WORKSHOP ON RIVER-SEA TRANSPORT
CCNR, DUISBURG, 11 SEPTEMBER 2019

THE SPECIAL CASE OF INLAND NAVIGATION VESSELS NAVIGATING AT SEA
OPPORTUNITIES AND OBSTACLES

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OUTLINE

1. Coastal sea ports with limited hinterland connections
2. Inland navigation ⇔ maritime navigation
3. River-sea connections for Belgian/Flemish sea ports
4. Concluding remarks - Discussion points
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1. Coastal sea ports with limited hinterland connections
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COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS


- Maritime ports with no or insufficient connection with inland waterway system
- Solution: cover limited trajectory at sea by inland vessels
- Cases (in Europe):
  - Zeebrugge, Belgium
  - Le Havre, France
  - Marseille – Fos, France
  - Venice / Ravenna, Italy
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 1:
Zeebrugge (Belgium)
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 1:
Zeebrugge (Belgium)

Connections to inland waterways:
long voyage,
Class IV only
Case 1: Zeebrugge (Belgium)

Projects for new inland waterway connection: never realised
Case 1:
Zeebrugge (Belgium)

Alternative connection:
Sea trajectory to
Western Scheldt mouth
(15 nm)
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 2: Le Havre (France)

2005: container terminal *Port 2000* (4.2 km quay wall)
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 2: Le Havre (France)

2005: container terminal *Port 2000*

Lock & canal for inland navigation: not realised!
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 2:
Le Havre (France)

2005: container terminal *Port 2000*

Alternative connections:

- sea trajectories to historic port of Le Havre (N)
- or
to mouth of river Seine (S)
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 2:
Le Havre (France)

2005: container terminal

*Port 2000*

Future developments (2023):
direct river access

*(accès fluvial direct – “chatière”)*
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 3: Marseille-Fos (France)
Connection to river Rhône by Golfe de Fos
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 3:
Marseille-Fos (France)

Connection to river Rhône by Golfe de Fos
COASTAL SEA PORTS WITH LIMITED HINTERLAND CONNECTIONS

Case 4: Mantova-Valdaro (Italy)

Inland port connected to ports of Venice, Ravenna, other Adriatic sea ports by Porto Levante.
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INLAND NAVIGATION ↔ MARITIME NAVIGATION

Maritime shipping ↔ Inland shipping

International conventions (IMO) ↔ National legislation / Regional conventions (e.g. CCNR, ESTRIN)

Less standardized ship dimensions (exceptions due to important waterways) ↔ More standardized ship dimensions (cf. lock dimensions)

Designed for steady course-keeping at full sea ↔ Designed for confined/shallow water

Navigation areas exposed to wind/waves ↔ Navigation areas not/less exposed to wind/waves

Flag state – national register (crew / environment)

Classification society (ship)
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship design: strength

Ships (inland & maritime) have to withstand external bending moments
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship design: strength

Ships (inland & maritime) have to withstand external bending moments:

- Still-water bending moments
  - Loading/unloading
  - During navigation

weight distribution (downward)

buoyancy distribution (upward)
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship design: strength

Ships (inland & maritime) have to withstand external bending moments:

- Still-water bending moments
- Wave bending moments

“Hogging”

“Sagging”
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship design: strength

Ships (inland & maritime) have to withstand external bending moments:

- *Still-water* bending moments
- *Wave* bending moments

⇒ CLASS RULES & REGULATIONS
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship design: strength

**Bureau Veritas: “range of navigation”**

11.2 Range of navigation IN(0)

11.2.1 The range of navigation \( \text{IN}(0) \) is assigned to a vessel having a structure with scantlings deemed suitable to navigate on still and smooth stretches of water.

11.3 Range of navigation IN(0,6)

11.3.1 The range of navigation \( \text{IN}(0,6) \) is assigned to a vessel having a structure with scantlings deemed suitable to navigate on stretches of water where there may be strong currents and a certain roughness of the surface on which a maximum wave height of 0.6 m can develop.

11.4 Range of navigation IN(0,6 < x ≤ 2)

11.4.1 The range of navigation \( \text{IN}(0,6 < x \leq 2) \) is assigned to a vessel having structure scantlings and other design features deemed suitable to navigate on stretches of water on which a maximum significant wave height \( x \), ranging between 0.6 m and 2.0 m, can develop, e.g., estuaries, lakes and restricted maritime stretches of water.

**Lloyd's Register of Shipping: “navigation zones”**

2.1.1 Zone 1. A zone where the maximum significant wave height based on long-term significant wave height statistics, excluding the highest five per cent of the observed waves, does not exceed 1.6 m.

2.1.2 Zone 2. A zone where the maximum significant wave height based on long-term significant wave height statistics, excluding the highest five per cent of the observed waves, does not exceed 1.0 m.

2.1.3 Zone 3. A zone where the maximum significant wave height based on long-term significant wave height statistics, excluding the highest five per cent of the observed waves, does not exceed 0.5 m.
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Ship operation: loading condition

Inland waters: hardly any freeboard
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Specific design aspects: level of aft deck
INLAND NAVIGATION ↔ MARITIME NAVIGATION

Specific design aspects: bow shape
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SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

1962: Service Rule on estuary traffic (BSI)

- Rules for allowing inland vessels on a coastal trajectory between Zeebrugge and the Western Scheldt mouth
- Class: range of navigation – suitable scantlings
- Additional requirements:
  - Freeboard
  - Strength
  - ...
- Operational limitations
  - Significant wave height $H_s < 1.2 \text{ m}$
  - In practice: wind $\leq 5$ Beaufort
- Mostly (bunkering) tankers
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

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SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

Significant wave height (cm)

1/01/2013  8/01/2013  15/01/2013  22/01/2013  29/01/2013  5/02/2013  12/02/2013  19/02/2013  26/02/2013
Bol van Heist, JAN - FEB 2013
1.7 m  1.2 m  0.6 m

1/06/2013  8/06/2013  15/06/2013  22/06/2013  29/06/2013  6/07/2013  13/07/2013  20/07/2013  27/07/2013
Bol van Heist, JUNI - JULI 2013
1.7 m  1.2 m  0.6 m

Bol van Heist, NOV- DEC 2013
1.7 m  1.2 m  0.6 m
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

1962: Service Rule on estuary traffic (BSI)

1980s: harbour expansion Zeebrugge
   ➔ more bunker activities

2000s: increasing container traffic
   ➔ more adequate hinterland connections needed
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

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2004 – 2007: individual studies – Hs ≤ 1.60 – 1.75 m
(tankers, ro-ro, container carriers)
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2000s: increasing container traffic ➔ more adequate hinterland connections needed

2004 – 2007: individual studies – Hs ≤ 1.60 – 1.75 m (tankers, roro, container carriers)

2007:

- legal framework (Belgian federal government)
- financial support (Flemish government)
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

2007: legal framework: Royal Decree

SERVICE PUBLIC FEDERAL MOBILITE ET TRANSPORTS

F. 2007 — 1187

8 MARS 2007. — Arrêté royal relatif aux bateaux de navigation intérieure qui sont aussi utilisés pour effectuer des voyages non internationaux par mer

ALBERT II, Roi des Belges,
A tous, présents et à venir, Salut.
Vu la loi du 5 juin 1972 sur la sécurité des bâtiments de navigation, notamment l’article 17ter, § 1er, inséré par la loi du 22 janvier 2007;

Vu la loi du 24 novembre 1975 portant approbation et exécution de la Convention sur le règlement international de 1979 pour prévenir les abord;
le 20 c

requirements for obtaining an “annotated supplementary Community certificate”

allowing INLAND vessels to navigate between the Western Scheldt and the ports on the Belgian coast

Vu la loi du 21 décembre 1990 relative à l’enregistrement des navires, notamment l’article 1er, § 2;

Vu la loi du 6 avril 1995 relative à la prévention de la pollution par les
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 requirements

- Full ADNR certification
- Crew: specific STCW certification
- “Restricted seaworthiness” (upgraded inland vessel)
  - Equipment, MARPOL, COLREG
  - STABILITY: almost identical criteria to IMO Code
  - Fire safety: e.g.
    - e.g. class A-60 bulkheads & decks between wheelhouse, accommodation spaces & machine rooms
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Full ADNR certification
- Crew: specific STCW certification
- “Restricted seaworthiness” (upgraded inland vessel)
  - Equipment, MARPOL, COLREG
  - STABILITY
  - Fire safety
  - Container stowage, structural strength, draft scales, manoeuvrability, navigation aids, communication equipment, propulsion, bilge pumps, electrical installations, fire fighting, anchor, personal life savings, bulwarks, railings
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Full ADNR certification
- Crew: specific STCW certification
- “Restricted seaworthiness”
- Operating restrictions regarding swell, freeboard, speed and loading condition
  
  ➡ probabilistic (seakeeping) study ("risk analysis")
  
  ➡ not required for vessels with watertight steel hatches or with a watertight deck (tankers)

  restricted to $H_s \leq 1.2 \text{ m}$ (minimum freeboard / height of hatches instead)
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Operating restrictions regarding swell, freeboard, speed and loading condition: “risk analysis”
  - Probability calculations:
    - Ship lifetime: 20 years
    - 300 round trips / year
    - Use historic directional wave measurements of one year
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Operating restrictions: “risk analysis"

<table>
<thead>
<tr>
<th>Green Water (foredeck &amp; aftdeck):</th>
<th>Slamming (bow emergence):</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 / lifetime</td>
<td>≤ 1 / year</td>
</tr>
</tbody>
</table>

- Diagrams showing the connection points and safety analysis

[Images of ships and waves]
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Operating restrictions: “risk analysis”

Cargo holds/tanks:

Exceedance of reference level $\leq 1 \text{ / lifetime}$
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Operating restrictions: “risk analysis”

Roll angle
- 2/3 of flooding angle
- or maximum in stability curve
- or 15 deg:

Wave bending moment
Wave torsional moment
Lateral acceleration

limited to 1/lifetime

1/lifetime values to be determined
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Full ADNR certification
- Crew: specific STCW certification
- “Restricted seaworthiness”
- Operating restrictions regarding swell, freeboard, speed and loading condition
- Assessment procedures for captain:
  - “go / no go”
  - based on actual measurements and forecast of weather conditions and wave height
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

RD 2007 Requirements:

- Full ADNR certification
- Crew: specific STCW certification
- “Restricted seaworthiness”
- Operating restrictions regarding swell, freeboard, speed and loading condition
- Assessment procedures for captain
- Important role for classification society:

  *The inland waterway vessel must be registered with an approved organisation. It must be classified, for the hull and the machine installations, in the highest class of its category. The classification must also state that the construction and strength of the inland waterway vessel comply with the regulations [...].*
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

1962: Service Rule on estuary traffic (BSI)

1980s: harbour expansion Zeebrugge
        ➔ increased bunker activities

2000s: increased importance of container traffic
        ➔ need for more adequate hinterland connections

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2004 – 2007: individual studies – $H_s \leq 1.60 – 1.75\ m$
    (tankers, roro, container carriers)

2007: legal framework (Belgian federal government)

2019: amendments (Flemish government – provisional)
2019 Amendments:

— Certificate possible for lower range of wave heights:

An annotated supplementary Community certificate shall be issued for a significant wave height between 0.6 m and 2.0 m.

— Less strict class registration for lower wave height range:

The inland waterway vessel must be registered with an approved organisation. It must be classified, for the hull and the machine installations, in the highest class of its category. A vessel with operating restriction regarding swell less than or equal to a significant wave height of 1.2 m must be classified for the machine installations, but not in the highest class of its category.
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

2019 Amendments:

— Dry dock surveys ↔ underwater surveys:

... the annotated supplementary Community certificate shall be valid for 5 years. The validity shall also depend on an annual confirmation by the Inspection Committee, subsequent to the following surveys carried out by said Committee:

— an annual survey within a period of three months before or after the anniversary of the annotated supplementary Community certificate and
— a survey in dry dock between the second and third anniversaries of the annotated supplementary Community certificate.

The survey in dry dock can be replaced by an underwater survey under the condition that the approved organisation [...] has explicitly approved this replacement in writing prior to the survey.

—
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

2019 Amendments:

— Risk analysis – probabilistic criteria:

— Not required for operating limitation w.r.t. significant wave height (Hs) of 1.2 m and less;

— New set of deterministic freeboard values for Hs ≤ 1.2 m, for
  — Vessels with a closed watertight deck (tankers);
  — Vessels with hatches closed by means of watertight steel hatch covers;
  — Vessels with open hatches.
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

2019 Amendments:

— Risk analysis – probabilistic criteria:

more realistic number of round trips per year:

— 300 round trips per year ➔ ≥100 round trips per year
— free distribution of number among different trajectories

 [...] the lifetime is assumed to be 20 years, and it is assumed that the inland waterway vessel will make 100 voyages in each direction in the restricted area [...].

In case the inland vessel performs more than 100 voyages in each direction, the actual number of planned voyages has to be considered. In that case the certificate [...] will be issued based on that number of voyages and will only be valid if that number is not exceeded.

The number of planned voyages can be freely distributed among different trajectories between the mouth of the Western Scheldt and a coastal harbour, or between two coastal harbours.
SEA-RIVER CONNECTIONS FOR THE BELGIAN/FLEMISH COASTAL SEAPORTS

2019 Amendments:

- **Stability requirements**: adapted to realistic wind and wave conditions

- **Navigation equipment**: nautical radar only required for $H_s > 1.2$ m

- **Wave data for risk analysis**:
  - 2007: measured data only
  - 2019: measured data + results of validated numerical calculations
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CONCLUDING REMARKS - DISCUSSION POINTS

Modal split Zeebrugge: is there room for a larger share for estuary traffic?

40.1 MILLION TONS

The majority of cargo leaves or arrives at the port by lorry. However, transport by rail is increasing. Many goods arrive by one ship and leave in another ship. This is called transhipment.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Total</th>
<th>% Total</th>
<th>% inland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>15.919</td>
<td>83.2%</td>
<td>77.9%</td>
</tr>
<tr>
<td>Rail</td>
<td>15.174</td>
<td>7.4%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Transhipment Feeder</td>
<td>6.739</td>
<td>3.2%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Estuary Shipping</td>
<td>1.232</td>
<td>0.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Pipeline</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Inland Shipping</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

- **Road**
  - Containers: 1.696
  - Break bulk: 5
  - Liquid bulk: 1.440
  - Solid bulk: 0

- **Rail**
  - Containers: 849
  - Break bulk: 0
  - Liquid bulk: 1.219
  - Solid bulk: 84

- **Transhipment Feeder**
  - Containers: 190
  - Break bulk: 5
  - Liquid bulk: 1.440
  - Solid bulk: 0

- **Estuary Shipping**
  - Containers: 30
  - Break bulk: 0
  - Liquid bulk: 0
  - Solid bulk: 0

- **Inland Shipping**
  - Containers: 384
  - Break bulk: 448
  - Liquid bulk: 0
  - Solid bulk: 0

- **Total**
  - Containers: 122
  - Break bulk: 112
  - Liquid bulk: 0
  - Solid bulk: 0

- **Pipeline**
  - Containers: 0
  - Break bulk: 0
  - Liquid bulk: 0
  - Solid bulk: 0

- **Total**
  - Containers: 2.098
  - Break bulk: 122
  - Liquid bulk: 0
  - Solid bulk: 84

- **Total**
  - Containers: 5.310
  - Break bulk: 5.310
  - Liquid bulk: 0
  - Solid bulk: 1.148

- **Total**
  - Containers: 27.424
  - Break bulk: 27.424
  - Liquid bulk: 0
  - Solid bulk: 1.816

- **Total**
  - Containers: 1.816
  - Break bulk: 1.816
  - Liquid bulk: 0
  - Solid bulk: 0

- **Total**
  - Containers: 40.101
  - Break bulk: 40.101
  - Liquid bulk: 0
  - Solid bulk: 0

- **Total**
  - Containers: 15.919
  - Break bulk: 15.919
  - Liquid bulk: 0
  - Solid bulk: 0
CONCLUDING REMARKS - DISCUSSION POINTS

Non-international ↔ international voyages?

Royal Decree concerning inland waterways vessels
also used for non-international sea voyages
CONCLUDING REMARKS - DISCUSSION POINTS

Non-international ↔ international voyages?

Royal Decree concerning inland waterways vessels also used for non-international sea voyages
CONCLUDING REMARKS - DISCUSSION POINTS

Non-international ⇔ international voyages?

Non-international voyage:

- Port of departure = Belgian port
- Port of arrival = Belgian port
CONCLUDING REMARKS - DISCUSSION POINTS

Non-international ⇔ international voyages?

Non-international voyage
- Port of departure = Belgian port
- Port of arrival = Belgian port

International voyage
CONCLUDING REMARKS - DISCUSSION POINTS

Non international voyage ⇔ International voyage:

- is there any legal way out for exceptions?
  - Within EU?
  - Bilateral agreement?
  - Within member states of CCNR?
CONCLUDING REMARKS - DISCUSSION POINTS

Is there a lack of standardisation?

— (non-)uniformity of legislations / regulations:
  — National legislation: case-specific
  — Similarities: Zeebrugge – Le Havre
  — Classification societies

— Discussion point:
  — More uniformity required?
  — More attention to local situation?
CONCLUDING REMARKS - DISCUSSION POINTS

Is significant wave height the best criterion?

1962 Service Rule: Beaufort number

2007 Royal Decree: significant wave height

????: Full directional wave spectrum + wind speed & direction
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Emeritus Professor Ghent University
Knowledge Centre Manoeuvring in Shallow and Confined Water