Port of Rotterdam in figures

Port of Rotterdam engine of the economy
- Total port area 12,500 ha (net 6,000 ha)
- Total employment 180,000 people
- Total added value €21 billion (3.2% GNP)
- 3,000 companies
- Largest port in Europe, 9th port worldwide
- Throughout 461.2 million tons, 12.4 million TEU (containers)
- Depth up to 75 ft

Port and industrial area

Port areas

Dominated by fossil fuels and logistics

Cargo ratios in 2016

- Liquid bulk: 19%
- Dry bulk: 21%
- Containers: 40%
- Breakbulk: 19%
**Water depth European ports**

**Top 20 world ports**

**Landlord port model**

**The assets of PoR**

Total of 32 asset types
- 70.5 km Quay walls
- 180 km Embankment
- 310 ha Roads
- 3,500 ha Sea bed
- Civil Structures, Buildings, Vessels etc.

Invested Capital € 3.66 Billion
Maintenance budget € 72 Million
Approx. 140 employees in AM

**Deterioration of Infrastructure Assets**

- Deferred maintenance costs
- Inadequate capital allocation
- Run-to-failure repair & maintenance programs
- Inspections based on random observations
- Loss of competitive edge and productivity
- Safety/security concerns

**Asset Management: A Strategic Imperative**

- Waterfront structures like quays, jetties and wharves are the heart of the business case
- Income of the Port depends on the availability of the asset
- Loss of profit will deplete cash flow and thus the opportunity to invest in the future
- Disruption to the tenant’s business is the most unwanted situation
**Asset Management - More Challenges**

- More efficient use of assets
- Maintenance as an investment

**Objective in Asset Management Culture**

- Proactive
  - Budgets based on future needs
  - Replace high risk assets
  - Prioritize work based on risk
  - Focus on high benefit to cost ratio

- Reactive
  - Budgets based on last year
  - Reactive projects
  - Prioritize work based on budget

**In other words: Asset Management Maturity**

- Focus on lifecycle sustainability
- Optimal decision making
- Maintenance is part of the supply chain
- Value & performance increase

**Asset Management Program: Stepstones**

1. Document the assets correct and manage
2. Understand the current condition of the assets
3. Understand what needs to be caught up, keep up and put in place
4. Understand what exchanges the functionality - risk profile
5. Understand the business value, what the contribution of the assets to the business is
6. Establish the level of service for an asset and generate the cost of service
7. Prioritize the needed budget based on risk and business value

**Master Data: Portmaps**

- One system for all our maps
- Three clicks to content
- Smart object model
- Implemented in only 6 months in 2013
- Live since 1-1-2014
- 2M+ maps generated since going live
- 600+ daily users

**Portmaps Architecture**
PortMaps

Expert system: KMS

- Port of Rotterdam developed in partnership an asset management tool called KMS, which is the Dutch abbreviation of Quay wall Modelling System that:
  - Uses the results of deterioration models for concrete and steel and compares it with the “end of contract” date
  - Identifies and ranks the risks that endanger all the functionalities of the structure
  - Uses the business value of a quay wall to clarify its maintenance priority

The KMS system

Asset Management on Quay Walls

- A quay wall’s remaining lifetime and system integrity is mainly determined by the quality of the substructure.
- When the quay wall’s integrity is in danger, it’s often due to:
  - accelerated low water corrosion occurring at the substructure or
  - concrete deterioration in the superstructure

Inspection module

STADIUM® Expert System

- STEP 1
- STEP 2
- Degradation Analysis per Zone and Element
- Evaluate Degradation with STADIUM®
- For each Zone/Element combination
- Schedule Next Inspection
- Close Monitoring Required
- Select the most critical Zone/Element combination
- Maintenance Proposal

Port of Rotterdam
STADIUM® Expert System

Risk Management

Risk Strategy

Risk Analysis Expert System

From Risk Analysis to Prioritization of the Maintenance Plan
- Determine generic risk, effect, financial risk and probability (FMECA/RCM)
- Combine asset & generic risk for a specific risk factor
- One factor to express the economical added value of an asset
- Prioritization of the maintenance plan based on the risk factor and business value

Annual Maintenance Cycle
**Long Term Asset Planning**

![Graph showing asset planning]

**KMS Benefits**
- Short term:
  - Transparency in annual budget for maintenance
- Mid - Long Term:
  - Insight on residual service life and maintenance costs per structure
  - Insight on total port concrete and steel costs
- "Just in time" inspections
- Proactive, prioritized and risk-based maintenance
- Save $$$

**Return on Investment (ROI)**

*With More than 70 KM of Quay Walls...*

![Image showing a graph with the text: An Estimated 2.1 Million Euros in Savings Between Inspections]

**Improvements in modelling: Anode lifetime**

![Graph showing improvements in anode lifetime]

**Smart Infrastructure: Inspection vs Sensing**

- Made possible by Internet of Things (IoT) and increasing availability of high-quality IT connectivity
- By deploying smart - autonomous - devices that generate real-time operational information and share it, we can effectively control and manage the four modalities within the port.
- Examples in Port of Rotterdam:
  - IoT-based networks real time air pollution detection and registration
  - Quay walls, glass fiber sensors for detection of piping effects
  - Real-time traffic and traces of push barges in the port area with help of sensors

**Finally: the Port and its “Digital Twin”**

![Diagram showing the concept of a digital twin in the port context]
Wrap up & Conclusion

Building an asset management organization from zero base to going concern in ... year(s)?
- Start small and grow,
- Start with your million dollar quay wall
- Knowledge and Expertise is in the house
- Getting AM in the hearts and minds, tell the story
- On top of daily work
- Do not underestimate project management