

On CO2 efficiency and tradeoffs between safety and sustainability in the built environment

The construction of transport and energy infrastructure contributes significantly to global CO2 emissions through embedded emissions. As a result, policy makers and industries are currently investigating different options for designing and constructing greener and more sustainable infrastructures. Although progress is indeed achieved, we still lack the knowledge basis and the tools which can help us to assess how effective our decisions are in creating welfare – presently understood as a combination of economic growth, life safety and sustainability. Presently available decision-making models used for assessing the socio-economic benefits of infrastructure do not account for the implications with respect to sustainability. This also implies that we are presently not able to assess how choices regarding structural safety and durability performances affect sustainability.

The Department of the Built Environment at Aalborg University, experts on sustainability and infrastructure development at COWI together with the Department of Civil Engineering at Harbin Institute of Technology in China, have joined forces to provide new knowledge that will substantially enhance the basis for decision making with respect to infrastructure projects in the future.

In a first phase of this project that was granted by COWIfonden in 2021 and conducted in 2022, we first established the relationship between choices regarding infrastructure quality (lifetime/reliability) and quantity (amount/capacity) and their implications on sustainability, life safety and economy. On this basis we succeeded in establishing fundamental new knowledge regarding the trade-offs between sustainability, life safety and economic developments.

The present project builds on the general insights achieved in the first phase and aims based on specific cases provided by COWI to develop tools that help ensure that the new knowledge is assimilated by industry best practices and brought into practical use for the benefit of society. These tools will enable infrastructure planners, engineers, owner organizations and public authorities to optimize the development of new infrastructure as well as maintenance decisions for existing infrastructure with a joint consideration of sustainability, safety, and economy and to document the decisions made in a coherent and transparent manner.

Finally, it is envisaged that the outcomes of the project will provide a new regulatory basis for design of infrastructure, which will set requirements to maximum emissions of CO2 in a similar manner as we presently set requirements to life safety – namely through efficiency considerations.