflecting practice examples in the so-called 'Practice Approach' and in special cases using field experiments or real-time simulation techniques. It should be noted finally that nautical aspects of a planned inland waterway measure should be considered from the outset of and throughout a project and on an equal basis to other planning aspects. Because nautical demands often scale the construction costs and the ecological footprint, the planning process should integrate nautical studies throughout. Unfortunately, all too often nautical studies are considered only at the early stages or even worse only at the end. Integration helps to obtain a solution that considers and includes all relevant aspects. And, this seems to be the most important advice, do not hesitate to talk with local skippers before starting the study, not only just what they expect from the waterway project, but also what they recommend to solve critical problems.

PIANC, Boulevard du Roi Albert II 20, B 3 – B 1000 Brussels – Belgium
T + 32 2 553 71 61 – F + 32 2 553 71 55 – Email: info@pianc.org – **www.pianc.org**