

Marine Science meets Marine Industry – Material Session

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OCAS: a joint venture between
ArcelorMittal and the Flemish Region

OCAS

- Research centre for the application of steel
- 135 employees
- Laboratory floor space of 10 000m²
- Turn-over of 23.8 M€



Challenges for materials in the marine industry

- **Costs**
- **Aging of material & structure**
 - ✓ Corrosion
 - ✓ Fatigue
- **Coating**
 - ✓ Factory coating
 - ✓ Repair
 - ✓ Repainting

Challenges for materials in the marine industry – long term owners

- Monitoring helps to re-assess the mechanical degradation – fatigue
- Document the materials & the structure
 - ✓ Lack of toughness data will generally lead to very conservative assessment
 - But generally testing budget is put under pressure at construction phase
 - Possible to sample the material in the structure?
 - ✓ Example:
 - material with only reported 27J @-20°C
 - Estimation from Charpy tests leads to a toughness of ~70 MPa√m
 - Typical measured value is 170 MPa√m
 - Using actual value leads to allow defect 6 times larger in the structure

Primary & secondary material

- **Primary component are genrally designed according to detail rules, with significant conservatism**
 - ✓ Costly but safe
 - ✓ Cathodic protection & little corrosion
- **Secondary steel is often “less carefully” considered**
 - ✓ Can be at the origin of failure of primary (fatigue)
 - ✓ Corrosion is actually often worse on secondary steel

Specific mechanical requirements

- **Cranes : high strength steel**
 - ✓ Welding!
 - ✓ Fatigue!
- **Wires: high strength**
 - ✓ Maximum strength?
 - ✓ Large depth: weight issue
- **Dredging**
 - ✓ Erosion is dominant
 - ✓ Poor toughness!



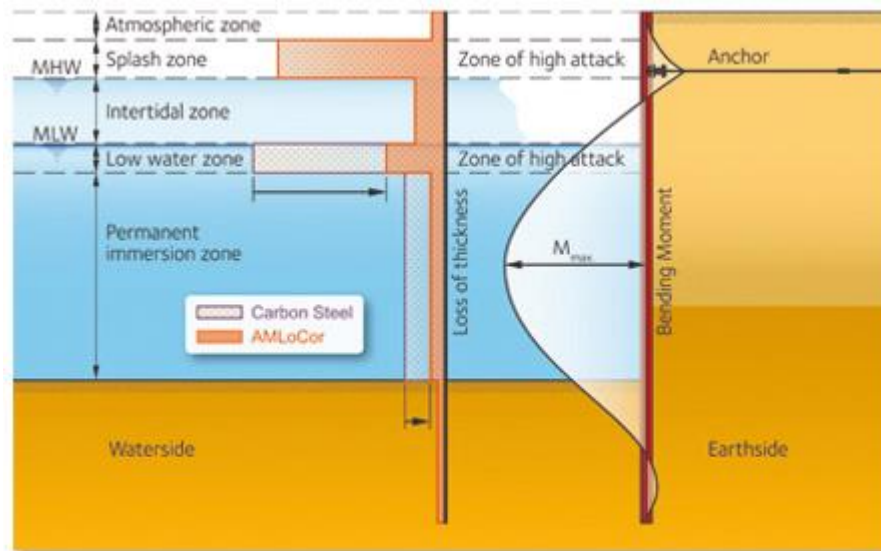
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Fatigue – Corrosion - Erosion

- **Corrosion enhances fatigue**
 - ✓ Movement of hydrogen atoms towards crack tip in fatigue crack
- **Erosion enhances corrosion**
 - ✓ No protection of the surface by corrosion products
- **(Welded) High strength material is more prone to fatigue in corrosive environment**
- **Corrosion protection strategy ICCP vs Sacrificial anodes is still a bit of “black art”**
 - ✓ Testing is difficult, so often it is chosen to rely on old standards, because then we can forget how scattered the results were

MIC - microbiologically influenced corrosion

- microbiologically influenced corrosion is very difficult to predict corrosion mechanism
- Solutions exist to decrease its influence in Harbour environment (AMLoCor)



Weathering steel for saline environment?

- Weathering steel is well known for bridges
- ... But not good with Chlorides

What can we do together?

- **Working together with steel / material producers to propose the adequate material**
 - ✓ What do you need?
- **Partnering with companies / universities**
 - ✓ Metal Structure Centre: Collaboration with Belgian Welding Institute and Ugent / Labo Soete
- **How to predict the life of component?**
 - ✓ Fatigue
 - ✓ Corrosion
- **... By specific realistic testing?**
 - ✓ JIP starting relative to fatigue testing of welded nodes
 - ✓ Maduros SIM program around erosion / fatigue / corrosion

MSC Seminar: Industrial examples of structural integrity of metal structures

- Gent, May 19 PM
- Discover the benefits of Engineering Critical Assessment



- Speakers: Fluxys, Engie, AM Ghent, Gasunie, Cranfield University

- Registration: <http://www.bil-ibs.be/webform/registration-eca-seminar>
- Website: <http://metalstructures.be/item/msc-houses-eca-seminar>