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Integration of resilience assessment aspects in life cycle management

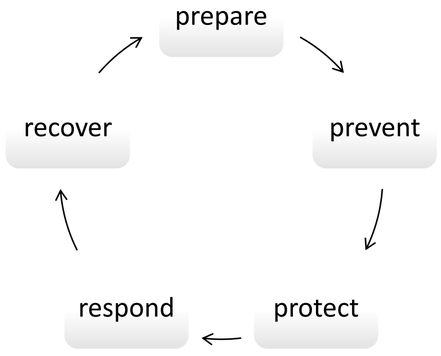
INTRODUCTION & SCOPE OF WORK

Considering the increase of extreme weather events due to climate change and the unfavorable age distribution of transport infrastructure in Germany, more efforts are required to optimize and coordinate maintenance, upgrading and replacement of existing transport infrastructure. Increasing age of structures and changing impacts are reducing their structural reliability over the years.

The paper presents a concept for the integration of resilience assessment aspects into a life cycle management (LCM) for transport infrastructure.

METHODOLOGICAL CONCEPT

Resilience can be described as the inherent capability of a system to absorb changes and disruptions of various kinds, to adapt to them and to retain its characteristic functionality.



The concept addresses all elements of the resilience cycle (Fig 1) and aim to provide managers and owners of transport infrastructure with a pragmatic approach.

Fig 1. Resilience cycle with five phases

In this way, the results support infrastructure managers and owners in ensuring the reliability of structures over the entire life cycle, starting from planning, through construction, use and maintenance to demolition.

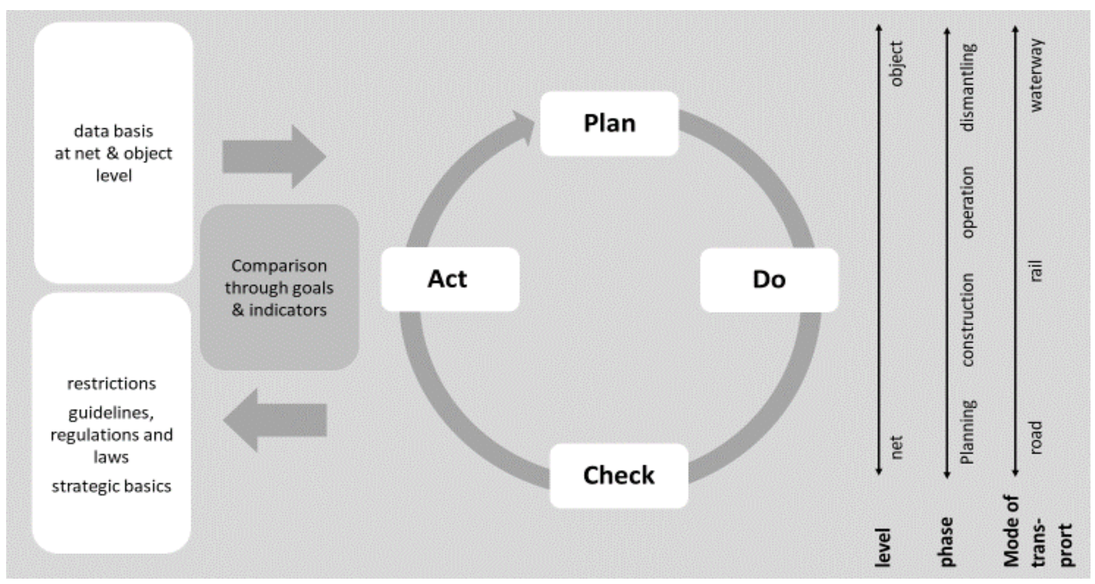


Fig 2. Concept of a LCM[1]

One idea for a concept for LCM is shown in Fig 2, with the PDCA cycle (**Plan - Do - Check - Act**) at its center. The basis for the LCM is information on the object and network level, remaining restrictions, specifications, regulations and laws as well as strategic foundations.

Goals are derived from the requirements of the basic principles. In order to make the fulfilment of these goals traceable and measurable, quantitative and qualitative indicators are identified. In this way, the basics are constantly compared with the actual situation of the networks and structures.

INTEGRATION OF RESILIENCE INTO LCM

Fig. 3 illustrates a possible PDCA cycle with integrated resilience aspects. In the Plan phase, objectives are set, critical structures are identified and suitable measures to increase resilience are prioritized.

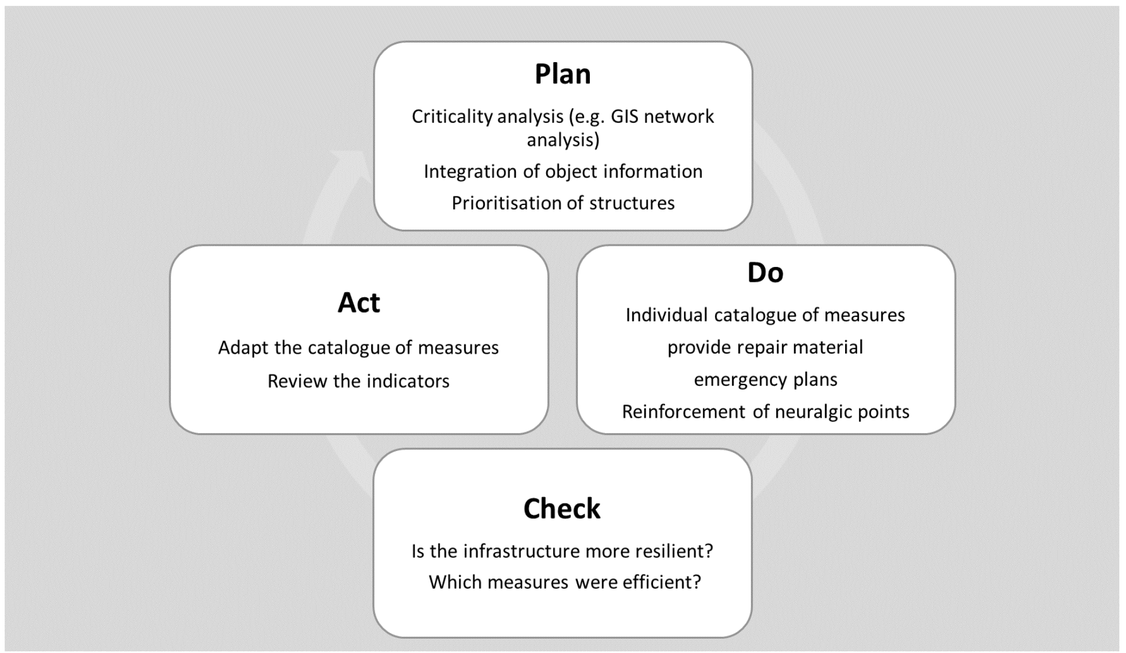


Fig. 3. Resilience aspects in a life cycle management[2]

In the **Do** phase, the measures are implemented, such as the creation of emergency plans, structural measures to strengthen critical structure elements or the use of new early warning systems. The individual work steps are documented in detail.

In the **Check** phase, the effects of the measures are checked. On the one hand, it is tested whether the resilience of the infrastructure facilities and the network under consideration has increased and, on the other hand, whether the implementation of the measures has proceeded according to plan. If this is not the case, the implementation of the measures must be revised or replaced by other measures.

This happens in the **Act** phase. Here, measures are revised, technological and administrative innovations are implemented or replaced by other measures. On this basis, updated goals with adjusted criteria and suitable indicators are defined in the following **Plan** phase and the cycle begins again.

The LCM can have different modules on the network and object levels, it can include different life cycle phases and concern different modes of transport.

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