PIANC

The World Association for Waterborne Transport Infrastructure

Design of Navigation Locks

InCom Working Group Report N° 206 – 2025

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27 August 2025

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This report has been produced by an international Working Group convened by the Inland Navigation Commission (InCom). Members of the Working Group represent severalcountries and are acknowledged experts in their profession.

The objective of this report is to provide information and recommendations on good practice. Conformity is not obligatory and engineering judgement should be used in its application, especially in special circumstances. This report should be seen as an expert guidance and state-of-the-art on this particular subject. PIANC disclaims all responsibility in the event that this report should be presented as an official standard.

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ISBN 978-2-87223-057-0

Executive Summary

This document presents a detailed and modernised guide for the planning, design, construction, and maintenance of navigation locks. Initiated by PIANC's Working Group 206, the report updates best practices and technological advances since the previous edition in 1986, offering a robust framework for engineers, planners, and stakeholders.

Purpose and Scope:

- Update and unify global design practices for navigation locks.
- Address the growing complexity of lock infrastructure and evolving environmental and operational demands.
- Emphasise the critical role of locks in facilitating efficient, sustainable inland waterway transport.

Design Fundamentals:

The report outlines a comprehensive and phased approach to lock design:

- Concept Development: Establishes goals, cost-benefit analysis, and stakeholder alignment.
- Planning & Feasibility: Defines operational requirements and develops concept designs.
- Detailed Design: Finalises technical specifications, material selections, and risk mitigation plans.

Structural and Operational Components:

- Specifies strict construction criteria, including flatness of concrete surfaces and tolerances for formwork and joints.
- Details the integration of critical components such as expansion joints, valves, culverts, and access systems.
- Stresses ease of inspection and repair, with designs accommodating future maintenance without operational disruption.

Equipment and Safety Systems:

- Equipment such as bollards, ladders, signals, and guide structures are designed for operational efficiency and safety.
- Lock equipment must adapt to site-specific needs (e.g. water levels, traffic density).
- Protective measures include fall prevention, edge protection, and wall armouring.

Gate and Valve Engineering:

- Various gate types are analysed (mitre, single leaf, sector) for structural requirements and operational context.

- Material selection (steel, timber, aluminium, composites) is guided by performance and durability.
- Flow-induced vibrations and hydraulic load effects are considered during gate design.

Hydraulic and Environmental Considerations:

- Hydraulic systems are optimised for speed, safety, and control during filling/emptying cycles.
- Saltwater intrusion management is addressed through systems like bubble screens and flushing.
- Water conservation and water management strategies are incorporated into lock operation plans.

Construction Methods:

- Two main approaches: in-the-dry (cofferdams) and in-the-wet (prefabrication).
- Method selection is based on site conditions, environmental concerns, and project timelines.

Maintenance and Rehabilitation:

- Maintenance is planned at both routine and emergency levels.
- Rehabilitation strategies target aging infrastructure, with upgrades to modern standards and materials.
- Emphasis on safe access, inspection intervals, and the long-term durability of key components.

Conclusion:

The document serves as a definitive reference for modern navigation lock projects, balancing engineering rigour with environmental stewardship and long-term operational performance. It supports the development of lock systems that are adaptable, efficient, and aligned with future transportation demands.

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