

Future Infrastructure Forum 4

A lifecycle engineering approach to dependability assessment for underground structures

Z. Chen

PhD, MASCE

Lecturer in Facilities Management

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Current research projects

- COST Action on Megaprojects (The Effective Design and Delivery of Megaprojects in the European Union) (2011-2015), European Science Foundation (ESF).
- Project Portfolio Management in Mega Industrial Projects (2011-2014), The Tulip Foundation.
- Developing a system prototype for rapid and accurate post-disaster damage and needs assessment of built assets (Built Assets DNA) (2012-2013), EPSRC.

Purpose

- The dependability of underground structures consists of four crucial issues including reliability, maintainability, supportability and adaptability.
- 'Design for maintenance' + 'Learning process' + 'Integrative use of D.I.K.W.'
- A novel generic lifecycle engineering approach to dependability assessment for underground structures.
- A sub-set of a large research project.

Practice

- These issues have been considered in different ways in the design of underground structures.
- Threats and engineering failures such as cracks and uneven settlements, etc. in underground structures due to the change of design scenarios during construction and usage stages.
- Cases

Importance

- The importance of lifecycle dependability analysis in the design, construction and maintenance of underground structures.
 - Natural Environment Research Council (NERC), 2010: The impact of increasing changes in the water table on structural stability of buildings
 - Royal Academy of Engineering (RAENG), 2011: Infrastructure, Engineering and Climate Change Adaptation

Scenarios

- Unknown things
 - Reliability of design scenarios
 - Changes during construction
 - Pattern of usages
 - Unexpected changes
- Things to know
 - An innovative engineering solution to improve the performance of underground structures for longer service life.

Expertise

- Data collection
 - Objective data from ground and structure (design, construction, and use)
 - Subjective data – experts' knowledge/judgments
- Data analysis
 - Visualization and Statistics
 - Decision making with the best use of expertise
- Case projects