

BIM - reinforced experience

HOCHTIEF puts SOFiSTiK's 3D reinforcement software to the test

Is it worthwhile to generate reinforcement drawings on your own based on your 3D model, or is it better to provide subcontractors with the appropriate software? HOCHTIEF Infrastructure GmbH in Essen tested SOFiSTiK's BIM solution as part of a master's and bachelor's thesis. The results are very promising.

HOCHTIEF is building the world of tomorrow, states the Essen-based construction Group's website. The company's global focus is on complex infrastructure and building construction projects, as well as the mining business.

With its Building division, or HOCHTIEF Building for short, the Group subsidiary HOCHTIEF Infrastructure GmbH is responsible for the building construction business in Germany; in the Building technical office, 70 experts – architects, civil en-

gineers, physicists, façade builders and technical building services specialists – take care of the planning and design management of construction sites. Not only decades of specialized know-how are gathered here, but they also research and develop new optimized solutions for construction sites and buildings of tomorrow.

Methods and software in the field

HOCHTIEF is one of the leading BIM-pioneers in the world. This shows, when new insights into the application of the method are explored and then tested in the field. Now the team of structural engineers in Essen wanted to find out whether it is possible and economical to use existing Revit models for (semi-) automated creation of reinforcement drawings directly in Revit.

From building model to reinforcement plan

SOFiSTiK's reinforcement solutions – Reinforcement Detailing (RCD) and Reinforcement Generation (RCG) – seemed to offer appropriate features: the software generates the necessary reinforcement in each component and allows for drafting reinforcement plans suitable for the construction site. HOCHTIEF Building had these plans drawn up by subcontractors until now; these companies use various software, such as SOFiCAD. That meant that even the smallest change had to be updated by the subcontractor. This led to time-delays and thus sometimes to construction delays. The use of reinforcement software, which can use the Revit model, was expected to increase efficiency – no matter whether the reinforcement is created in-house or externally. Two pilot projects, which were carried out as part of a master and a bachelor thesis, were to provide the necessary insight for decision-making.



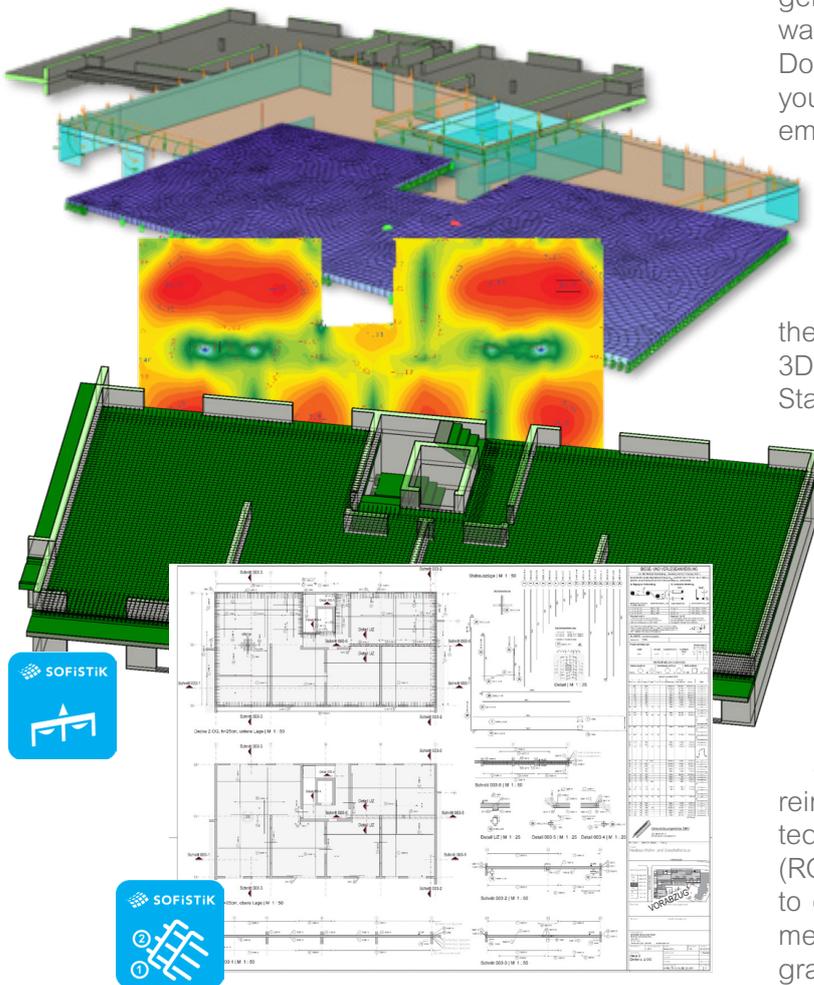
The master thesis shows it bright as day: The automatic generation of 3D reinforcement for the residential and commercial building at Podbielskistraße in Hanover worked perfectly.

Using BIM and FEM efficiently

“Use of BIM and FEM for the efficient and practical generation of member-allocated reinforcement” was the title of Hendrik Rispeter's master thesis. Does it make sense to use 3D reinforcement for your building? The former student trainee and now employee used a completed project to base his comparisons on – a four-storey residential and commercial building with an underground car park in central Hanover.

The Technical Office Building had carried out the formwork planning and plan coordination, so a 3D formwork model was already available in Revit. Stability checks and reinforcement drawings had been created externally with other software tools. This way the amount of work and quality of planning could be easily compared to results from SOFiSTiK software.

Hendrik Rispeter generated reinforcement based on the available data using Reinforcement Generation (RCG). This program calculates 3D reinforcement for every component and automatically generates a proposal for corresponding reinforcement in Revit. These reinforcements can be manually edited, adapted and optimised using Reinforcement Detailing (RCD). The “Check” function in RCG allows you to easily check whether the amount of reinforcement is sufficient, or even too much. This works graphically, at any time and is a great way to identify potential optimisation. The base are SOFiSTiK FEA design results, which are generated with the same Revit model.



It works: SOFiSTiK Reinforcement paves the way from static calculation to detailed reinforcement plans and back to the BIM model.

Complex problems require reinforced solutions

The second test project – the bachelor thesis by Armin Kurspahic – was to show whether the SOFiSTiK-solution is applicable for complex problems in “everyday use”. No comparison with a completed project was sought here. Instead tests were carried out on a current renovation project on the Federal Ministry of Health building in Berlin. It was a matter of “reinforcing highly reinforced and geometrically complicated joint connections”, says Ewa Podolecka. She has been working successfully with SOFiSTiK calculation software for many years as a structural engineer in the technical office and supervised both projects. The goal was to model individual, complex, heavily reinforced components using Autodesk Revit based on external reinforcement data and to sound out the possibilities and limits of Revit and RCD when designing 3D reinforcement.

Training is always necessary

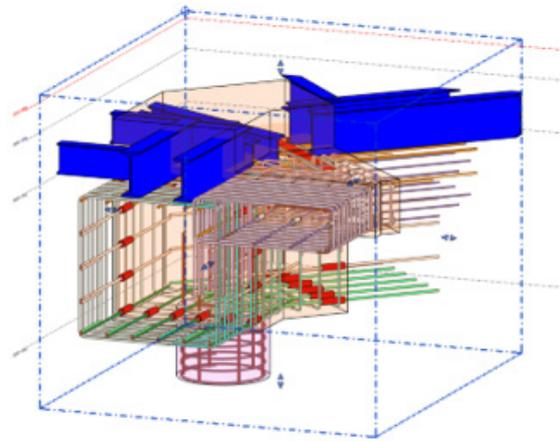
The student trainees had become familiar with the software in a two-day training session, in which they mastered the basic functionality. Their projects, however, were all about the details, for which in-depth expert training is recommended. “We knew how to use the software, but there were always special situations where external support was indispensable,” says Hendrik Rispeter. But they did not give up. It is crucial to stick with it, even when things get difficult. In the end, you always find a good solution and the resulting know-how is valuable for all future projects.



SOFiSTiK Reinforcement also delivers the expected performance in existing buildings – here for example the renovation of the Federal Office of Public Health building – and other complex situations.

Clear advantages

Whether slabs, walls, columns, or beams – the combination of automatic generation of reinforcement for every component and manual post-processing with the help of the software has proven itself. Reinforcement Generation (RCG) generates the previously calculated statically required area reinforcement. These individual rebars can then be converted to mats using RCD. Bars can be divided and overlapped afterwards simply by specifying a maximum bar length. Slab openings are – of course – taken into account.



The visualisation with the option to colour the rebars individually provides a clear overview.

Clarity through 3D visualization

Reinforcement can easily be aligned to concrete covers, component edges and predefined lines. Complex reinforcement situations can be visualized in 3D, that makes them significantly easier to comprehend. With SOFiSTiK RCD you can assign colours to rebars – this allows you to easily find your way through complex structures and collisions can be detected.

Reinforcement becomes part of the digital model

The biggest advantage, however, is that the 3D reinforcement is an integral part of the digital building model. This means that it automatically adapts to changes in geometry – in all views, including label elements. This proves to be an enormous advantage, especially when moving or resizing component openings/edges. Even shape details and rebar schedules are adapted automatically, this saves time and minimises errors.

A good choice for higher efficiency

The pilot projects at HOCHTIEF have produced important findings: if the users are well trained, the reinforcement solution by SOFiSTiK really delivers the desired improvements in efficiency and planning quality. However, Dr. Jörg Dietrich, Head of Structural Design and BIM Services specialist departments at HOCHTIEF, adds: "Switching to Revit 3D reinforcement and SOFiSTiK RCD/RCG is always a strategic decision, that cannot be made spontaneously and certainly not during an ongoing project". For projects where the technical office carries out the reinforcement planning in-house, RCD/RCG will be used from now on. The next test "on a living object" will deal with economic efficiency and further use of digital reinforcement objects. If the software also passes this test with flying colours, HOCHTIEF Building will no longer

generally outsource reinforcement planning, but will increasingly create them in-house.

- Grundbewehrung (generiert)
- Grundbewehrung (generiert + angepasst)
- Zulagen (generiert + angepasst)
- Konstruktive Bewehrung (manuell ergänzt)



Basic reinforcement is generated automatically and can be adjusted. In the event of geometry changes, the reinforcement adapts automatically.

The employees of the technical office Building at HOCHTIEF Infrastructure GmbH are impressed by the functional scope of the Reinforcement solution by SOFiSTiK: The structural engineers Ewa Podolecka, Hendrik Rispeter and Armin Kurspahic, as well as Head of Department, Dr. Jörg Dietrich.



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