COST Action
TU 1402

Quantifying the Value of Structural Health Monitoring

# Case Studies

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## The scientific focus of this action is (MoU):

- "The further development of the theoretical framework (…)
- In a kind that it can be directly applied in practical situations related to SHM (…)
- The development of efficient computational tools (…)
- The demonstration of the applicability of the framework with case studies.»

The development of case studies (WG4) is considered as a important link between theory (WG 1-3) and practice, including standardisation (WG5)

# Approach for developing the case study portfolio:

- Select application examples from different engineering domains
- Apply and demonstrate the applicability of the VoI assessment approach (developed in WG 1-3)
- Identify typical difficulties
- Deliver data

# Overview of the status quo:

- 19 case studies are under development
- VoI analysis for decision situations regarding design phase and operations phase
- Monitored phenomena include load processes, material properties and damage mechanism
- Structures from the domains Infrastructure/Bridges, Buildings, energy production and storage, geotechnical structures
- The development status of the studies is also varying
- 8 case studies are represented at this workshop

# Case study classification under development

| | |
|---|---|
| Structure | Type |
| | Life cycle phase |
| | Performance |
| Decision scenario | Decision maker |
| | Decision point in time |
| | Objective |

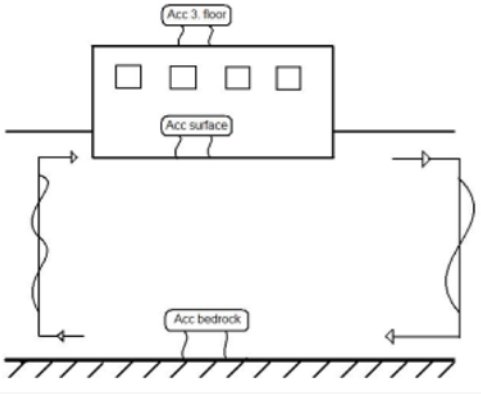
# Case study classification under development

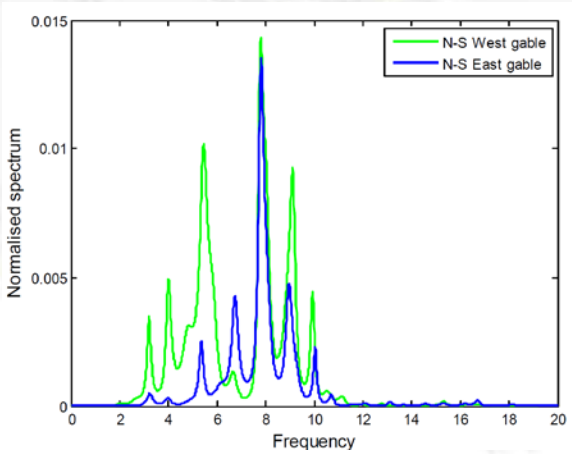
| | |
|---|---|
| Decision variables | Actions |
| | Action parameters |
| | Information acquirement strategies |
| | Strategy parameters |
| Results | Value of Information |
| | Decision rules |
| | Readiness level |

## Selection of case studies not presented at the workshop:

# Soil-structure interaction effects on the excitation and response of a low-rise RC building subjected to near- and far-fault earthquakes

Jónas Thór Snæbjörnsson (Reykjavik University), Iceland



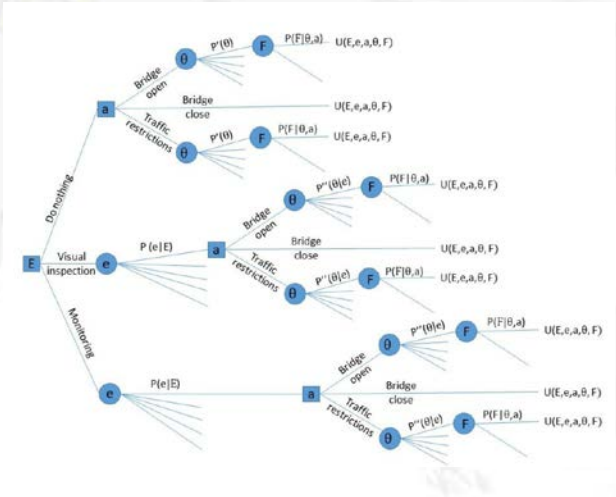

VoI analysis on damage detection measurements (retrospective)

Challenges: uncertainty quantification for the (virtual) case without any measurements

## Selection of case studies not presented at the workshop:

# The value of information for the seismic emergency management of a highway bridge

Pier Francesco Giordano and Maria Pina Limongelli (Politecnico di Milano), Italy,
Simona Miraglia (Aalborg University), Denmark




VoI analysis on options for visual inspections or monitoring

Challenges: Represent the effect of visual inspection outcomes to the reduction of uncertainties. Relate limit states to real consequences.

## Selection of case studies not presented at the workshop:

# Assessment of a fatigue detail of the Söderström Bridge

John Leander (KTH), Daniel Honfi (RISE), Ivar Björnsson, (Lund Uiniv.), Sweden

Figure 1a: A photo of the Söderström Bridge

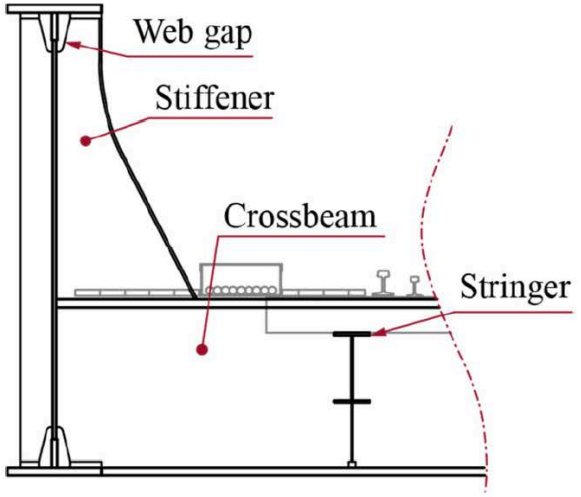



Figure 1b: Fatigue detail

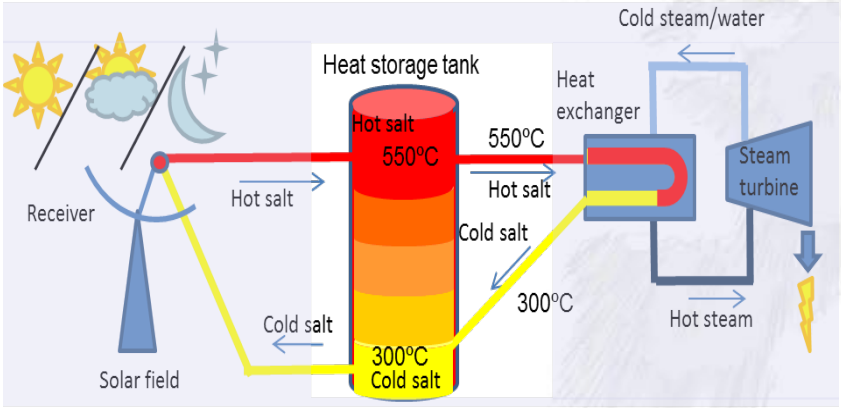
VoI analysis is an option for a refined engineering analysis (at a cost)

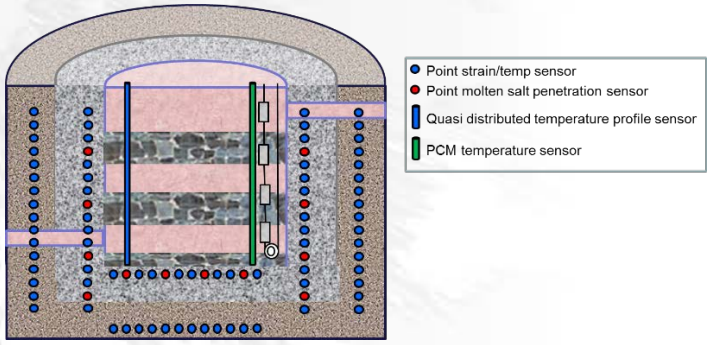
Challenges: Only fatigue failure on a component is considered. Subsequent decisions are affecting also other failure modes with different consequences

## Selection of case studies not presented at the workshop:

# Molten salt tank monitoring for highly efficient Centralized Solar Power Plants

Ander Zornoza, AIMEN Technology Center, Spain



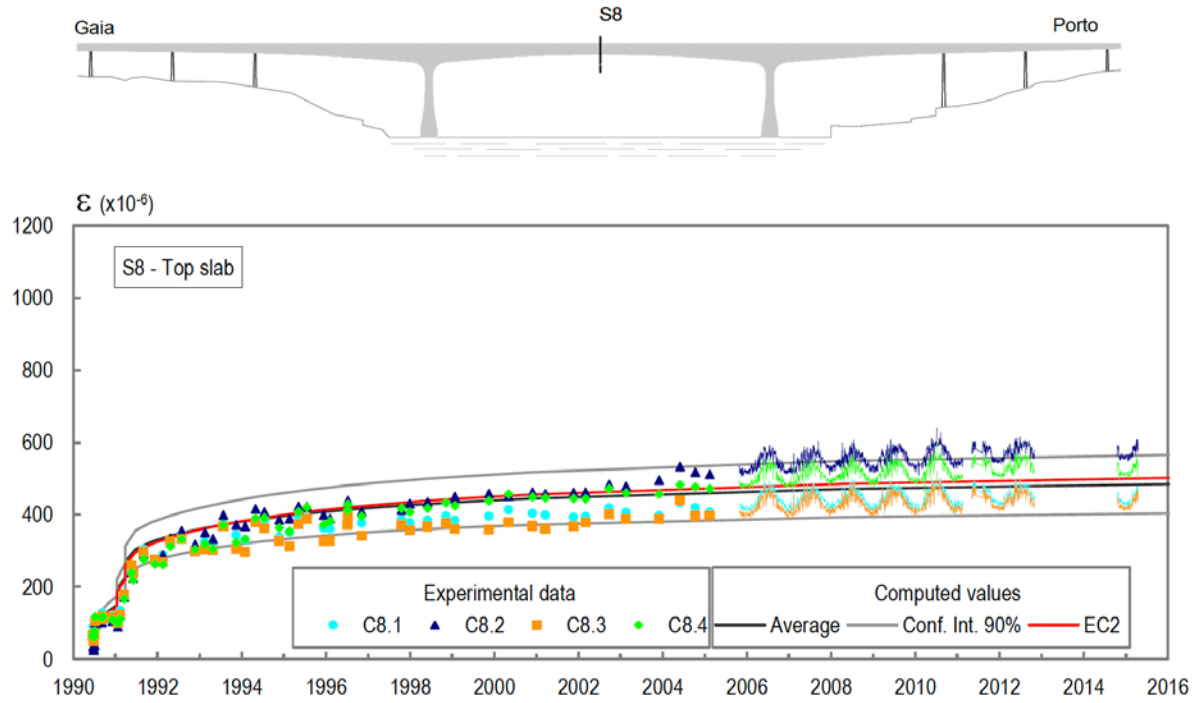

VoI analysis on monitoring concrete strain and reinforcement corrosion (retrospective)

Challenges: Uncertainty representation for the case without any measurements, effect of measurements on uncertainty, consequence representation.

## Selection of case studies not presented at the workshop:

# Thirty years of structural monitoring of Sao Joao Bridge

Luis Oliveira Santos, National Laboratory for Civil Engineering (LNEC), Portugal




Measurements of concrete strains to monitor creep.

Challenge: Decision for monitoring is taken, VoI analysis has to be formulated retrospectively.

Challenge: Decision for monit

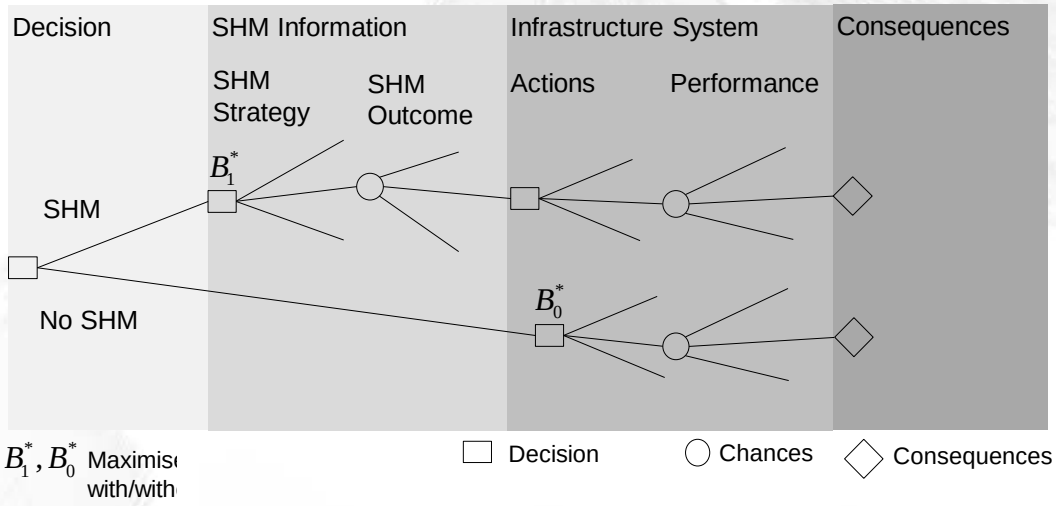
# Common challenges:

General:

- Identify reasonable assumptions / simplifications
- Represent uncertainty “honestly”

Specific:

- Formulate a likelihood for linking measurements to properties of interest
- Formulate limit states that represent “real consequences”
- Represent spatial- and time dependence



# Goal for case study documentation

Fact sheet will document each case study (drafts exist already and will be further developed)

All fact sheets follow a common classification scheme

They deliver insights to general and case specific solutions

They will point to the most critical bottle necks for practical implementation of VoI

# Thank you for your attention

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