PriMera Scientific Engineering
Volume 7 Issue 2 August 2025
DOI: 10.56831/PSEN-07-212
ISSN: 2834-2550

PriMera Scientific Publications

Time to Turn on The Real Structural Health Monitoring

Type: Editorial
Received: June 05, 2025
Published: July 29, 2025

Citation:
Rune Brincker., et al. "Time to Turn on The Real Structural Health Monitoring". PriMera Scientific Engineering 7.2 (2025): 01-02.

Rune Brincker[1]*, John Steen Johansen[2] and Hans Svenningsen[3]

[1]Retired Professor of Dynamics from Technical University of Denmark. Known for his contributions to Experimental Dynamics

[2]Psychologist, Chairman of the Local Board of the Housing Association SAB, Bellahøj I and II

[3]Master of Science (MSc) in Economics and Business Administration, Retired Certified Public Account

***Corresponding Author:** Rune Brincker, Retired Professor of Dynamics from Technical University of Denmark. Known for his contributions to Experimental Dynamics.

1. The concept of Structural Health Monitoring (SHM) has become recognized as a distinct field in structural engineering in the 1980s with the aim of using sensors to monitor the response of structures like buildings and bridges, in order to detect damage and improve safety. The SHM WW market is estimated to USD 3-7 billion, with an expected growth rate of 10 - 20% over the coming years.

   New technologies in data analysis such as Operational Modal Analysis (OMA) makes it possible to estimate mass and stiffness distributions in structures and therefore also makes it possible to detect damage as a change in stiffness and localize the damage in the structure using an updated finite element model called a digital twin.

   In this way, the SHM becomes the ultimate tool to provide the information needed to optimize the value of decisions concerning maintenance and life cycle issues.
2. However, facts are disappointing, because even though many owners of structures have already installed sensors to gather response data from their structures, only a very little part of the data is being analyzed. The reasons for this are difficult to define. But undoubtedly it plays a significant role that the information in the data is still manually extracted using manual analysis by engineering specialists with long experience, which is very costly. Our guess is that only like 1 % of all collected data is being analyzed.

   Another big problem is that structural engineers are still falling back on using simple models from standards instead of using the data from SHM. Standards are meant to be used for design – before the structure is present. When the structure is present, we should not use models based on standards. These models are only relevant in the design process. They are not there to say anything about reality.

   When the structure is present, the response of the structure is also present and can be recorded using known SHM technology, the information can be extracted by OMA, and thus, reality is then talking directly to us.

   We need the information about the reality to make the right decisions, and to optimize economy and sustainability.

   There is a classic dilemma between model and reality, but it is actually easy to figure out how to deal with the dilemma. For design it is fine to use simple models based on standards, but when

the structure is present, we do indeed need the information from reality, and also the help from the digital twin mentioned above, because now this is not a model built on assumptions, but a model representing reality.

3. The fact that the construction industry could have all information available, but still seems to hesitate, leads to catastrophic events like failures that should have been prevented, and tearing down of buildings that should have been preserved. Let us take a look at two examples.

   The Morandi Bridge was a bridge in Genoa built in the mid-1960s that collapsed on August 14, 2018, when a 210-meter long bridge section fell down and 43 people were killed. The remains of the bridge were dismantled in 2019. In 2017, researchers from the Polytechnic University of Milan had begun studying the natural frequencies in question, but unfortunately, the analyses that could have warned about of the collapse before it happened was not provided.

   The scandal surrounding the conservation-worthy Bellahøj buildings in Denmark began a few years ago when the owners launched the suspicion that the buildings might not be able to withstand a storm. This resulted in extensive studies by several consultants that ended with a proposal to reinforce and renovate the buildings for 350 million USD – an amount equivalent to demolishing all the buildings and rebuilding them.

   The first case about the Genova bridge is a case of having information but not using it, the second case about the Bellahøj buildings, is a case where the consultants are using simple models based on standards to estimate safety instead of looking at the reality. Information derived from movement data of the structures during wind loads might have shown enough safety.

4. The conclusion is that lots of monitoring is being carried out but the information in the data and the inherent potential not being used in a reasonable way.

   The structural industry and the structural owners should start using SHM and extracting the information from the data on a daily basis so that before a bridge like the Genova bridge collapses, the traffic can be stopped. Then, if the bridge collapses, the loss will be limited to the structure and no human lives lost.

   The Structural industry should also stop using simple models based on standards about structural load bearing capacity of existing structures, and instead measure the movements of the structure, update a model to be a digital twin, and finally use well-known principles from safety with classical limit state values for the material strains and stresses to obtain safety based on reality.

   The more information we have about the structure, the closer we are to reality, and the closer we are to reality the closer we get to the real and well-documented safety.

Figure 1: *Left*: The Morandi Bridge in Genoa that collapsed in 2018, where SHM data was collected but not used to predict the collapse. *Right*: Two of the Bellahøj Buildings, where safety was estimated using simple models based on standard instead of using SHM data.