



Adaptive pathways for critical infrastructure resilience

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Abstract

Climate change is triggering hazard events more frequently and the costs of the consequences on the built environment are higher. This induced the advent of resilience-based engineering. More recently adaptive pathways (APs) were presented to allow adaptive management as well as dynamic and flexible decision-making. APs allow, specifically in climate change contexts, the consideration of stressors that occur incrementally or cumulatively and amplified hazard scenarios. Thus, an AP framework enhanced with emerging technologies is proposed for critical infrastructure. It benefits from the resilience and sustainability of emerging technologies throughout the lifetimes of critical infrastructure. This advanced AP framework is supported by continuous assessment of the infrastructure performance, continuous monitoring, and implementation of mitigation measures if needed. The Hollandse Bridge case study is offered to demonstrate the framework.

Keywords: adaptive pathways; critical infrastructure; resilience; sustainability; monitoring.

1 Introduction

Critical infrastructure (CI), specifically transportation infrastructures and assets are suffering from excessive use and aging due to population and urbanization growth, product transportation, and frequent natural disasters aggravated by climate change (e.g., extreme temperatures and storms). Frequent natural hazards resulted in aggravated impacts on infrastructure, communities, and the environment. Maintaining the optimal CI functionality became a

substantial challenge (1). Therefore, there is a crucial need to strengthen CI and improve its management strategies.

Climate change induces daily stresses that accumulate over time and amplify hazard scenarios. Thus to preserve the CI functionality, disaster-mitigation strategies have shifted their focus from disaster response to preparedness and prevention ((2), (3)).

To address this, in the last decade adaptive pathways (APs) were proposed as a dynamic and