Engineering Insurance Exposure related to Wet Risks

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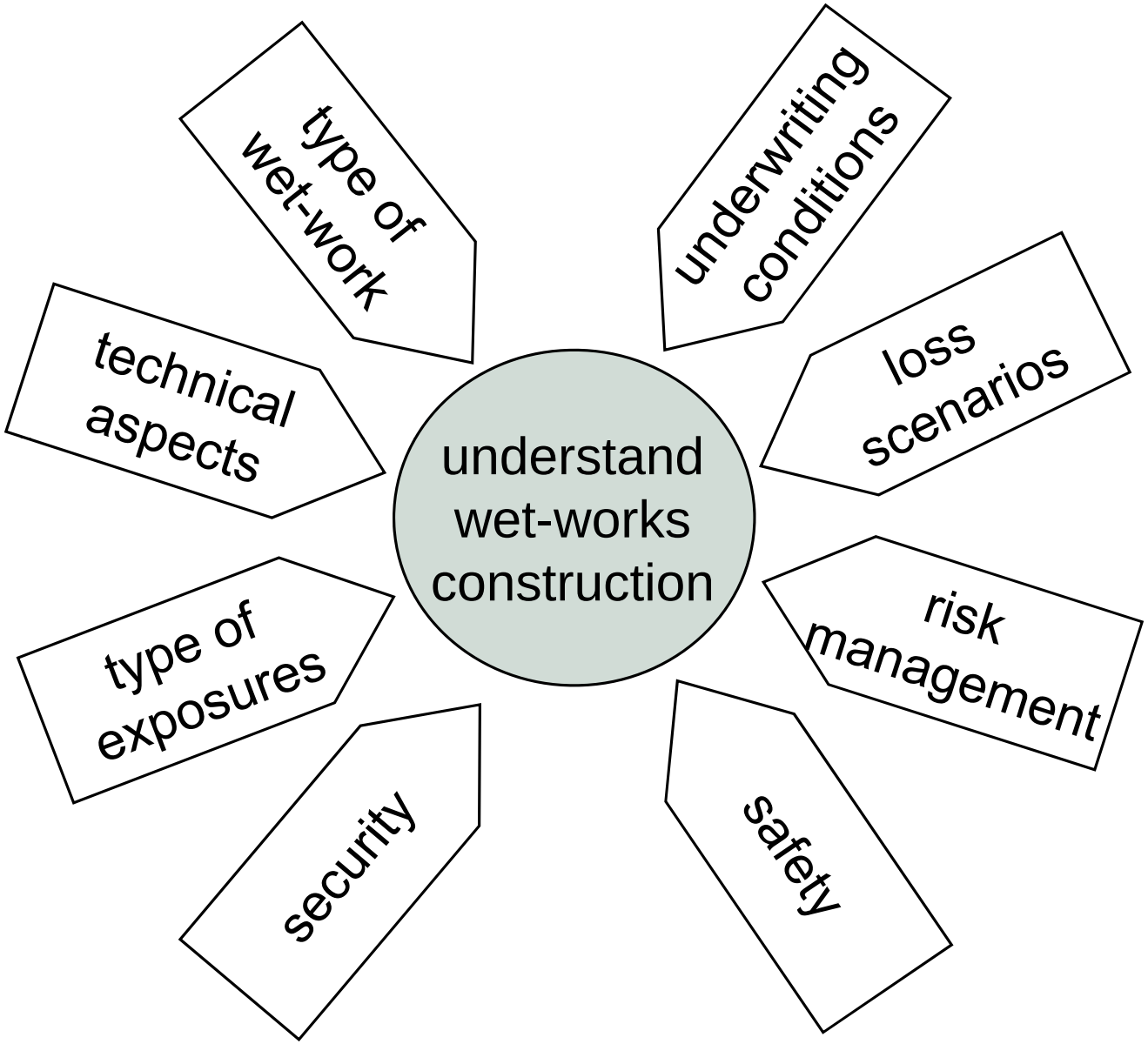
Chairman: Xavier Touzé, XL Re Europe

Working Group: Hans Mahrla , Infrassure
Thomas Boertzler, Munich Re
Maarton Keuning, Delta Lloyd
Kei Kato, Tokio Marine & Nichido Fire Ins.
Jean-Paul Perrin, SCOR
Oscar Treceno, Swiss Re

Objectives of Paper

- To help Underwriters
  - to better understand wet-works construction
  - build up awareness for the wide variety of perils
  - to perform professional risk analysis and underwriting
- This paper focuses on :
  - various types of wet-works
  - technical aspects
  - variety of exposures
  - typical loss scenarios
  - risk management, safety and security aspects
- It does NOT deal with risks related to offshore projects

Structure of Working Paper



Major Ports

Wet-Works Constructions

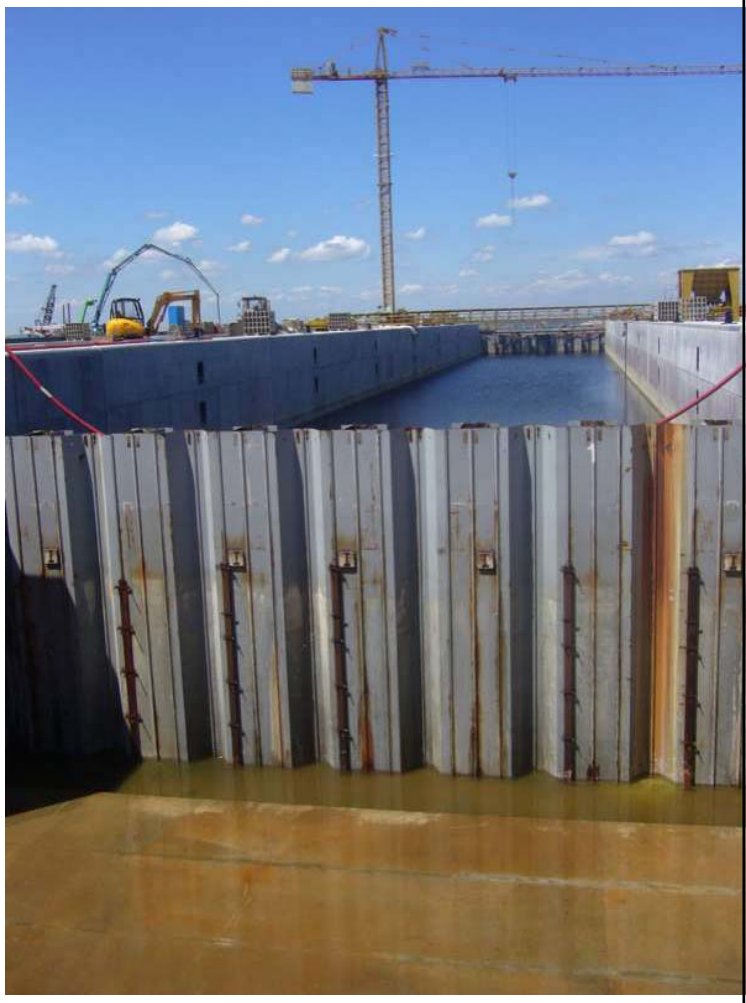
- Insurers only classify **“marine works”** as wet risks
- Types of Marine Works
  - harbour
  - dock (maritime) – impounded and dry docks
  - wharf
  - breakwater construction (offshore)
  - jetty
  - pier

Design of Marine-Works

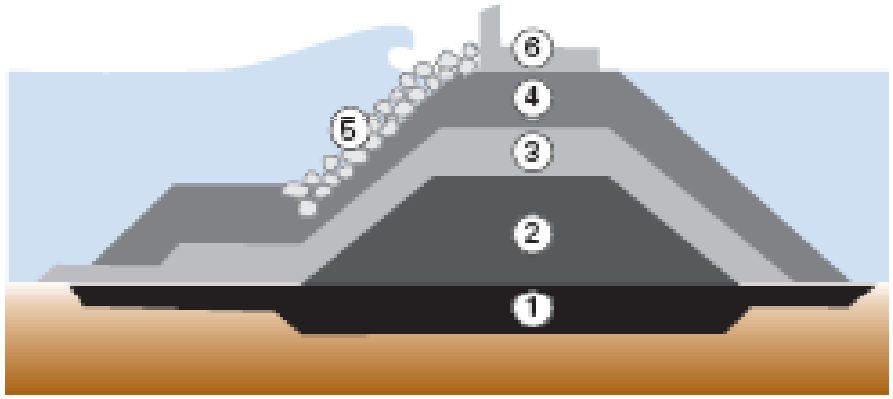
- complex physical processes call for
  - significant engineering and design
  - detailed knowledge of geology and soil conditions
  - geomarine and hydrology engineering (including complex dynamic effects)
- international (Eurocode) and national standards have to be taken into consideration
- quality of work must be assured even at adverse conditions

Example of wet risks

Breakwater / walls



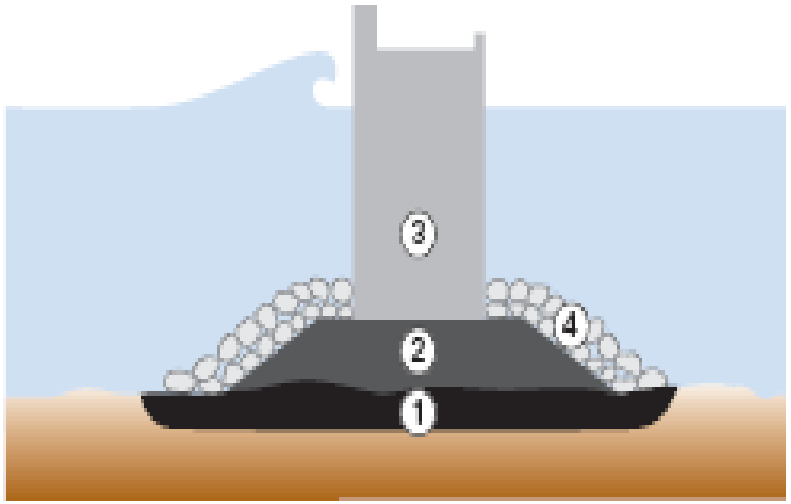
Sea-works - breakwater



4 Rubble mound breakwater cross-section

① Sea floor improvement
② Core fill
③ Transition material
④ Primary armour
⑤ Secondary heavy armour (rocky tetrapods, concrete blocks)
⑥ Concrete capping and wave wall

5 Vertical wall breakwater



① Sea bed Improvement
② Core fill
③ Concrete structure
④ Rock

Typical Exposures

- Natural Catastrophes such as earthquake, flood and inundation, windstorm
  - Action of sea remains the major exposure
- Faults in design, material and workmanship
- Geology / Hydrology and Soil Conditions
- Secondary (as usual) : Camps and Stores & Contractor's Plant and Machinery

The following insurance clauses (amongst others) are worth considering:

- Normal Action of Sea/River: It is agreed and understood that otherwise subject to the terms, exclusions, provisions and conditions contained in the Policy or endorsed thereon, the Insurers shall not indemnify the Insured for loss or damage directly or indirectly caused to the contract works or Insured's property due to
  - normal actions of sea or normal tidal actions which shall be deemed to mean the state of the sea or tidal water which must statistically be expected to occur once during :.... years observation period state of the or normal tidal action accompanied by wind speed not exceeding factor ..... on the Beaufort Scale.
- Combined with a clear definition in the policy of the hight of *the normal wave*: x… meter

Others related wet risks Insurance Clauses

- **Imminent storm** Warranty imposing continuous contact to weather office with min. 24 hours notice of Imminent storm
- **Exclusion for Dredging/Redredging**
  It is agreed and understood …., provisions and conditions contained in the Policy or endorsed thereon, the Insurers shall not indemnify the Insured for any cost incurred for dredging, redredging, overdredging or loss or damage resulting therefore.
- **Unprotected Sections (Core) Clause** → It is agreed and understood that otherwise subject to….. Policy or endorsed thereon that the maximum length of unprotected core shall not at any time exceed ...metres for all sections together, during the period from ... to ....

Recommended special clauses

- TPL : navigation distance for public traffic to work site minimum 200m
  - existing underground facilities, TPL without consequential BI
- **other clauses** base on the specifics of the risks i.e. directional drilling, settlements, deviation of schedule (storm related)
  - Special attention to material change of risk;
- **Implementation of Risk Management**; re/ insurers should appoint an independent expert.
  - to identify the risks, classify them depending on the relevance to the project as well as recommend improvements for mitigating the impact.
  - monitor implementation of his recommendations.

Loss definition

- **Loss** → the question about the **faulty part** is immediately raised.
  - The definition will vary between the **faulty** grain of sand in the filling material and the Marine-body as a whole.
    - Underwriters are well advised to define the faulty part in the policy wording in advance.
    - or use a clause without reference to the faulty part as new LEG2
- Marine-works often incur substantial cost overruns during constructions,
  - this requires adjustments of SI / Premium to avoid underinsurance.

PML (Probable Maximum Loss) Considerations

- PML depends on the unique physical characteristics of the projects and thus only limited generalisation is possible
  - PML should not be underestimated
  - main exposure is related to natural events i.e. storm plus surge
  - unprotect length may well be completely destroyed
  - consider also all limits given in extensions

Conclusions of Section 1 of this presentation

- The exclusion of adverse weather conditions (normal action of the sea clause) often proves insufficient.
  - It requires additional definitions, quantification and a mutual understanding
- High severity of losses
- Combination of various causes are very often decisive drivers for losses in wet works.
- Allocation of repair costs to the individual causes requires comprehensive investigations and costs.

Loss Examples
Example 1

- Harbour in Asia
  - incident; during construction a storm displaced and partially destroyed tetrapods
  - settlement; indemnified although policy contains exclusion of abnormal sea action, but wind speed and wave heights could not be clearly determined
  - Conclusion : caissons placement should not be performed during known storm seasons. The normal action of the sea should be clearly defined in the policy

Pictures Example 1

Broken tetrapods

Casting of tetrapods

Example 2
Container Terminal – Asia

- Container Terminal in Asia
  - Incident : prefab culvert outfall units were cast as open four cell boxes; they were floated into position and placed on a prepared foundation bed. Settlement turned out to be 600 instead of 300 mm as calculated. This was gradual and an error of design, therefore the claim for repositioning was declined.

Example 2 - 2

- But : during repositioning one pump was left running overnight in ONE cell only which unbalanced the culvert unit and caused it to tilt and slide away. Now the tilting and sliding away was caused by human failure and/or faulty workmanship. The structure was split into two elements and floated back separately with the support of specialist divers. Settlement approx. 1 mio USD.
- Conclusion : a clear method statement must be set up, considering all external factors. In this case human error supervened the original chain of events.

Example 2 – 3

Example 3 - Construction of a commercial harbour in Europe,

- SI 140 mio Euro. The works included the construction of a 1.400 m long concrete held quay wall of 40 m height. The wall was expected to be fully built within a protected, dry area and therefore, no action of the sea was feared.
- During construction, the schedule was changed and the harbour was opened to the sea, while the retention wall was still under construction. The contractor did not notify the insurer/reinsurers about these changes and therefore, nobody was aware of the change in risk.

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Example 3 - 2

The incident

- In order to build the retention wall, a ditch was open alongside as the construction made progress. Once the owner decided to start dredging the harbour, the ditch was protected by two clay embankment dams or cofferdams.
- When 350 m of the wall were finished, tide movements gradually had eroded the first cofferdam until it collapsed. Soon afterwards, the second cofferdam, not being able to resist the water pressure, gave in and the ditch was flooded.
- The water stream broke into the ditch and quickly reached the other ditch end, bounced back in the direction it had come from, in a progressive wave mode. As a result of this, the part of the wall which was still not reinforced by pinning and earth was stretched and cracked

Example 3 - 3

Retention wall and flooded ditch

Deformed section of retention wall

Example 3 - 4

- **The claim**
- The original amount claimed was € 35 mios. The cause of the loss was a rupture of the a cofferdam due to a design error and the action of the sea.
- No specific "*normal action of the sea*" exclusion was attached to the policy since it was initially understood that the quay was going to be built fully onshore.
- Despite an obvious material change of risk, it was very difficult to reject this claim. Considering the legal environment, a litigation for a case with no sufficiently accurate original project descriptions would have been hazardous and most probably unsuccessful.

Example 3 - 5

- **Conclusions**

- never consider works in a harbour as dry, even if the main part of the construction is going to be executed on earth. An exclusion of "*normal action of the sea*" should always be inserted.

- Systematic risk surveys – followed by the corresponding adaptation of the terms and conditions – would have helped the Insurer / reinsurer to detect the material change of risk in time and to react accordingly

Example 4

- Extension of an industrial harbour in South America

  The owner of the port had extended it by constructing a mole of approx. 100 m length. The bottom of the sea had not been removed nor replaced suitable non-cohesive and compacted material.

  This caused settlements, the bored pile wall of the mole tilted to the sea side, anchors broke and the whole quay had to be closed down.

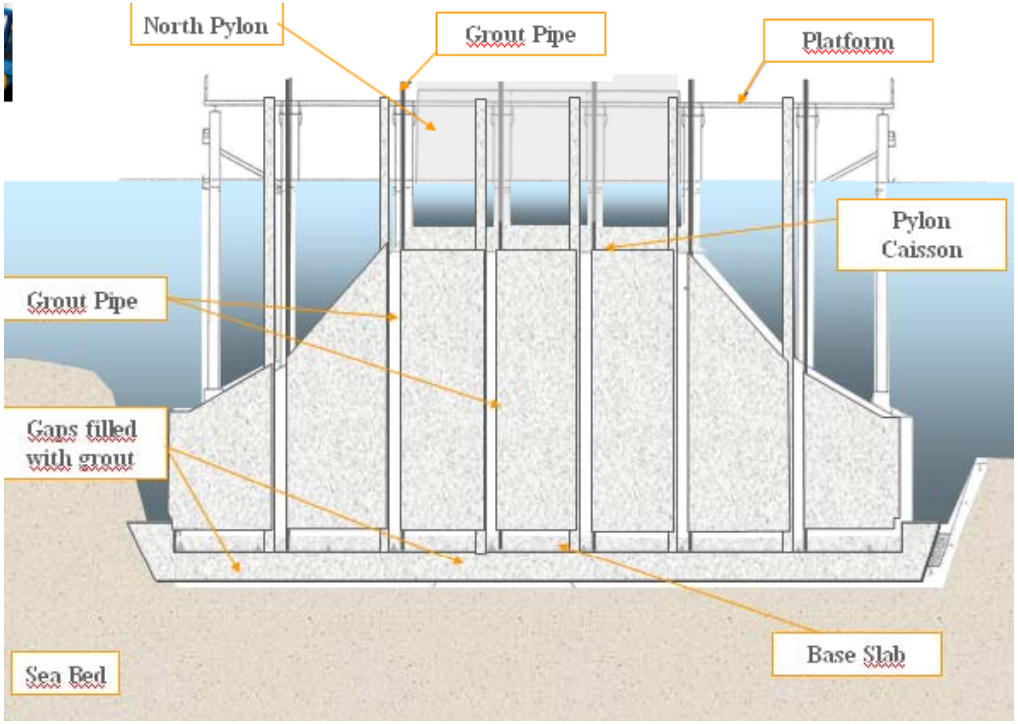
  Settlement : was declined as the root cause was faulty design

  Conclusion: sea ground / soil conditions must be properly investigated and engineering basics observed.

Example 5
Pylons for a bridge in Denmark

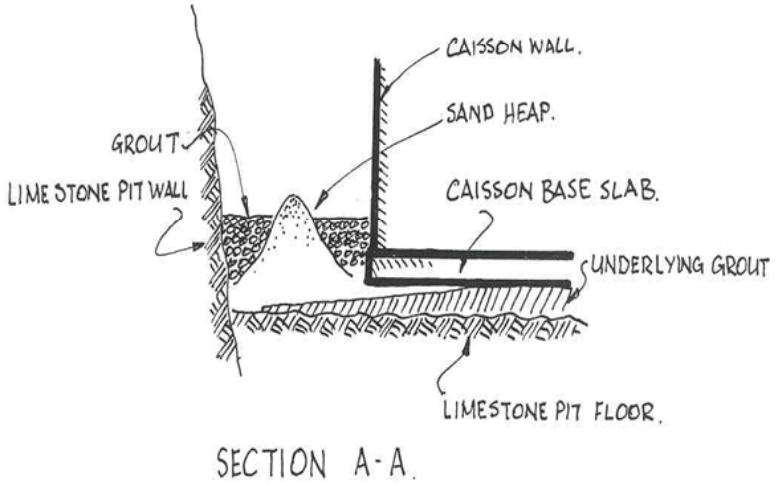
Example 5 - 2

- The foundations for the pylons consist of pre-fabricated concrete caissons, approx. 18 m below the surface of the sea. The caissons were floated out to their locations, then lowered into the sea and positioned on three supporting pads on the bottom of a pit which was excavated in the limestone seabed. Following that the cavity between the underside of the caisson base and the bottom of the limestone pit was grouted.



Example 5 - 3

- The incident; after heavy sea activities it was discovered that one grout had de-mixed or had been washed out and may had become inadequate.



SECTION A-A.

- In spite of comprehensive investigations it could NOT be established whether the demix was due to weather conditons resp. action of the sea or whether it was caused by faulty design/workmanship.

Example 5 - 4

- Settlement : the claim, originally 30 mio Euro was declined but due to complicated legal situation and uncertainties of root cause a commercial settlement was negotiated (< 1 mio Euro)

- Conclusion : simple exclusion of adverse weather conditions often proves insufficient, ultimate cause not always unambiguously known

Overall Conclusiones

- Firstly, of course usual claims as on other non-wet risks to be expected

- More important, in addition there is a special and increased exposure on wet risks with a serious large claims potential :

1. Soil Conditions (-> movements of earth/soil/structures, tilting, sliding, settlement)
2. Design / Workmanship (temporary phases !!)
3. Storm surge / action of the sea