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Why the 200-year bridge is a myth - a new perspective towards an evolving structure

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1 Abstract

When we design bridges for 100, 120 or even 200 years we have a static use case in mind. We design for one given traffic load - maybe increased 10% for the future - and anticipate virtually no adjustments in use and structural behavior, except for some bearing or cable replacement features. Looking back how demands changed even within the last 50 years, it would be naive to anticipate we know what is required in 200 years. Also - the effort spent in maintenance and refurbishment is significant during its service life.

We should think of bridges as living or evolving things. And digitization can help! A structural health monitoring system (SHMS) is necessary to better understand needs for strengthening and repair. A site-specific traffic analysis will show how demands change regarding means of transport and loads. Also, a "living" BIM model which will be maintained and nurtured during the whole life of a bridge is an important step to get a clear overview "how it goes" and what will be required next. Finally – the structural system of a bridge should allow for easy replacement of components, widening or re-use elsewhere. Modular construction would be a key element to allow for better adaptability.

Keywords: adaptive structures, longevity, SHMS, BIM, digitalization

2 From passive to active asset management

Bridge engineers all over the world must cope with ageing infrastructure. Two main reasons contribute to the poor state of our bridges:

- increased traffic volume and axle loads
- poor durability of construction materials.

To avoid such problems in the future we currently tend to design bridges more robust and with more durable materials. We want to allow for increasing traffic and to protect steel or reinforcement to the best degree possible [2]. Claiming to design bridges with a service life of 200 years is the latest trend topic of this development.

However, we don’t really know what we will need in the future. And is it sustainable to over-design bridges for way too much load and absolute protection? Is it sensible to even think about stainless steel reinforcement or coating on concrete?

The problem might be that we still think of bridges as a passive structure – built once with minimum

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