

## Cloud-based computational process controlling in mechanised tunnelling

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Mechanized production is gaining increasing influence in the construction industry that is still one the most artisanal industries. In particular in tunnelling, this mechanization has become more and more important with nowadays most tunnels being driven by tunnelling machines. The use of complex machinery in mechanized tunnelling offers the opportunity to employ feedback from the machine to enlarge the knowledge on the tunnelling process and to assist in steering decisions required for a good performance and safety. Tunnel boring machines (TBMs) are equipped with various sensors in any given part of the complex machinery that draw a complete picture of the tunnelling process – if properly evaluated [1].

The approach of process controlling in tunnelling is to store the data acquired from the TBM in a unified, semantically enriched database and to exploit these data in order to gain additional knowledge, deeper analyses and a boost in productivity and safety for the tunnelling process. Employing techniques that are commonly referred to as “big data”, an added value is generated by the combination of expert knowledge, design specifications, geotechnical and surveillance data and the sensor data readings from the TBM.

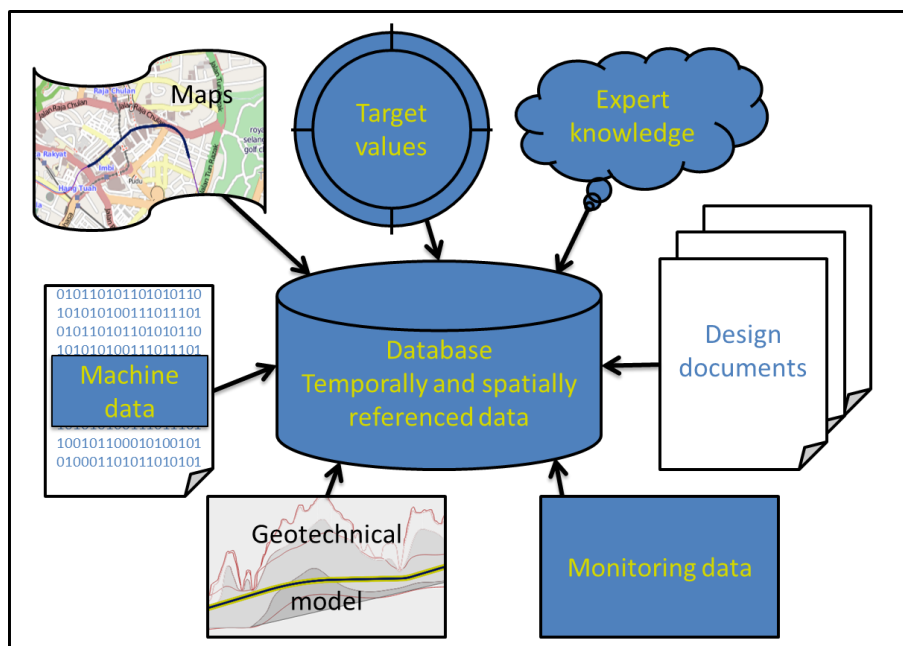


Fig. 1: Types of information employed in process controlling for mechanised tunnelling

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All information that is available on a tunnelling project is being referenced in terms of time and space in a common geodetic information system. Based on this common referencing, data can not only be displayed in charts and on maps but also cross-correlated and compared to each other in arbitrary combinations. This helps to keep track of the tunnelling process and to detect potential problems on-the-fly.

While the referencing and the application of data mining techniques provides the semantic background for a step towards computational steering of TBMs, a further step is required take advantage of gathering all data in one framework: global and real-time access and availability. By means of state-of-the-art cloud computing technology, both the server-side database and the client software employed in our process controlling approach are completely web-based. Thus, data is not only centrally acquired and processed but at the same time made available to all project partners – everywhere and in real-time.

The contribution demonstrates the capabilities of the cloud-based computer aided process controlling approach by means of practical examples and shows how the performance of a tunnel drive can be improved by the combination of real-time machine data analysis in combination with expert knowledge [2].

## **REFERENCES**

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