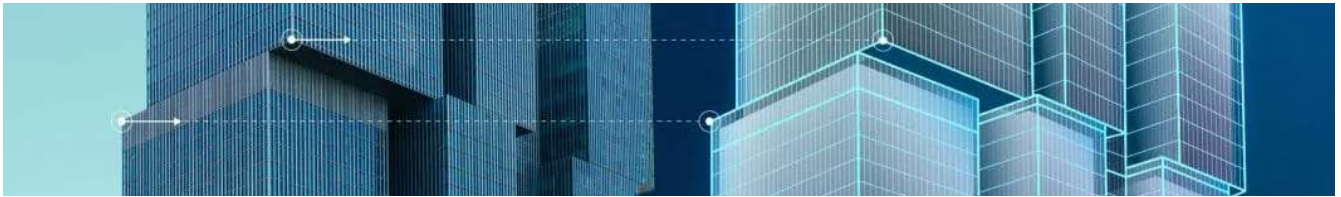


DEMYSIFYING DIGITAL: DIGITAL TWINS



What is a digital twin?

A digital twin is a virtual representation of a real-world asset or system. The twin acts as a bridge between the physical asset and the digital world, allowing for the collection and processing of asset data; enabling insights not normally attainable. It is a digital representation that mirrors the real

world and evolves as the physical asset evolves, acting like a “black box” for all the data relating to the asset.

Digital twinning as a concept is not new, having been applied in manufacturing in the early 2000's. However, the technology has only recently seen widespread implementation on pilot projects across a growing number of industries, including in retail,

medicine, and in smart cities. They have been leveraged with the most success in the more traditional infrastructure sectors such as oil and gas, aerospace and automotive. Companies in these asset heavy sectors have seen great improvements in their products, processes, and performance, translating into benefits such as increased efficiency and up to [30% in reduced costs](#).

Examples

Safety

The approach to the [design of a Digital Twin](#) is motivated by the desired benefits and tailored to a use case.

An example of a use case for complex rail and metro systems is safety, for example the need to balance routine maintenance and operations with passenger movement and safety. The use of a digital twin to plan tasks and virtually rehearse maintenance procedures reduces the time needed onsite during asset down time. Virtual rehearsals also ensure proper processes, planning, and safety precautions have

been prepared prior to any work commencing on site.

‘What if’ scenarios are a use case for historic assets with difficult to analyse structures, such as the [world's oldest iron bridge in Shropshire, UK](#). The twin enables a dramatic improvement in accuracy with the move from a traditional analytical approach of stress calculations, to a numerical method of modelling and simulation.

Optimising performance

Another digital twin use case is asset optimisation. Valuable insights can be gained on the historical use of an asset and how it is performing, through the monitoring and analysis of operational data. Internet of

things (IoT) sensors, AI and machine learning can be used in conjunction with a digital twin to predict and schedule maintenance activities; optimising performance throughout the life of the asset.

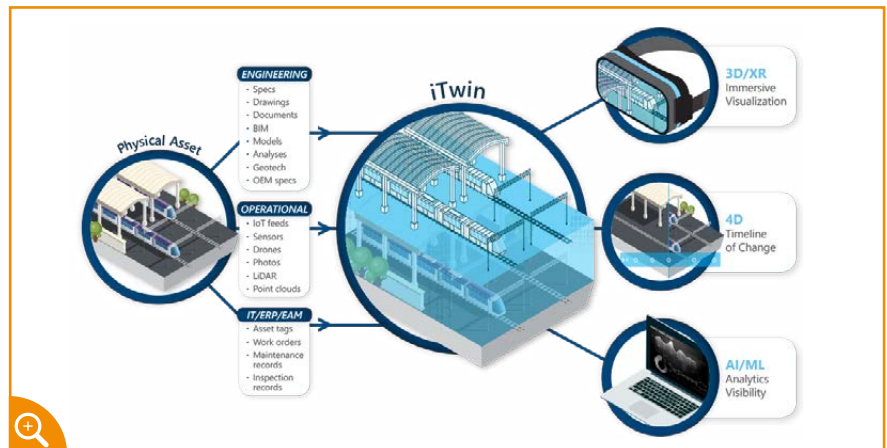
A digital twin of a wind turbine for example, will use Internet of Thing (IoT) sensors to log information on the turbine's operation. AI and the data stored as part of the digital twin will infer predictions on the remaining useful life of components and produce the optimum maintenance schedule to determine when to repair or replace components. The data also provides realistic load histories and advanced wake models which have proved invaluable for [design optimisation of next generation wind turbines](#).

Looking ahead.. what does the future hold?

Industries across the global economy are embracing the digital revolution at different speeds. The construction industry in particular, is not considered to have modernised to the same extent or speed as other industries.

The industry has found it difficult to evolve from traditional 2D workflows, separate disciplinary inputs, separate contractors and subcontractors and separate operators; to a more holistic integrated delivery model.

The drivers for improved efficiency and lower life cycle costs are ever increasing, resulting in the digital twin concept becoming increasingly critical to a wide variety of sectors with promising prospects for the built environment and construction industries



Digital twins (Bentley)



Key takeaways

- 1 A digital twin is a virtual representation of a real-world asset.
- 2 It allows for a full simulation of an asset or structure, allowing for safety, maintenance and performance improvements to be “rehearsed” virtually.
- 3 It enables the optimisation of design – for example sharing the right time to repair or replace components in an asset.