Maintenance-friendliness in management of civil engineering structures

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Abstract

Cost efficiency and reliability are mayor concerns in structural engineering, e.g. bridges. Acquisition costs depend strongly on buildability. Traditional approaches to lower maintenance costs are efficient maintenance and robust or maintenance-free design, normally expensive. This study's approach is systematic and successive life-cycle assessment of reliability, availability, maintainability, safety (RAMS) and sustainability (LCCA, e-LCA, s-LCA, risk and legitimacy). IMF (index of maintenance-friendliness), IAC (algorithm for the identification of collateral components) can be used to quantify maintainability, e.g. low accessibility for inspection or operation, unease to operate, unsafety, etc. A holistic model has been suggested to confront these concerns in urban development. More than simplifying complexity, the authors suggest to deal with it.

Keywords: buildability; complexity; life-cycle; maintenance-friendliness; mimetic; RAMS; reliance; risk; sustainability.

1 Introduction

1.1 General

There are situations where normal maintenance of transportation structures (bridges, tunnels, retaining walls, etc.) is not possible, e.g. access to inspect and/or service is limited, measures require an unreasonable temporary traffic calming or road closure, a third party is affected, etc. Then, the structure is not maintenance-friendly.

This is especially critical for urban development when building tightly or building coastal structures that are exposed to especially aggressive environments. The traditional approach is to choose between much higher expense for acquisition (robust or maintenance-free structure) and much higher maintenance cost.

This study's general hypothesis is that the introduction of quantitative assessment of maintenance-friendliness from early stages, in civil engineering projects, leads to considerable LCC savings without considerable increment of acquisition costs, and to sustainability. Our aim is to enhance the explicit use of maintenance-friendliness as a tool to optimize decision-making in construction and maintenance processes.

We review, qualitatively, models coming from industrial engineering to assess reliability, availability, maintainability and safety and

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