



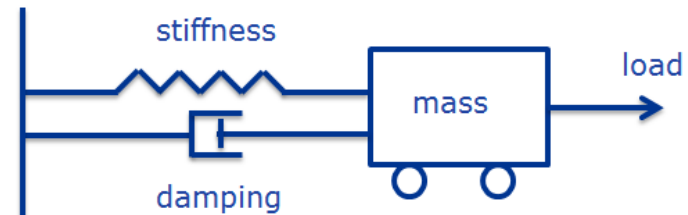
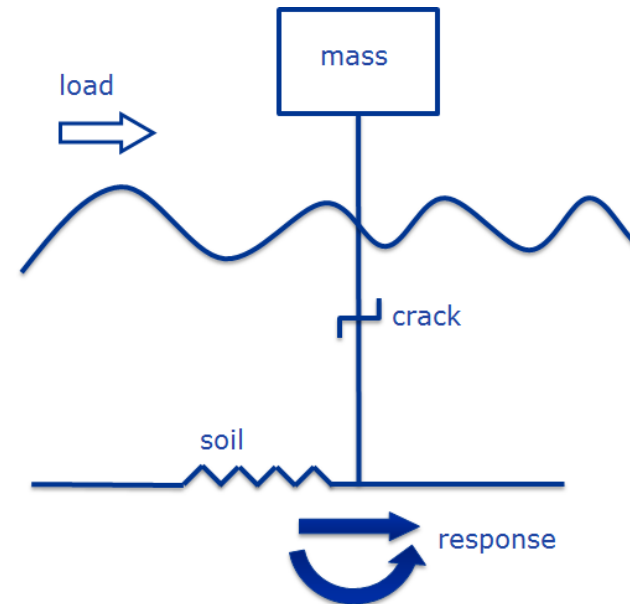
# QUANTIFYING THE VALUE OF SHM - A GENERIC EXAMPLE

J.H. Roldsgaard, Rambøll  
M.H. Faber, Technical University of Denmark

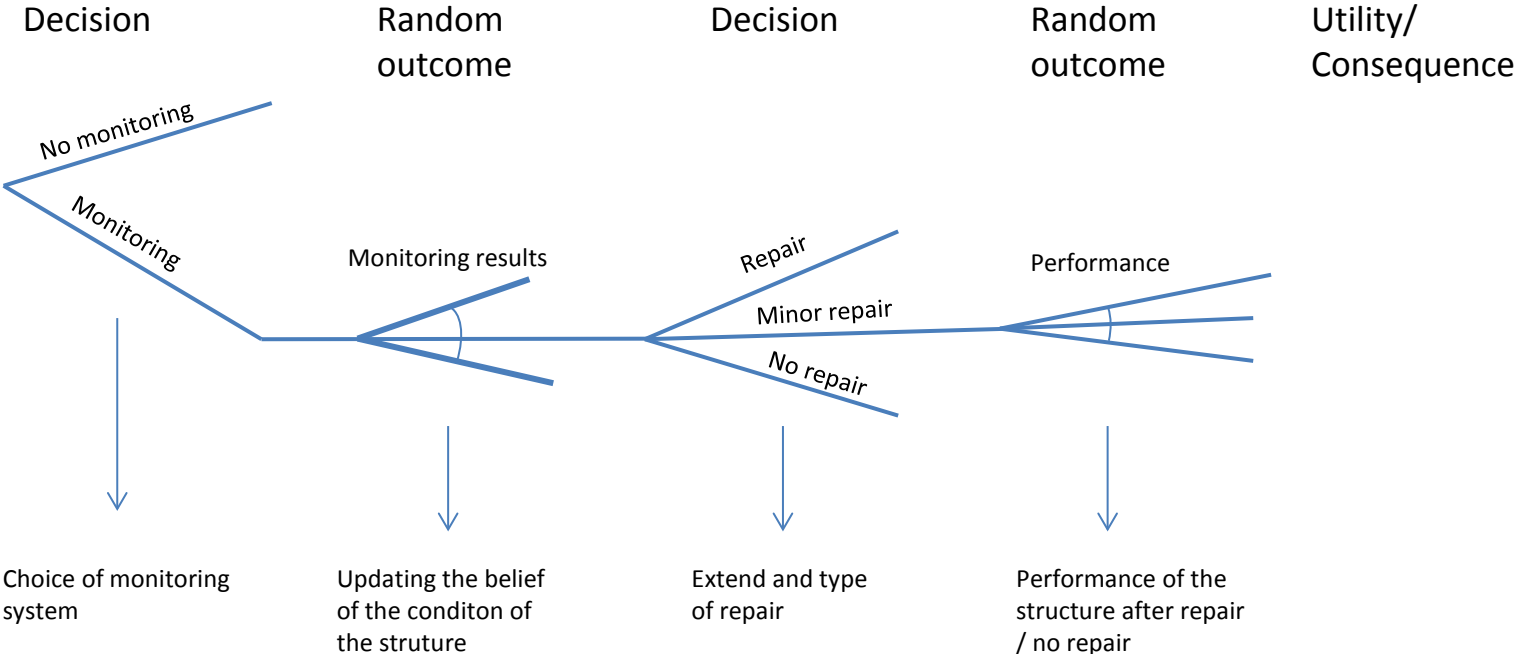
**RAMBØLL**

# THE EXAMPLE (WORK IN PROGRESS)

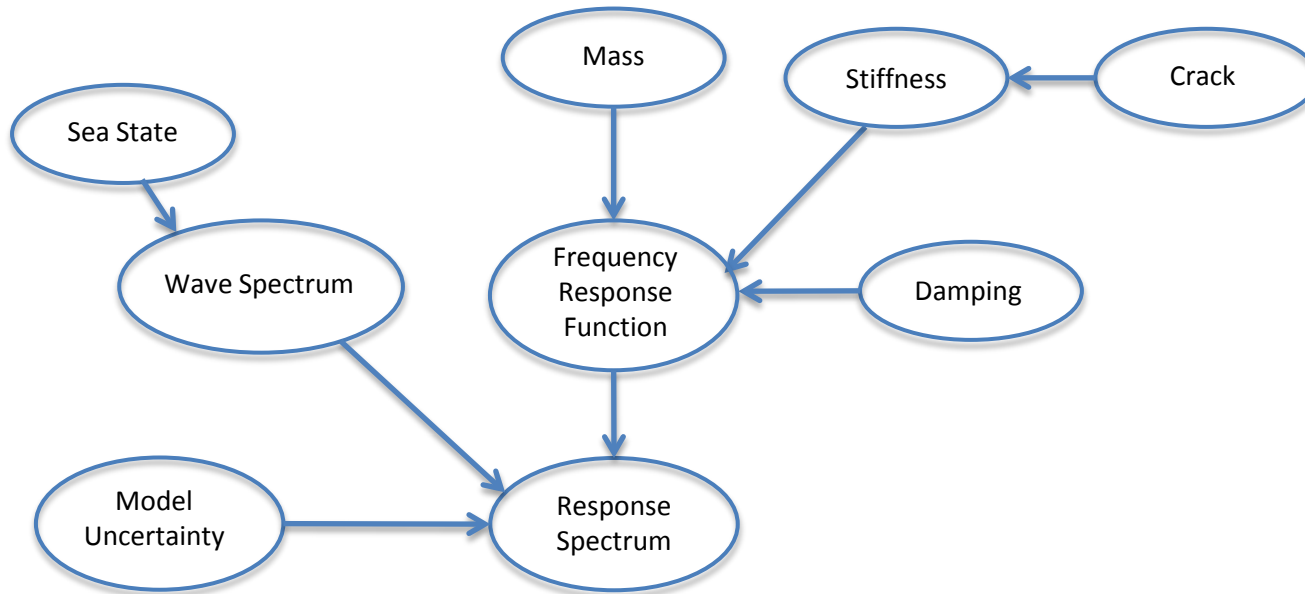
- Addition to few existing examples
- Framework model
- Offshore structures – difficult to inspect / repair
- Single-degree-of-freedom (SDOF) system
- Random variables:
  - Load, mass, stiffness, damping, crack
- Monitoring systems:
  - Climatic parameters, strain gauges, accelerometers, displacement



# DECISION TREE



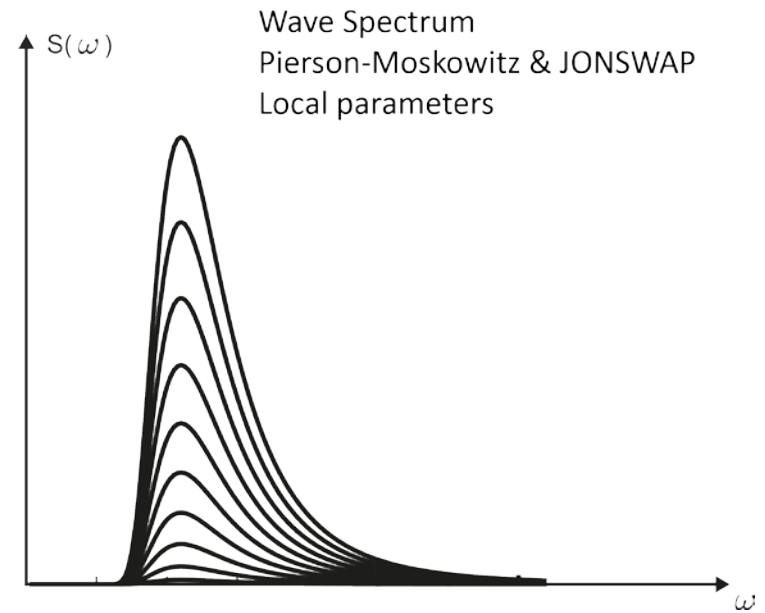
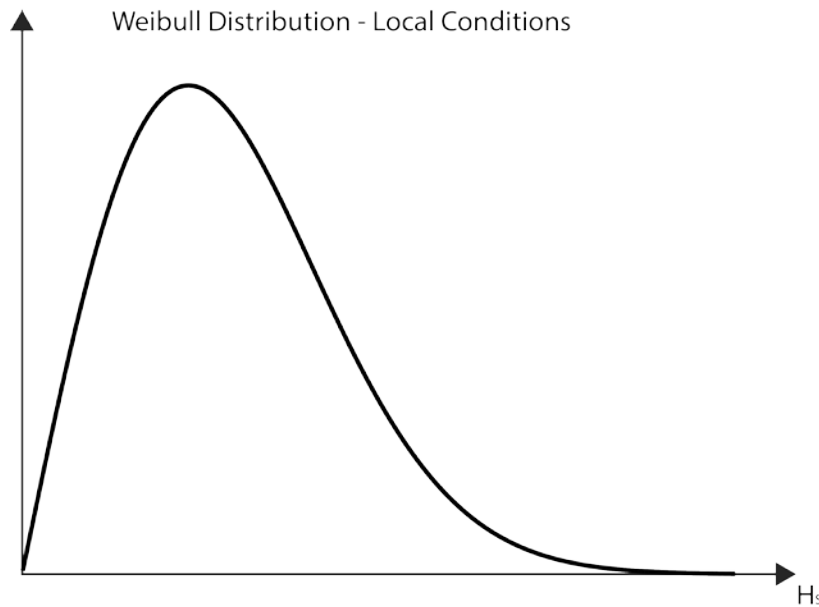
# BAYESIAN PROBABILISTIC NETWORK



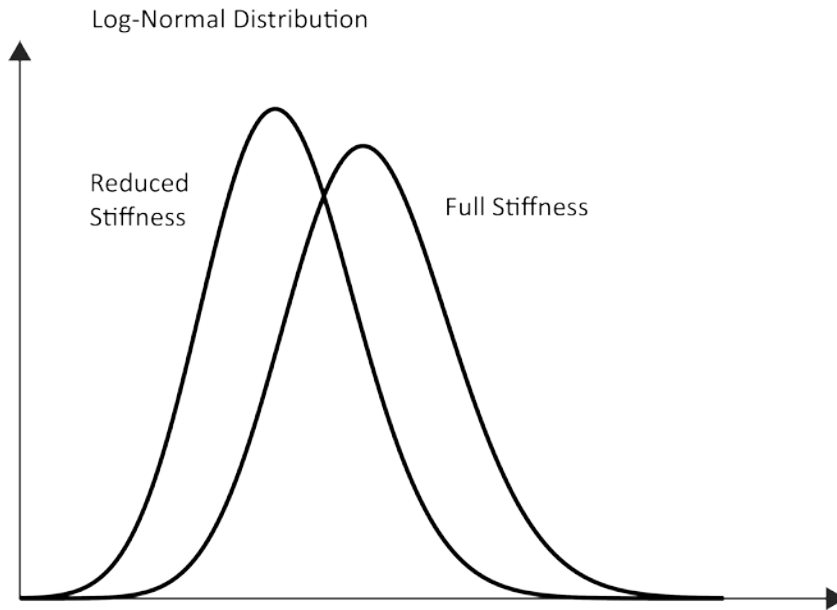
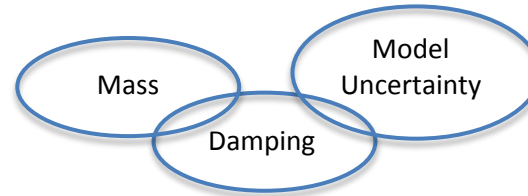
# BAYESIAN PROBABILISTIC NETWORK

Sea State

Wave Spectrum



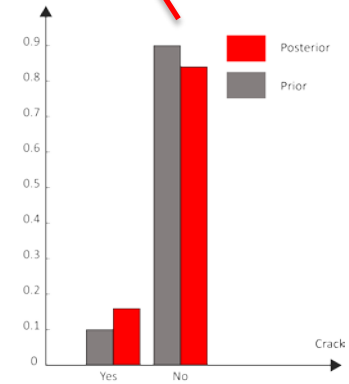
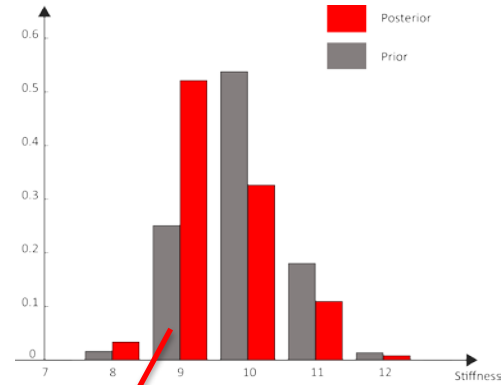
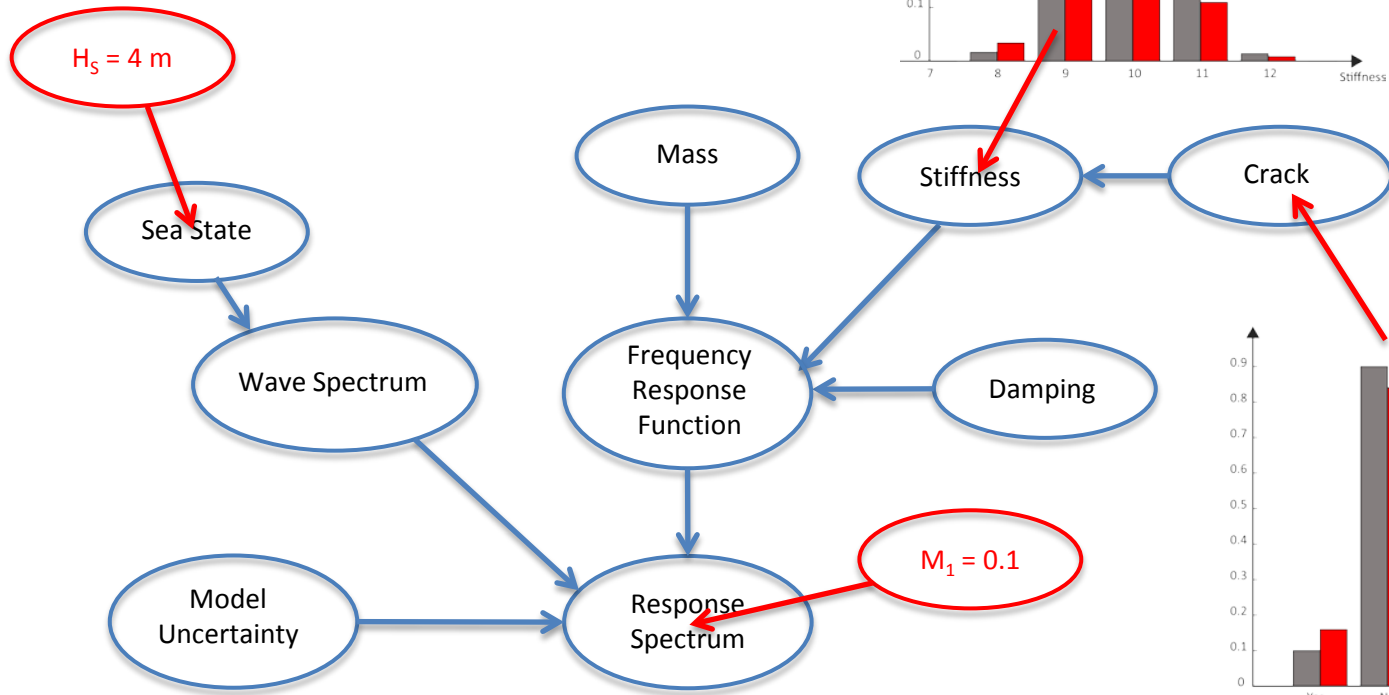
# BAYESIAN PROBABILISTIC NETWORK



- Mass – Deterministic
- Damping – Deterministic
- Model Uncertainty – Normal
- Cost

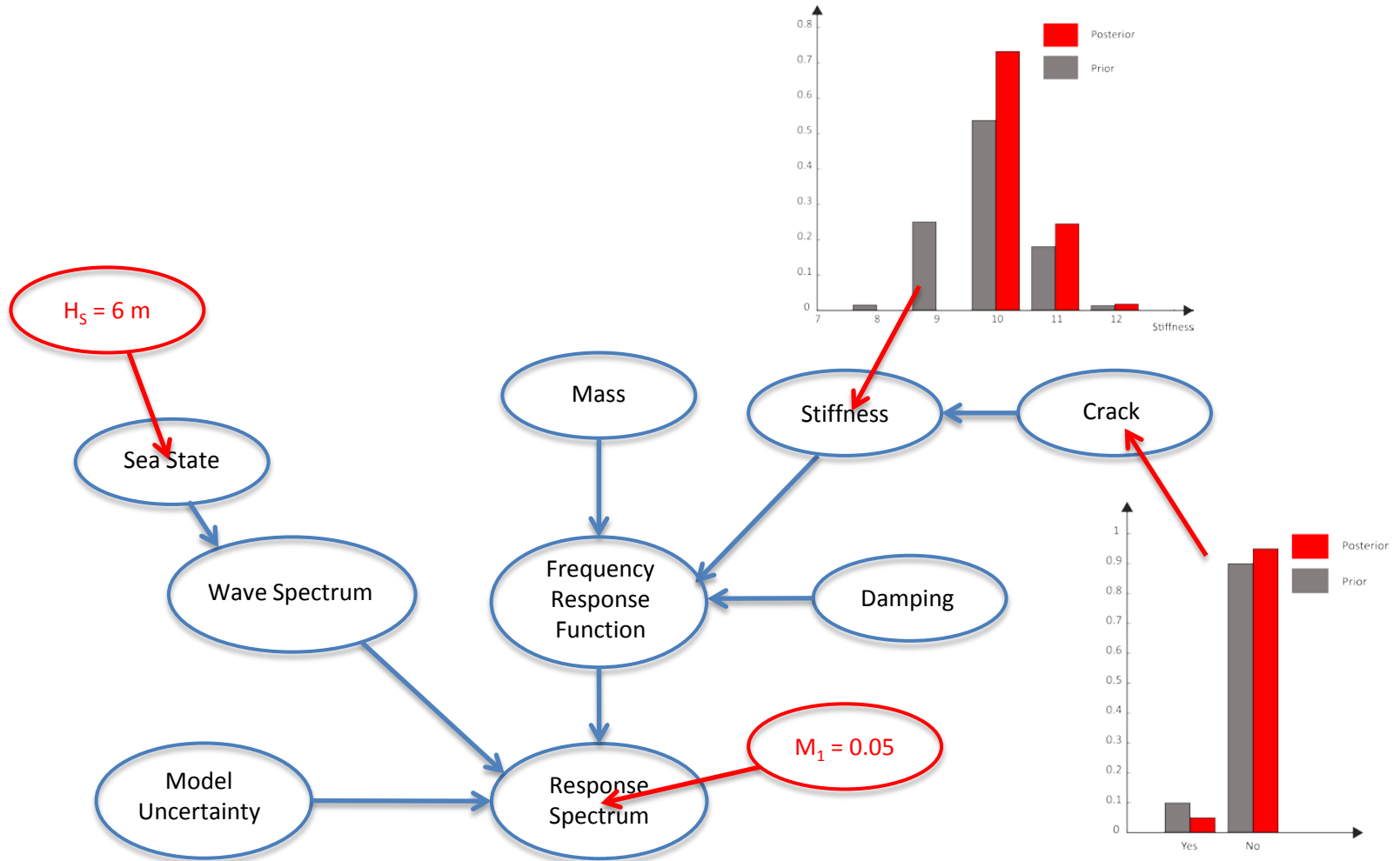
| Inspection | Yes   |      | No    |      |
|------------|-------|------|-------|------|
|            | Yes   | No   | Yes   | No   |
| Crack      | Yes   | No   | Yes   | No   |
| Value      | -1000 | -200 | -5000 | -100 |

# RESULTS



| Inspection | Yes  | No   |
|------------|------|------|
| Value      | -330 | -880 |

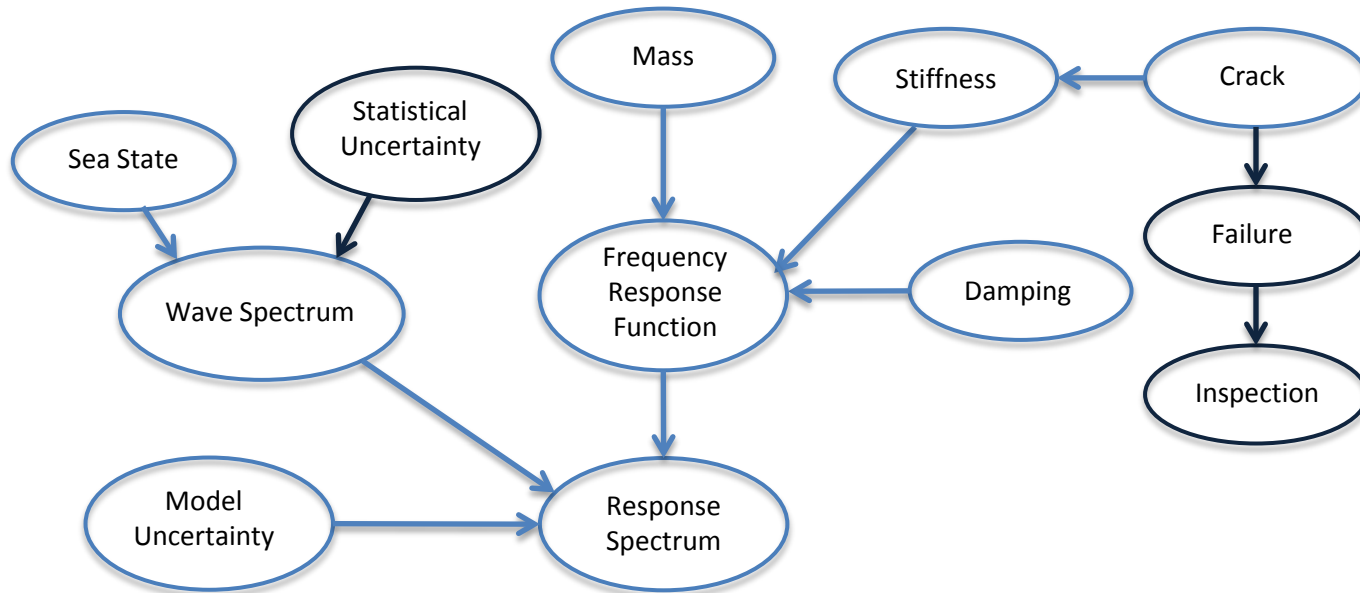
# RESULTS 2



| Inspection | Yes  | No   |
|------------|------|------|
| Value      | -235 | -320 |

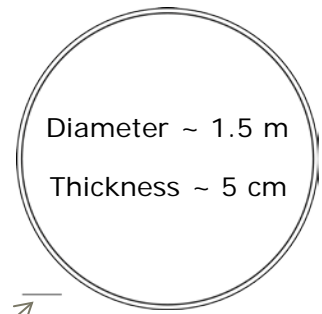
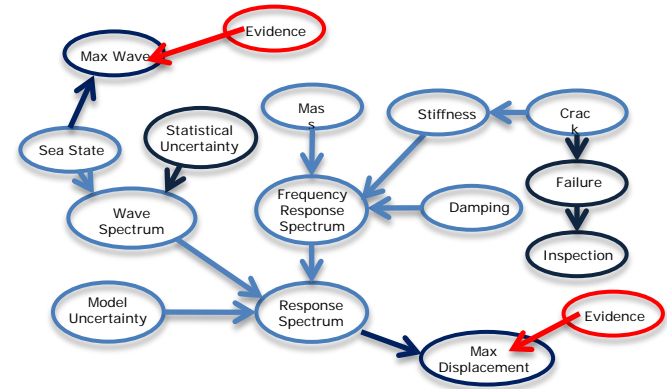


# BAYESIAN PROBABILISTIC NETWORK - FUTURE WORK



# BAYESIAN PROBABILISTIC NETWORK - MORE EVIDENCE

- Crack size versus structural dimensions
- More evidence needed
  - Maximum wave given a sea state and maximum deflection
- Localization of the crack
- Cost considerations



Crack length ~ 20 cm

**THANK YOU**

**QUESTIONS?**

**COMMENTS?**