Climate change from a ports perspective

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Port of Rotterdam Authority
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Workshop on Sea Ports and Climate Change
Content

- Delta Programme: climate change on a national perspective
  - Focus on Rhine Estuary-Drechtsteden
  - Possible and favourable strategies
- Consequences of climate change for the port of Rotterdam
  - Characteristics
  - Opportunities and threats
- Four opportunities
  - Adaptation strategy water safety
  - Change of freshwater distribution upstream
  - Opportunities for port development in the Botlek area
  - Sediment management on river basin scale
Delta Programme

- Protection against flooding and maintaining sufficient supply of freshwater in the long run (2050 – 2100).
- Guarantee of a safe climate for investment in The Netherlands

- Delta Programme has 3 national and 6 regional programmes
- Port of Rotterdam Authority is part of the regional programme Rhine Estuary-Drechtsteden
- Delta Decision on the Rhine-Meuse Delta in 2014, phased:
  - Possible strategies (2012)
  - Favourable strategies (2013)
  - Preferable strategies (2014)
Delta Programme

Sea level rise Delta Scenarios:
In 2050: +0,15m to +0,35m
In 2100: +0,35m to +0,85m
Most important bottlenecks in the future

- Maeslant barrier has technical limitations (>2070)
- Flooding of areas outside the dike
- Dike strengthening accompanied with high costs
- Inlet freshwater Gouda no longer reliable (>2050)
Reference situation, current strategy (possible strategies)
Improved current strategy (possible strategies)
Closing off the sea side (possible strategies)
Closed ring of barriers with locks (possible strategies)
Conclusions possible strategies

- The current strategy is likely to become a preferable strategy.

- The strategy with a completely closed ring of barriers with locks on the arms of the rivers is no longer considered.

- The strategy “closing off the sea side” is not (yet) from the list.
Consequences port of Rotterdam
Opportunities and threats

- Long term vision: important for climate for investment
- Water safety (outside the dikes) of port area
- Accessibility seagoing shipping and inland navigation
- Freshwater supply
The importance of the port of Rotterdam for the Netherlands

- (In)direct added value (2010):
  € 22.2 billion or 3.3% of GDP
- Strategic added value:
  a.o. port offers quick and cheap access to foreign markets, promoting imports and exports. Businesses and consumers benefit from this. High standard innovative suppliers and service providers.
- 2010: (in)direct employment: 145,000
  2030: + ca. 25,000 jobs ((in)direct)
- Annual average business investment
  2011-2030: € 1.5 billion
Flooding of area outside the dikes
(extreme climate scenario 2100)
Water safety
Port area lies outside the dykes but relatively high

<table>
<thead>
<tr>
<th>Location</th>
<th>Height above sea level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maasvlakte</td>
<td>± 5,0 m</td>
</tr>
<tr>
<td>Europoort</td>
<td>± 5,5 m</td>
</tr>
<tr>
<td>Botlek</td>
<td>± 4,5 m</td>
</tr>
<tr>
<td>1st, 2nd Petroleumhaven</td>
<td>± 3,4 m</td>
</tr>
<tr>
<td>Waal- / Eemhaven</td>
<td>± 3,3 m</td>
</tr>
</tbody>
</table>
Current and future situation (1:1.000 year)

Current

60 cm sea level rise
Consequences of flooding

Consequences are categorized

- (Deadly) casualties
- Social disruption
- Environmental damage
- Economical damage
# Current insights water safety in the port

<table>
<thead>
<tr>
<th>Vulnerability:</th>
<th>On the long term, east of the Oude Maas case study Botlek area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casualties:</td>
<td>Number of casualties at flood event is low (depth max. 1 m)</td>
</tr>
<tr>
<td>Social disruption:</td>
<td>Liquid bulk and public infrastructure is vulnerable:</td>
</tr>
<tr>
<td></td>
<td>- Loss of electricity influences other processes</td>
</tr>
<tr>
<td></td>
<td>- ICT very important for other functions</td>
</tr>
<tr>
<td></td>
<td>- Roads, tunnels and pipelines distribute goods from and to the hinterland</td>
</tr>
<tr>
<td>Social disruption:</td>
<td>Disruption of the distribution to the hinterland for some cargo leads to social disruption</td>
</tr>
</tbody>
</table>
Accessibility for ships
‘optimum water safety – accessibility’

- Current strategy: “Maeslant barrier closed at high water events”:
  - With further sea level rise the Maeslant barrier closes more often.
    - Currently average 1 x every 11 years,
    - With sea level rise of 65 cm the average could be 1x every year

- Alternative strategy:
  - Closing of the sea side by barriers with locks
  - Daily waiting period at locks, causes:
    - Cost increase industry / logistics
    - Modal shift (from water to road and rail)
    - Loss of cargo to other ports
Passage costs barriers current strategy (extreme climate scenario 2050)

- Increasing closing frequency of barriers due to climate change leads to an increase of passage time for ships
- Yearly passage costs in 2050 (in million Euro; price level 2012)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>GE scenario</th>
<th>LG scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maeslant barrier</td>
<td>3,4</td>
<td>2,2</td>
</tr>
<tr>
<td>Hartel barrier</td>
<td>0,8</td>
<td>0,5</td>
</tr>
<tr>
<td>Hollandse IJssel barrier</td>
<td>0,03</td>
<td>0,03</td>
</tr>
<tr>
<td>Total</td>
<td>4,3</td>
<td>2,8</td>
</tr>
</tbody>
</table>

- These numbers serve as reference for the other possible strategies which were investigated.
Passage costs shipping for possible strategies (extreme climate scenario 2050)

- Yearly passage costs in 2050 (in million Euros, price level 2012)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>GE scenario</th>
<th>LG scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Improved current strategy</td>
<td>1,2</td>
<td>1,0</td>
</tr>
<tr>
<td>2a Closing of the sea side</td>
<td>319,7</td>
<td>95,0</td>
</tr>
<tr>
<td>2b Closed ring (barriers+locks)</td>
<td>427,1</td>
<td>121,8</td>
</tr>
<tr>
<td>3a Open Haringvliet</td>
<td>0,4</td>
<td>0,5</td>
</tr>
</tbody>
</table>

- Extra indirect effect with closed strategies for containers is estimated at 15% and loss to other ports (Bremerhaven, Antwerp)
Accessibility inland navigation

- Rotterdam has excellent hinterland transportation over water
- Inland navigation is fastest growing modality
- Lower river discharges decrease cargo capacity
Low water level = less capacity
Actions accessibility inland navigation

- Early warning leads to innovative solutions at the right time
- Solutions:
  - increasing of storage locations
  - optimizing water transport management
  - adaptive ship design
  - ...

[Logo: Port of Rotterdam]
Freshwater supply port area from Brielse Lake

Brielse Meer
Zoet water in een zoute Delta

Atvoer naar Zee

Voorlig via de Bemise
Penetration of saltwater from the sea (extreme climate scenario 2050)
Freshwater supply port of Rotterdam
(extreme climate scenario 2050)

- Inlet point Bernisse possibly close to its limitations
- Possible measures:
  - plume of air bubbles in the river mouth
  - optimizing the management of the Brielse Lake
  - optimizing the distribution of river discharges
Opportunities (1)
Adaptation strategy water safety

- Tiered approach water safety
  - Prevention
  - Sustainable spatial planning
  - Contingency plan for flood events

- Action
  - Urgent issue, but not acute: Adaptation of the port when opportunities are at hand (restructuring)
  - Choice for flexible, no-regret solutions
  - Together with authorities a toolbox has been developed for the prevention of casualties by flood events
  - Communication plan for port industry
Good example of adaptation: Port City
Floating City Concept
Opportunities (2)
Change of freshwater distribution upstream

Now:
- sensitive for penetration of saltwater from the sea

Alternative:
- insensitive for penetration of saltwater
Opportunities (3)

Port development Botlek area

- Increasing in scale of ships puts competition of Botlek area under pressure on the long run.
- Is deepening of the water way economically feasible?
- Research has started (nautical, morphology, penetration of saltwater, market analysis etc.)
- Delta Programme takes it into account in the next strategy phase
Opportunities (4)
Sediment Management on river basin scale


- **SedNet** is the European network aimed at incorporating sediment issues and knowledge into EU strategies to support the achievement of a good environmental status and to develop new tools for sediment management.

- The focus of SedNet is on all sediment quality and quantity issues on a river basin scale, ranging from freshwater to estuarine and marine sediments.

- Climate change is more and more in focus.

www.SedNet.org