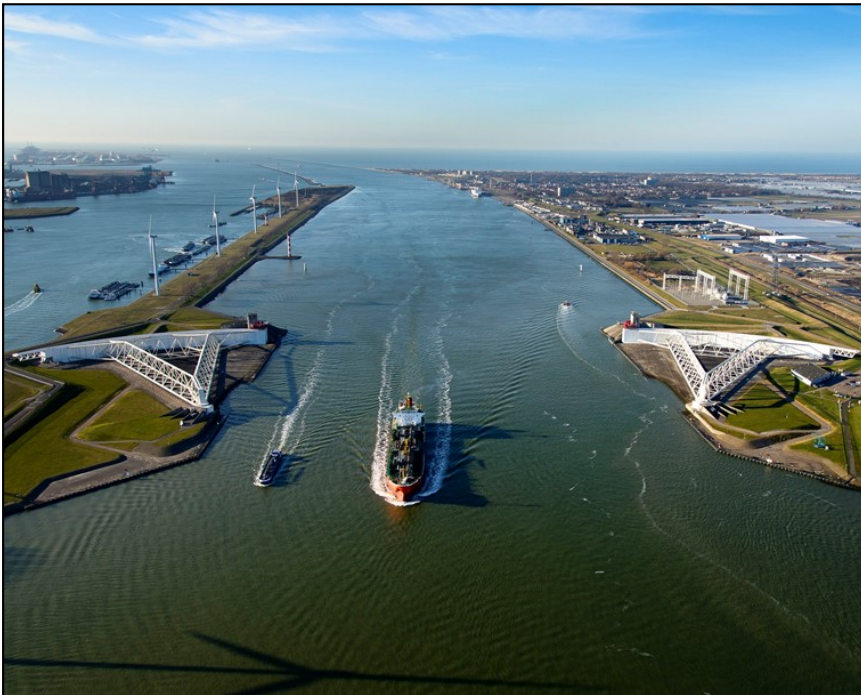




Rijkswaterstaat
Ministry of Infrastructure
and Water Management

Storm Surge Barriers in the Netherlands & I-STORM



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- Senior advisor Storm Surge Barriers
- Leader Operational Team Maeslant Barrier
- Co-founder and Member of Delivery Board I-STORM network

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What we have in common



Galveston, after Ike in 2008



New Orleans, after Katrina in 2005

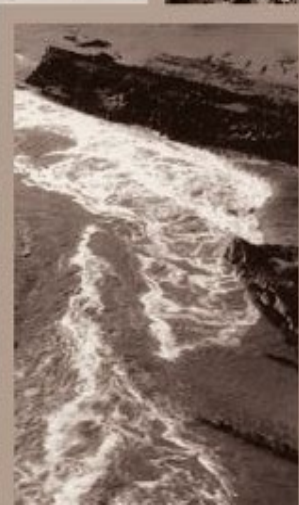


London, 1953



Netherlands, 1953





Storm Surge Barriers in the Netherlands



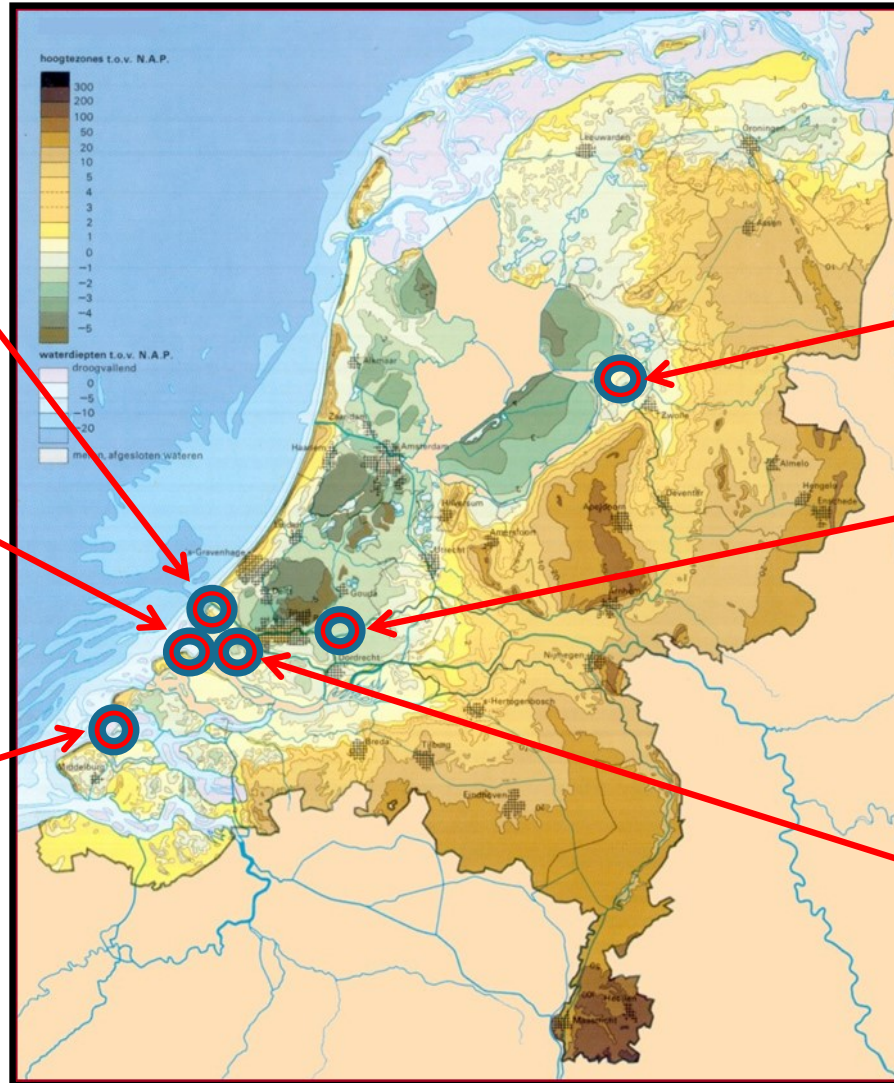
Maeslant Barrier - 1997



Haringvliet Sluices / Barrier - 1970



Eastern Scheldt Barrier - 1985



Ramspol Barrier - 2002



Hollandse IJssel Barrier - 1958

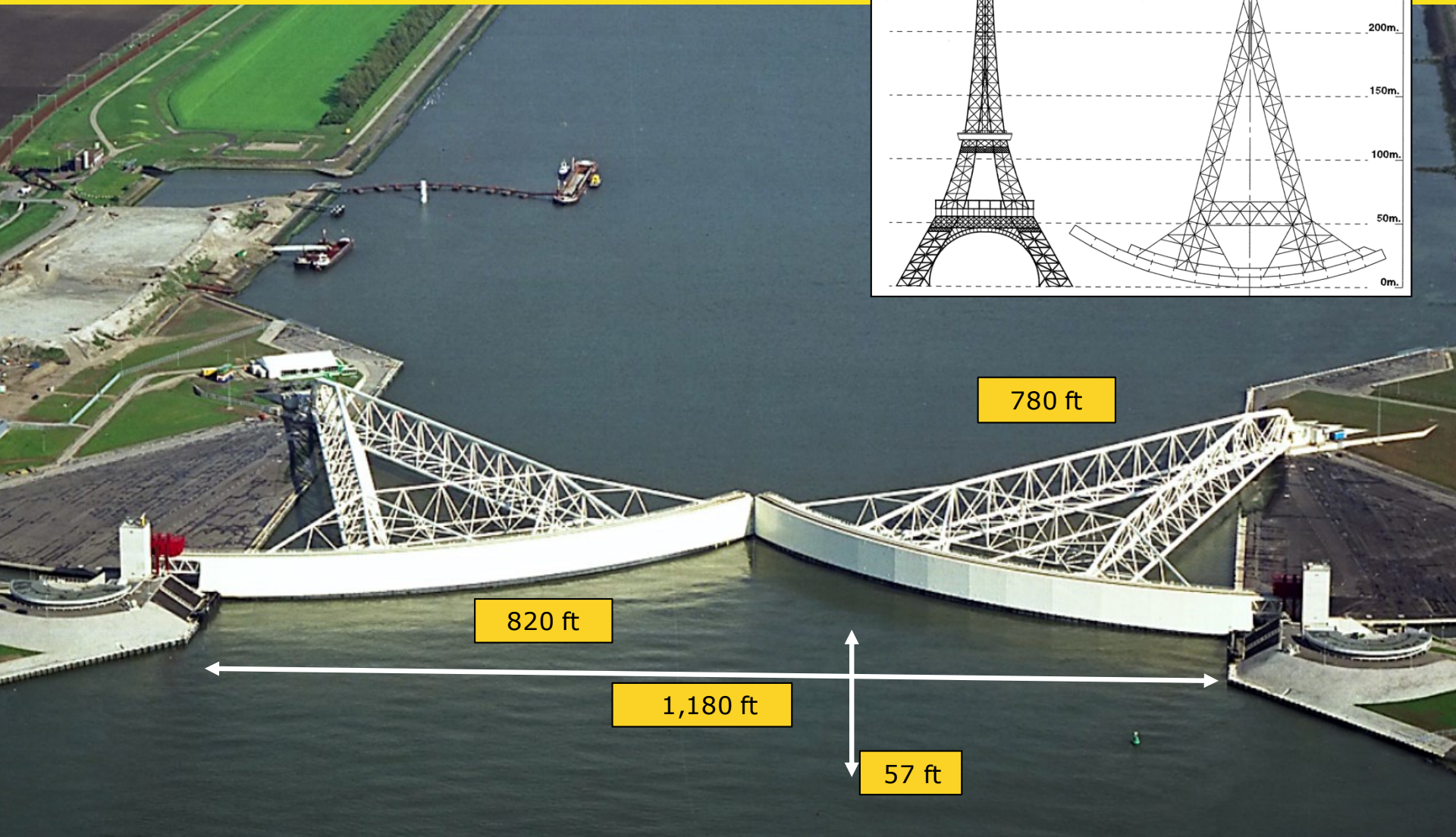
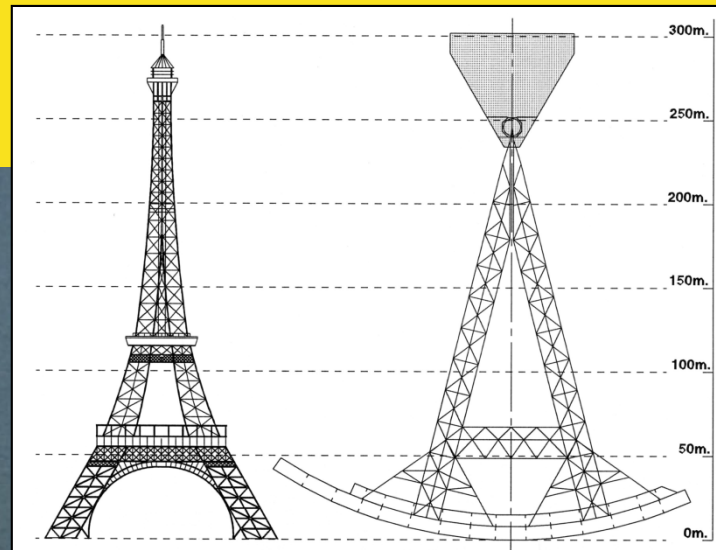


Hartel Barrier - 1996





Maeslant Barrier





The design and building period gets much attention and financial support

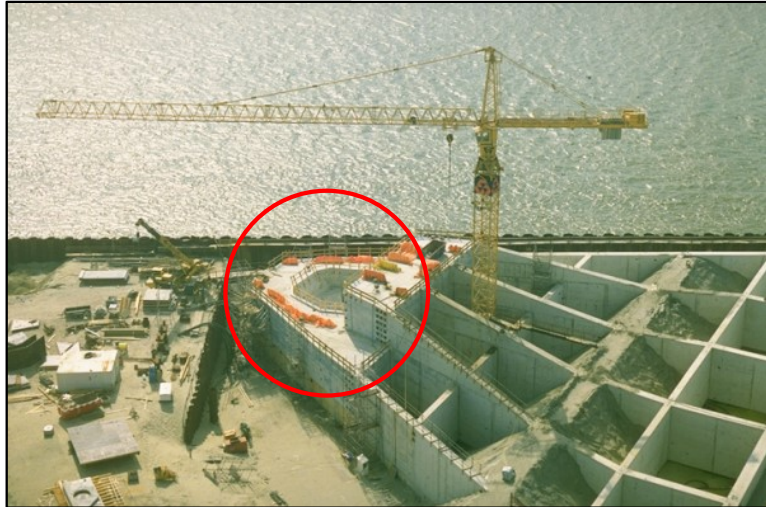
But then the challenge begins with

**Management, Maintenance & Operations
as a daily business**

for another 100-200 years

Two examples

Example 1 – Ball Joint



Facts

- The ball joint: a 30ft steel ball rotating in a steel hollow. Designed to be 'maintenance friendly'
- **Already after 5 years (and only test closures)**

Two Problems

- Technical problem: Unexpected rapidly wear of the coating of the steel hollow
- Additional environmental problem: New laws blocked the use of specialized coating

Solutions

- Short term: Additional maintenance turned out to be no permanent solution
- Longer term: Alteration of design (2-4 million euro's)



➤ **Focus on optimising design, usually not on MMO**

- Focus on reduction building costs
- Cheaper design alternatives often not as good thought through
- Design considerations (or changes to it in final stages) are often not registered thoroughly in documents and systems
- **Lack of involvement responsible MMO representatives**
- . . .

➤ **Design mostly unique and prototype**

- The unicity and specific characteristics of each barrier constrain the value that the industry can add with short term contracts
- MMO organization faces many unforeseen challenges
- **Sub systems generally designed for other use**
- . . .



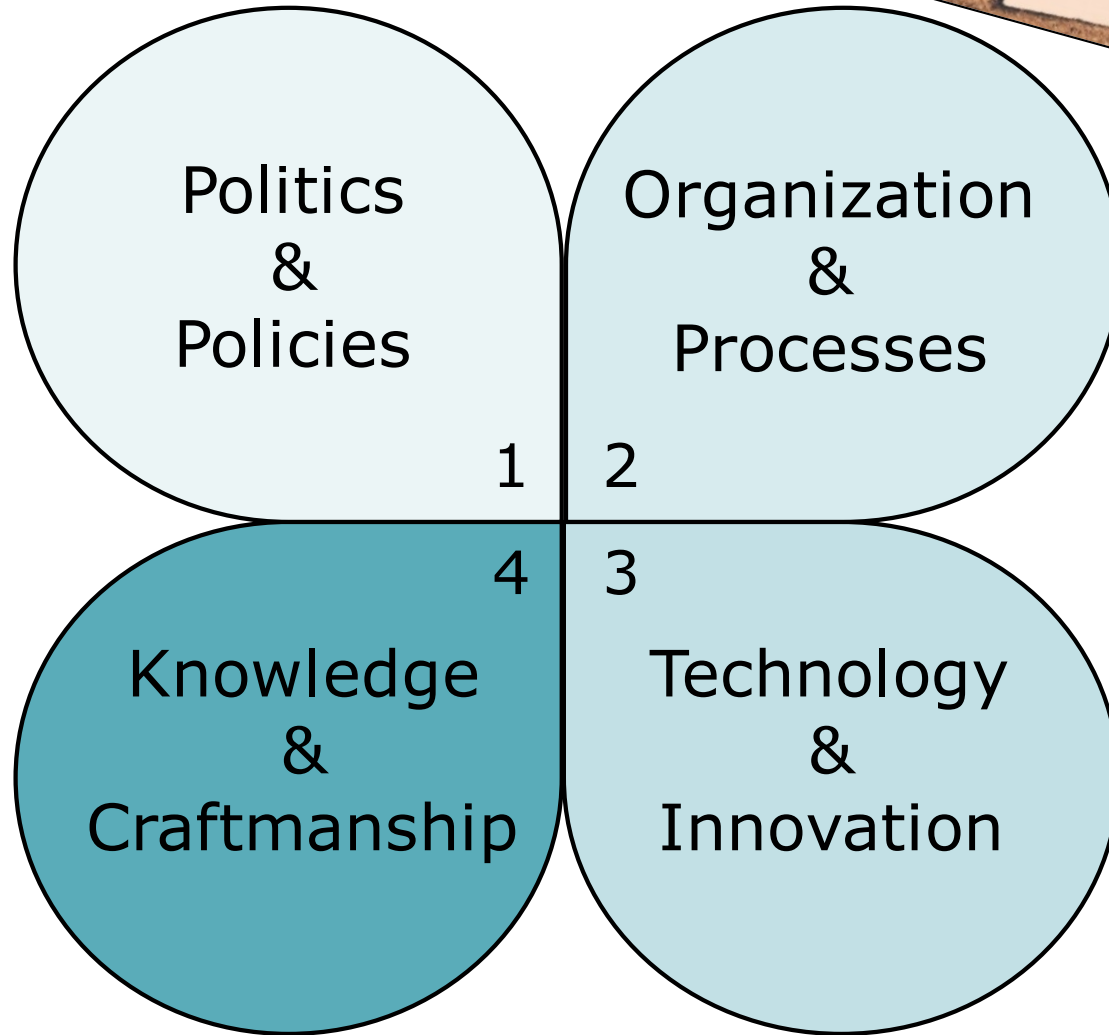
➤ **Stress on required knowledge and experience**

- Low frequency of use or testing (shipping, required water levels)
- Mostly governmental organisation responsible
- Development, construction and building attract common interest, but maintenance and operations define reliability
- **High reliability requirements demand professional asset management**
- . . .

➤ **Changing environment during life time up to or more than 100 years**

- Environmental rules and new added functionalities increase the challenges
- **Regulations, policies and organizations change frequently with mostly unpredictable but significant influence**
- . . .

Characteristics and challenges





Conclusive Note:

To prove that a storm surge barrier operates to its (legal) requirements, it has to achieve high standards for **maintenance, operations** and **organization**

Therefore, pay special or equal attention to those aspects already in the phase of design and construction

I-STORM

can be the community to learn, share and develop experiences

I-STORM
INTERNATIONAL NETWORK
FOR STORM SURGE BARRIERS



I-STORM

International Network for Storm Surge Barriers (I-STORM)

About I-STORM

An international knowledge sharing network

- For Storm Surge Barrier (SSB) professionals around the world
- Sharing knowledge and experience to improve management, maintenance and operation of SSBs
- To better protect people, places and property from flooding
- Continuously improve barrier operations, management and performance
- Collaborate on research and development
- Established in 2006



I-STORM's Core Members



Environment Agency

Rijkswaterstaat

US Army Corps Engineers

Consorzio Venezia Nuova



Current Members

Barrier Members

- MOW Vlaanderen, Nieuwpoort Barrier Belgium
- PUB, Singapore
- SLFPA-E, New Orleans, USA

Associate Members

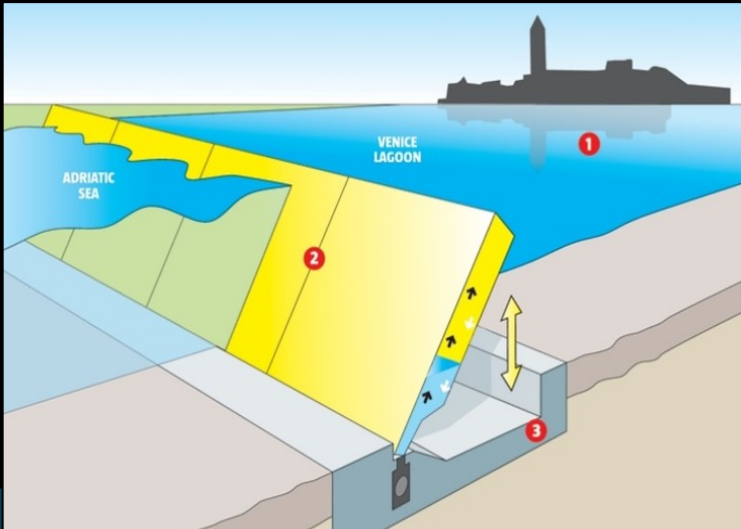
- Arcadis, NL & USA
- Aveco de Bondt, NL
- Bosh Rexroth, NL
- CGI, NL
- CTBS, TAMUG, USA
- Dannenbaum Engineering, USA
- Delta Pi, NL
- Deltares, NL
- DSAM, NL
- Intermedion, NL
- Jacobs, UK
- KGAL, UK
- Paul van Poorten Consulting, NL
- NRG, NL
- Danish Coastal Authority, DK
- Royal Haskoning, NL
- Texas Government Land Office, USA
- TNO, NL
- Technical University Delft, NL
- Waterworks @ B Business Energy, NL
- Hollandia Infra BV, NL
- HR Wallingford, NL, USA
- University of Southampton

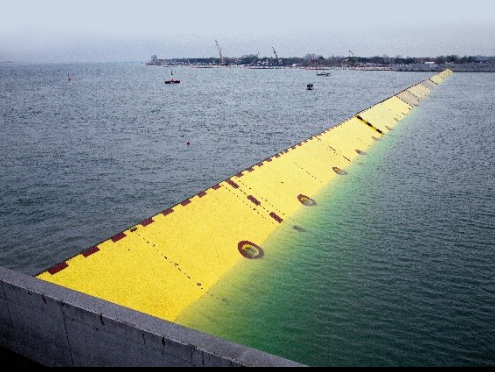


Design Workshop Galveston



Operational Review Venice





Questions?

