Drilling blast holes to advance the roof section of the Brenner Base Tunnel in 2015. (Photo: P. Kudella, KIT)

Anything but Boring

Soil and Rock Mechanics: A Mecca for Frontier Workers with Imagination Who Enjoy Detective Work and the Occasional Surprise

Zero to thirty meters: That is the interesting depth for any foundation, urban tunnel, flood control construction or wind turbine anchoring. Dr. Peter Kudella explains the work of the KIT Institute of Soil and Rock Mechanics, which he is heading and describes as extremely diverse. "We examine the soil on or in which construction is planned. We observe its composition and deduce how it is likely going to behave."

Soil often needs to be viewed from two sides, as it will be fundament as well as building material. "A causeway, for example, rests on something, but is also made of the same material."

The thinking about loads needs to be oriented in two ways as well: Static and cyclic. There are buildings that, once constructed, remain standing for decades, representing a more or less consistent load on the ground. Then there are regularly recurring events. For instance, the wind is blowing at a wind turbine, or it is not. It changes direction. All these forces have an impact on the turbine's anchoring in the ground. "Especially regarding the cyclic soil mechanics, we are still conducting almost basic research to predict long-term behavior."

Considering that this expertise is needed in virtually every construction project, its research and academic landscape is remarkably small. "That is why I welcome every initiative, also here at KIT, to train more and better," says Kudella. He describes the ideal soil and rock mechanic as a frontier worker with imagination who enjoys surprises and detective work.

Geotechnical engineering, accordingly, is less about how the soil became like it is. Rather, the central question is: How does it react to interference and how can that be used? Additionally, there is another dimension to consider. "The typical construction engineer is concerned with walls and beams, thinking in planes and straights. However, subsoils are three-dimensional and there are stresses in any direction. Also, you cannot see through it – you have to imagine it and describe it mathematically."

And then there are the surprises. When building, you never now what was there before. According to Kudella "that makes it all the more interesting because it requires intuition. A good example is the tram here in Karlsruhe. During construction of a tunnel, an objection was raised: What if there are any cellars in the projected course that are not recorded in the plans, perhaps built secretly?" So, a search was conducted and they found – nothing. The tunnel was built without any disruption.

Assembly of the tunnel boring machine in the DESY starting shaft in Hamburg, 2010. (Photo: P. Kudella, KIT)

INDISTRIAL RESOURCE STRATEGIES

THINKTANK Collaborates with Industry

Recycling the automotive industry's plastic components has always been problematic, because they mostly are mixed plastics. The Industrial Resource Strategies THINKTANK and automobile manufacturer Audi are tackling the challenge. In a joint pilot project, they aim to chemically recycle automobile plastics and return the fractions into a resource-saving cycle. "This example illustrates very well how we work", says Professor Jochen Kolb, who works at the KIT Institute of Applied Geosciences and chairs the THINKTANK's steering committee. "We find a relevant topic, approach it scientifically, bring it to public attention, and develop concrete projects collaborating with partners from the industry." Another collaboration with the company iPoint focuses on blockchain technology. This approach is also aiming to advance the development of a sustainable closed loop economy.

More information in German:
www.thinktank-irs.de