

International research cooperation - Risk-informed decision making for sustainable and resilient infrastructure systems

The donation from the COWIfonden will support international cooperation between Professor Mark Stewart, University of Newcastle, Australia, and Professor Michael Havbro Faber, Technical University of Denmark (DTU).

Throughout their careers, Professor Stewart and Professor Faber have devoted much effort to modelling and assessing the reliability of different structures and infrastructure systems, such as bridges, tunnels and offshore platforms.

Previously, the two researchers have cooperated on a number of projects, such as development of a method for risk assessment, reliability assessment of road bridges based on test loading and modelling of the reliability of reinforced concrete structures exposed to corrosion. This cooperation was made possible largely by a donation from the COWIfonden in 1998 supporting Professor Faber's stay as guest professor at the University of Newcastle, with a research group headed by Professor Robert Melcher to which Professor Stewart was also attached.

The two researchers plan to allocate much of their time in 2016 to exploring how risk-based decision making can be combined with quantitative sustainability assessment to facilitate development of strategies and concepts for sustainable and resilient infrastructure systems.

From both a theoretical and a methodological perspective, risk-based decision making is a very powerful and well-established basis for assessing and comparing different decisions on for example the design and operation of infrastructure systems. Both as concepts and methodological tools, resilience and sustainability are less mature than risk-based decision making. The concept of resilience has been used for decades to describe the inherent ability of systems to survive disruptions and reestablish their functionality without any external assistance. Typically, the focus has been major disruptions, such as accidents or natural disasters. Conceptually, sustainability is closely related to the common understanding of resilience; however, the focus is not on major disruptions but rather on the negative impact locally and globally on the very environment on which human existence depends. Typically, such impacts occur slowly - and usually unnoticed. *"Our hypothesis is that the concepts of resilience and sustainability may be combined and that modern quantitative sustainability assessments, such as lifecycle analyses (LCA) may be applied to integrate the negative impact on the environment into the risk-based decision making analysis."*

In practice, the two researchers take sabbaticals in 2016, and the research cooperation will be realised through guest stays at the University of Newcastle, Australia, and the Technical University of Denmark (DTU), respectively. The two stays will both have a duration of three to four months. Costs of travels and mutual stays will be covered by the COWIfonden.