Bridge monitoring

The construction industry accounts for a substantial part of global CO_2 emissions. Depending on the country, the proportion is between 10 and 20 percent of all CO_2 emissions from human activity. In addition, important raw materials like metals or even gravel are consumed

(https://www.tagesspiegel.de/wissen/die-klimaschaedliche-gier-nach-zement-klimakiller-beton/25033772.html).

(https://www.chemietechnik.de/klimabilanz-der-zementindustrie/)

All infrastructure is designed for a predefined lifespan. For example, a bridge is usually designed for a service lifespan of 50 to 100 years. During this lifespan, maintenance is often needed every 25 years due to damage, corrosion, fatigue and normal wear. In addition, every bridge is unique, and so requires large safety reserves (usually a factor of 1.5 to 2.25) because it is difficult to accurately predict in advance the effective loads and stress on the construction materials.

With a long time monitoring of bridges (or other infrastructure) in the middle or at the end of the calculated lifespan, the period of service can be extended dramatically. This allows the cost, materials and emission of CO2 to be amortized over a longer time, saving costs against building replacement infrastructure.

In Europe 2/3 of all infrastructure (bridges, tunnels, streets, walls etc.) have passed the middle of their lifespan.

https://www.spiegel.de/wirtschaft/soziales/deutschland-so-ist-es-um-die-bruecken-bestellt-a-1215558.html).

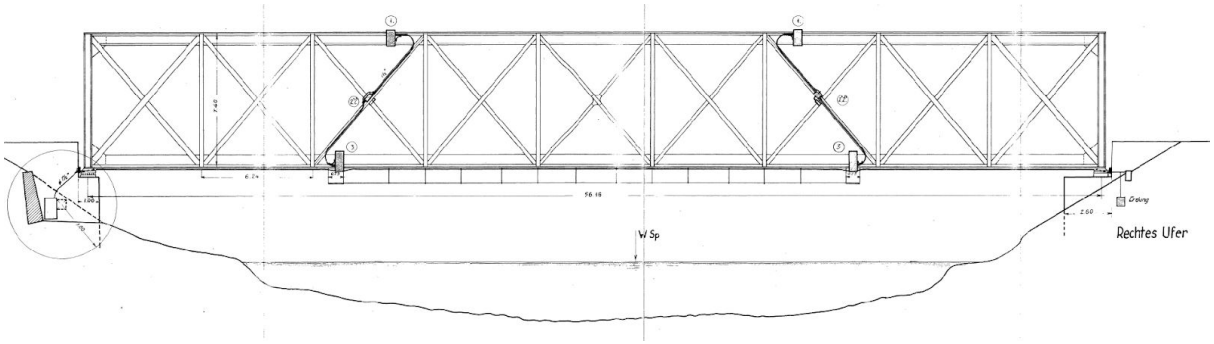
In Europe more than 1 Mio. small and big bridges are in service. If we are able to extend the lifespan of each bridge only 10%, (from 100 to 110 years,) we will save several thousand replacements or major overhauls of bridges each year. This alone will reduce CO_2 emissions by more than all due to aviation!

For example the Deutsche Bahn AG has around 25'000 bridges as part of their active infrastructure

(https://de.statista.com/statistik/daten/studie/13360/umfrage/anzahl-der-bruecken-im-besitz-der-db-ag/) .

If we extend the lifespan of only 10% of the existing railway bridges in Germany, we save 5.6 million tons of CO_2 impact (calculated with average savings for our digitally surveilled bridges). If we extend this to all useful measurable infrastructure in Europe this effect will be increased to approx. 1.57 billion tons of CO_2.

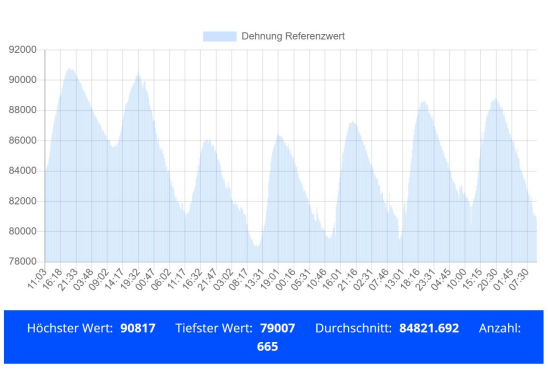
Currently we are monitoring several bridges to extend the lifespan or to prevent progressive and unexpected damage. For example a specific railway bridge that is a typical average bridge with 56 m span from the beginning of the last century (1906). The traditional calculations with all necessary safety factors showed that the bridge is at the very end of its lifespan due to fatigue. With several sensors the effective stress in the steel framework of the bridge can be measured with very high resolution and live transmission.

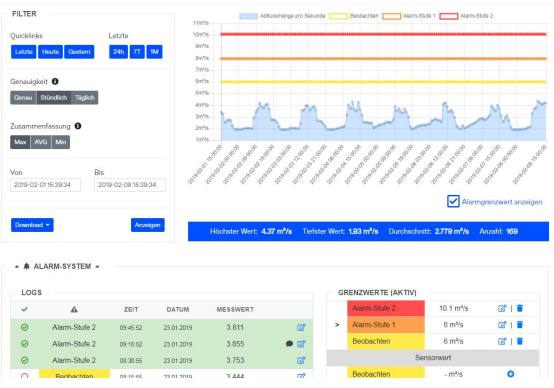


Because of the effective stiffness in the truss knots, the stress is much lower than expected. With these results, the structure can be used for many decades longer than the conservative calculations showed. With the new understanding of the behavior of the structure the lifespan can be extended. In addition, all traffic and the resulting stresses are logged to follow the effective traffic development in future. These measurements are monitored by the relevant authority for transportation and help ensure the safety of the general public.

For this bridge this means:

- More than 10% of the cost of a new bridge can be directly saved by extending its lifespan
- Around 210 t of steel or 2'940 t of concrete can be saved in the next decade
- Saving around 2'360 t of CO_2 in the next 25 years
- The bridge operator gets real time data and condition alerts in case of a critical incident
- The risk of accidents due to undetected structural failure is reduced





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Infrasens is a fast growing start up that develops and applies ERP for Infrastructure. Our solutions are made for permanent surveillance at large scale and already in operation on buildings, bridges, tunnels, construction sites, power stations, geologic areas and as well in atomic reactor power plants. Based on our Infra-Cloud platform, civil infrastructure is measured holistically - from frequent manual surveillance to precise and certified but affordable real time sensor data. Headquartered in the middle of the Swiss Alps, our customers - civil engineers and infrastructure managers all over the world - use our tools to digitize infrastructure.

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