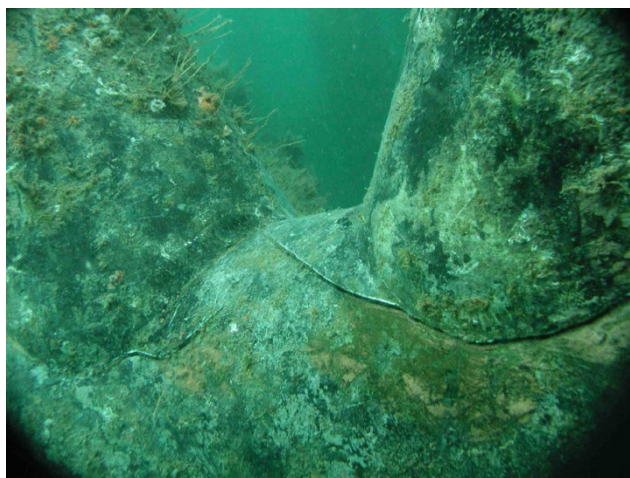


The Problem

Flooded Member Detection (FMD) is a well-established method of establishing whether a serious crack has developed on a subsea structural member. However, it only works after the crack has grown through-thickness, and so relies on there being sufficient structural redundancy to maintain integrity. What then happens when the structure goes beyond design life and may be less reliable? In such circumstances, can the possibility of two or more members failing in quick succession be ruled out? The HSE has questioned whether considering only single member failure in redundancy analysis is sufficient for integrity assurance. MMI were commissioned to develop a long term assurance for a structure operating beyond design life, taking account of multiple member failures.



Our Approach

We developed a probabilistic model of what could happen in a sequence of stages:

- Using probabilistic fracture mechanics, we calculated the individual failure likelihood of every member of the structure. As a check method, we also applied random failures based on a constant member failure rate
- We conducted jacket pushover analyses in various member failure combinations (single and multiple), using fatigue life and member utilisations to select combinations
- For a given inspection frequency, the probability of collapse was then calculated, and this result was used to determine the optimum integrity assurance strategy

Outcome

For platforms with marginal levels of structural redundancy, and operators who use FMD as their principal monitoring technique, this approach has been found to be able to resolve the problem of multiple member failure - which is particularly important as platforms go beyond design life. As an additional outcome, it was able to inform an optimal integrity assurance strategy.