

The digital construction site - tangible opportunities for the future of the construction industry

Authors: Dipl.-Geophysicist Burkhard Unterstell and Dr. Jad Jarroush

The digital transformation of the German construction industry has reached an important milestone with the achievement of stage 3 of the plan of the Federal Ministry of Transport and Digital Infrastructure (BVMi) for the introduction of BIM: Since 2020, BIM is to be applied in the federal infrastructure projects. It remains to be seen how and how quickly the advantages of BIM planning will be widely implemented in practice. Nevertheless, we believe that now is the right time to look at the opportunities that the long-awaited and now tangible digitalisation will bring to the construction industry.

In particular, the execution phase of projects, i.e. the construction site per se, holds many more opportunities for the use of digital technologies, but these are still rarely used. Although many construction machines are already GPS-controlled, information about the current state of the construction site, for example, is still largely collected and evaluated in the traditional way. With the future digital availability of planning data in 3D, i.e. BIM models, the question arises as to how to provide this data set with a digital counterpart, i.e. a digital actual twin of the construction site. If both planning data and current data on construction progress are available in digital form, a decisive potential for cost savings and adherence to schedules will arise.

It is exactly at this interface that the digital construction data analysis starts. It provides a system for monitoring construction progress and optimising project management from preliminary planning to execution. It focuses on a well thought-out and practical digital analysis of the most diverse construction and management processes.

The digital construction data analysis determines field data mostly by means of drone flights and converts the acquired data into 3D surface models using photogrammetry. The actual twin of the construction site thus obtained is the basis for analyses and comparisons with the digital planning documents. Multidimensional analyses provide valuable insights for the optimization, control and documentation of processes, quality and cost planning.

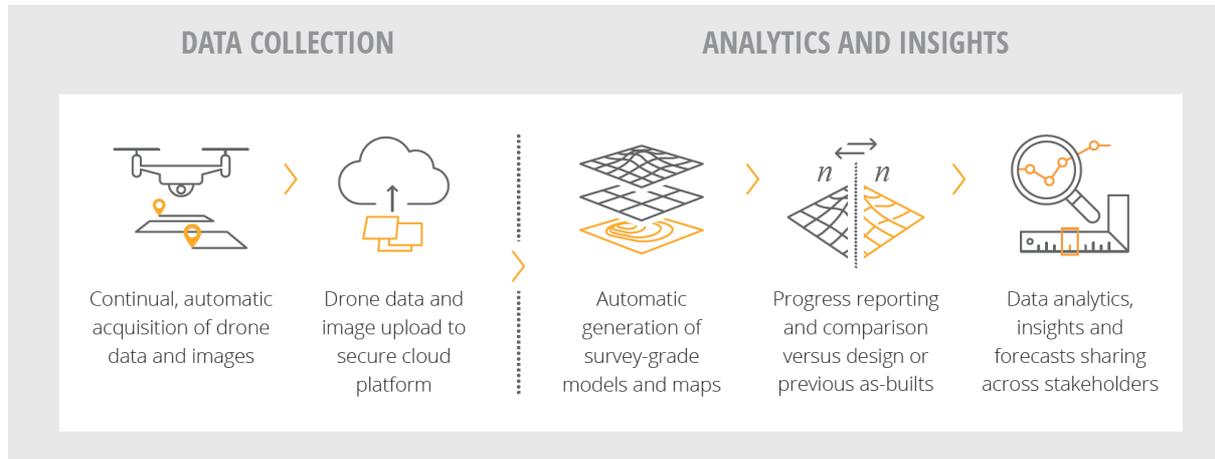
INFO-BOX

Advantages of digital construction data analysis

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- Visualization and monitoring of the project progress
- Target/actual comparisons of drafts and schedules
- Cross profile analyses at predetermined intervals
- Control and determination of the extent of earthworks
- Identification of objects for precise comparison between actual and plan
- Detection of deviations from planning
- Time-traceable documentation

Data-supported decisions - only with the latest data records!

Time always plays a role, as it does with digital analysis: Construction data analysis during construction is designed to document the **dynamic processes and changes on the construction site** and to provide information for target-performance comparison **in a timely manner**, so that a smooth and loss-free construction process can be ensured.



Construction data analysis from data collection to decisions. Source: Datumate

When construction data is collected in the traditional way, the manual surveying and subsequent creation of digital terrain models often takes weeks, is costly and depends on individual persons and specialists. In contrast, digital construction data analysis relies on automated drone surveys and photogrammetric modeling. Within hours after a drone flight, the acquired information can already be processed and analysed.

The intervals of data collection are flexible and depend on the construction project and the progress of construction work. Daily, weekly or monthly flights with drones can be carried out and the data sets thus obtained can be analysed.

Time is also one of the key cost drivers in infrastructure construction projects. Project managers operate in the area of conflict between time, costs and quality and must constantly balance the various interests. This difficult balancing act quickly becomes unstable if - as is the case with 20% of all infrastructure projects - schedules are not met.

If you want to manage a construction site more efficiently, an improved view of the time factor, i.e. the actual construction progress, is an important prerequisite. Digital construction data analysis makes it possible to obtain the necessary key figures for efficient construction site operation with automated support.

Removing innovation barriers – a challenge for many companies

Unfortunately, there is no standard recipe for how best to introduce new digital technologies into a company. The PwC study „[Die Digitalisierung der Deutschen Bauindustrie 2019](#)“ (in German) found that a quarter of German construction companies prefer to outsource BIM. Thus, service companies play an important role in breaking down barriers to innovation in the construction industry.

For years, BIM has been an important part of the service portfolio of **Dorsch Gruppe**, one of the largest independent planning and consulting groups in Germany. In 2019, Dorsch entered into a

partnership with **Datamate**, developer of the construction data analysis platform **DatuBIM**. This enabled Dorsch to expand its range of digitization services from planning to project execution. Such strategic partnerships combine new technology with many years of expertise and give construction companies an easier entry into digital transformation. In addition, the provision of new technologies as a service counteracts the serious shortage of skilled workers in the construction industry.

Real-world innovation strategy – using an example of Deutsche Bahn

Deutsche Bahn (DB) has been relying on digital innovations for years, whether at the customer interface, in operational and administrative processes, or in new, data-based business models. Deutsche Bahn interprets digital transformation as a phase model that creates space for innovation and enables parallel pilot applications. In order to introduce new technologies into the company in a targeted manner and at the same time pursue long-term planned strategies, Deutsche Bahn created the **DB mindbox Startup Hub**.

Since 2015, DB mindbox has been active in finding innovative solutions to specific problems. Selected startups go through a three-month pilot program, combined with mentoring and support from experts in the specialist areas. The pilot projects are used to test whether the new technologies can meet DB's specific requirements.

When DB mindbox launched the "New Era of Construction Tech" program in 2017, the DB mindbox scouting team already had the comprehensive digitization strategy of Deutsche Bahn in mind. Datamate was the only international start-up company to secure a place in the pilot program with its DatuBIM platform for construction data analysis and was invited to participate in two additional pilot projects.

This phase plan in the pilot programs ensures that several DB subsidiaries can benefit from the new software, while at the same time giving the startups the opportunity to develop further. Like design partners, Deutsche Bahn accompanied **Datamate** from the beta version to the commercial version of the construction data analysis platform **DatuBIM**.

Digital construction data analysis put to test - DB pilot projects with DatuBIM

In a total of three pilot projects, **Deutsche Bahn** was able to evaluate the digital construction data analysis platform DatuBIM for different problem solutions.

For the construction project **Berlin-Gesundbrunnen – Berlin-Karow – Bernau** several requirements from the project management could be addressed with the software development. For example, the creation of a project DGM with an accuracy of less than 2.5 cm over a distance of 3.2 km with a total area of 18 ha was required to monitor the extension of the line from 2 to 4 tracks. Among other things, 6 railway overpasses and one station were renewed in this project, and the overhead line system and noise protection measures were newly installed.

One focus of this pilot project was to determine whether digital construction data analysis is capable of using the scarce resources of construction supervisors for railway projects more efficiently. A further objective was the cost-effective provision of exact construction data from the analysis of drone flights.

In close cooperation with the responsible parties on the DB side, DatuBIM fulfilled all requirements in the mindbox pilot project. By flying a commercial RTK drone, supported by 106 ground control points, the required terrain model was generated with an accuracy of less than 2.5 cm using automated calculation. With automated break line and object recognition, the model was available for further meaningful analyses in the course of the project.

After the successful pilot phase with the DB mindbox, DB Netz AG selected another project for the application of digital construction data analysis: The expansion project **Western Höllentalbahn Freiburg - Titisee-Neustadt**. In this pilot project, which was limited to 3 months, the focus was on the documentation of the construction progress as well as the control of the earth movements for accurate billing.

Besides other measures, a station was renewed and the tracks were extended from 2 to 4 over a length of 500 m. The primary goal here was to produce a complete progress report. In addition, a target-performance comparison was carried out for the position of the platform edges in relation to the course of the rails by means of automated evaluation of the flight data. The construction progress was documented by 6 drone flights and the changes on 6 marked cross sections were recorded between the individual flights by means of automated evaluations. In this way, the construction supervision could make detailed statements about the construction progress without having been on site every day.

Due to the successful implementation of this second pilot project with DB Netz AG, **Datumate** was commissioned to demonstrate the possibilities of (automated) digital construction data analysis in another pilot project.

The construction project **Railway Relocation Sande** is to ensure an efficient rail connection to Germany's third largest container port. **DatuBIM** was selected to monitor and document the progress of the construction of the railway embankment. In the course of this project, 4 bridges were built on the 6 km long section of the railway line and a construction road of 20 km was constructed.

In accordance with the construction progress, 2D orthophotos and 3D terrain models were generated from each flight. By means of automated evaluation, volume comparisons were made and thus the layer-by-layer construction of the embankment was successfully documented.

Digital construction is construction with digital construction data analysis

If you wish to understand the term "digital onstruction" in all its aspects and put it into practice, you should not stop at BIM and digital planning. Although the German construction industry is still a long way from the end-to-end digitization of all life cycle phases in construction projects, the above-mentioned practical examples demonstrate that automated construction data analysis can close gaps in digital construction.

The advantages are obvious: Construction data analysis provides the necessary up-to-date information for timely decisions. The construction data analysis developed by Datumate starts in the execution phase of a project and is basically dynamically oriented to provide active support to project managers. UAV images and their processing into digital actual twins is only the first step. The meaningful information for important decisions in the further course of the project results from the comparison of models with each other and with the planning.

The automated generation of reports and data analyses saves the project manager valuable time, which alleviates the lack of skilled personnel. Designed as a secure cloud-based platform, this solution brings all participants up to the same level of information in a timely manner, enables data sharing, promotes transparency and thus facilitates collaboration.

Digitization makes companies fit for the future and gives them a competitive advantage. As a partner of the successful start-up company **Datamate**, the **Dorsch Gruppe** is well prepared to take a pioneering role in the ongoing digitalisation in the construction industry. We are convinced that digital construction data analysis will soon become an integral part of professional project management.

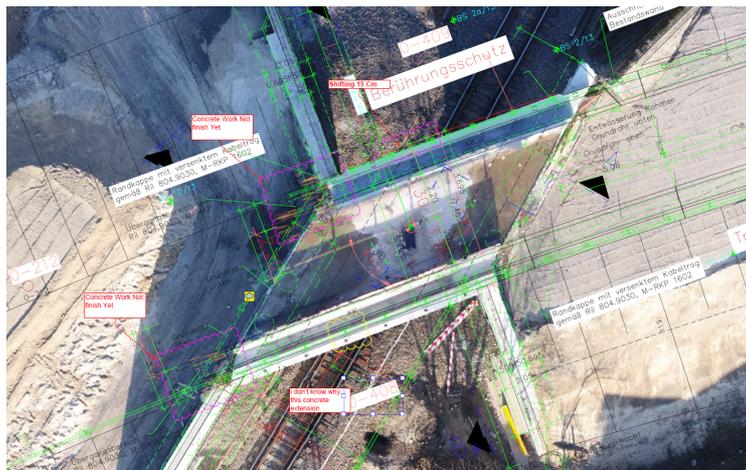


Figure 1: 3D model compared to the project plan [detail]. Source: Datamate

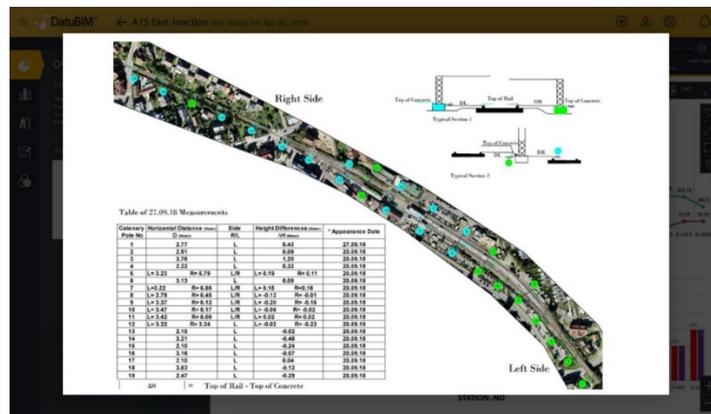


Figure 2: Progress report on the erection of catenary supports. Source: Datamate

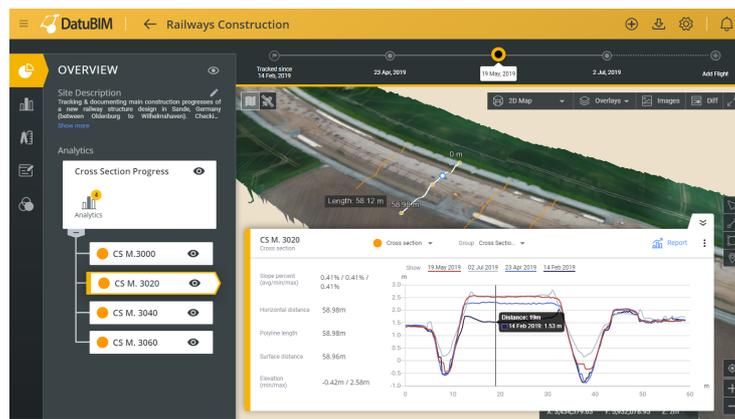


Figure 3: Cross-section analysis at intervals to document the surcharge dam. Source: Datumate

<https://www.deutschebahn.com/resource/blob/3985436/edf737542c2ee3bc3ea17173f5af33aa/Implementierung-von-BIM-im-VR-I-data.pdf>

<https://dbmindbox.com/de/dbstartupexpress/batches/new-era-of-construction-tech/>

PWC – Die Digitalisierung der Deutschen Bauindustrie 2019 <https://www.pwc.de/de/digitale-transformation/digitalisierung-der-deutschen-bauindustrie-2019.pdf>