

Summary

In addition to the well-known database, GeoBrain Foundation Technics also has a forecasting model. Making use of expert knowledge and 2,400 practical experiences, the model is able to provide a judgment about feasibility and the risk of damage. The model for sheet piling has recently been positively validated. It seems that it can indeed help designers improve designs. Use of the tool is now on the rise. 'Principals will increasingly insist that designers use this type of practical tool'.

Figure 1 Precast concrete tension piles in a deep excavation.

Positive validation of GeoBrain Foundation Technics forecasting model

Model 'forecasts' design feasibility better than guidelines

Until recently, construction knowledge was mainly in the heads of people. GeoBrain Foundation Technics (GBF) enables this specialist know-how to be accessed centrally, in a structured way. GBF now contains some 2,400 'experiences'. And the number increases daily. More and more designers draw on the knowledge of this 'collective brain' each day via Internet. As a result, construction problems can be prevented: the failure costs fall, the quality increases.

Milestone

The recent positive evaluation of the GBF forecasting model is an important milestone in the tool's development. Annemieke Mens MSc (TU Delft) validated the model as part of her doctoral research into the application of artificial intelligence in foundation technology in order to reduce failure costs. "A designer can indeed use the GBF model to make a more accurate forecast of

the risk of failure while executing the foundation design than with the current formulas in the Dutch CUR design guideline 166. Validating the model was more problematic than originally thought. The accuracy of negative forecasts in particular is difficult to control. The likelihood that they are actually executed is small.'

GBF was developed to improve the quality of foundations, says Thomas Bles MSc, project leader of GeoBrain Foundation Technics at Deltares: 'A great deal still goes wrong during construction. Some 13 per cent of all sheet piling experiences in the database are described as 'poor'. This figure even rises to 20 percent when sheet piles longer than 20 metres are used. And construction using precast piles is evaluated as poor in 8 percent of cases. These problems not only lead to extra costs, but result in serious delays and damage to reputations as well. The most important reason is that insufficient consideration is

given to feasibility during the design phase.

Most problems can easily be prevented by making use of available construction knowledge in the design. GBF provides access to this knowledge. The amount of knowledge from hundreds of experts is simply larger than that of just one. That's the thinking behind GeoBrain.'

'Missing link'

Links to design software MSheet and MFoundation have recently been introduced. With 'a single click of the button', designers can see an overview of similar experiences and the forecasting model gives insight into the risk profile. It then becomes very easy to complete the design by carrying out a feasibility check. An interactive link has been made between the design software and the Internet application in order to improve accessibility to the information. More and more designers and foundation specia-



Figure 2
A typical Dutch deep excavation (Delft).



Figure 3
Example of construction risk when driving a sheet pile.

lists are discovering the advantages of the 'missing link' that GBF actually is. The majority of top-10 engineering consultancies in The Netherlands, such as Arcadis, Oranjewoud and Witteveen+Bos now use GBF. And increasingly larger numbers of specialised construction companies are also working with the tool.

A study by the EIB (Economic Institute for the Construction Industry) shows that GBF can lead to savings in direct costs: it is expected that the gain from reducing delays, claims, and damage to reputation is much greater. Nonetheless, the economic value has not been the deciding factor up to now. The most important obstacle to its use has been the segmentation of the construction industry. Bles: 'Designers have little contact with foundation construction companies. The principal or main contractor often sit in between. As a result, it's not always obvious which problems play a role. In the worst case, those involved often hide behind their own responsibility. Construction risks are often incorrectly pushed along to the construction phase, although they can in fact be managed effectively in the design phase.'

New types of contract

An important stimulus behind the current comotion is the introduction of new, integrated forms of contracts. This is also the opinion of Peter Schouten MSc, geotechnical specialist at Arcadis. 'Timely understanding of the risks therefore becomes more important. This has also meant a greater need to carefully consider the feasibility of designs. GBF is ideally suited to

'It should be standard practice to check the feasibility for each design. We often estimate this based on our own experience. It's far better though to make use of earlier experience, particularly in the case of complex projects. In this respect, the Geobrain Foundation Technics database is an important source we can use, for example to analyse the feasibility of piling.'

– Brenda Berkhout MSc, senior geotechnical consultant, Witteveen+Bos

'Imagine that I'm considering the use of sheet piling, and then search the database for similar situations and find out what the experiences were in those cases. I can easily evaluate the feasibility of different variations using a single method.'

– Peter Schouten MSc, geotechnical specialist at Arcadis

quickly give a picture of the risks involved, and to obtain information about feasibility.'

Principals also now see the value of GBF, says Bles: 'Certainly in complex projects, there are not only delays and costs to consider but loss of prestige and damage to reputations as well. Local governments in particular do everything possible to prevent this. Nobody wants their name associated with a "Schouwborg Middelburg".' He expects that principals will increasingly demand that designers use tools such as GBF. Your story for the principal becomes much more difficult if you later have to admit that you've not made use of that knowledge.'

And finally, insurers see the benefits too, according to Alfa Falconi MSc, risk expert for construction projects at Achmea Insurance. 'We advise our clients, especially municipalities, water boards, and provinces, to take the performance of building contractors and engineering consultancies into account when contracting out construction projects. A great deal can go wrong with sheet piling, for example. GBF is a good tool for estimating the risks.'

GeoBrain Foundation Technics has become a basic tool for designers. It will never replace them, however. And it is also never 'finished.

Thomas Bles MSc: 'That's the great thing about a learning system. It becomes "smarter" and more valuable with every new experience. Or in other words: engineers can develop better, smarter foundation designs. The designer will always remain central in this. We try to help by developing better tools.'

Click on www.geobrain.nl if you would like more information. If you wish to use GBF, you can also request a user name and password here. An English language version is available, although it should be noted that the experiences are from The Netherlands and Belgium. Parties from abroad who are interested in developing their own version should contact Thomas Bles MSc (thomas.bles@deltares.nl).

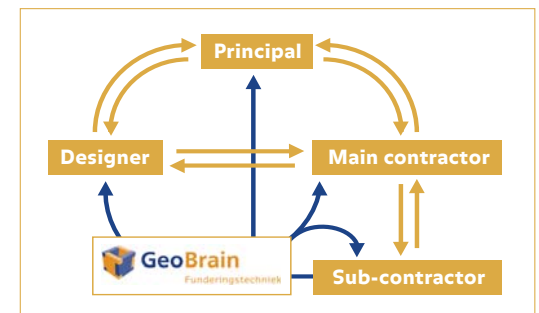


Figure 6 Position of GeoBrain in the construction process.



Figure 4 Example of construction risk when driving a precast pile.

Predict driving vibro piles

< Previous Geotechnics Installation Result Report Next >

Result prediction

Risk:	None	Small	Reasonably large	Large	Not feasible
Risk of significant protuberance of the pile	Green	Green	Green	Green	Green
Risk of significant constriction of the pile due to:					
• swelling clay layer	Green	Green	Green	Green	Green
• stiffness difference of adjacent soil layers	Green	Green	Green	Green	Green
• tensioning of the subsoil	Green	Green	Green	Green	Green
• washing due to strong ground water current	Green	Green	Green	Green	Green
Risk of a significant crack in the pile due to:					
• swell/upward movement of adjacent piles	Green	Green	Green	Green	Green
• groundwork along the piles	Green	Green	Green	Green	Green
• equipment driving past	Green	Green	Green	Green	Green

Measures

The risks involved with constriction of the pile can be decreased further by using the following values for the different parameters:

- Use of a vibro-combination pile

Figure 5 Forecasting

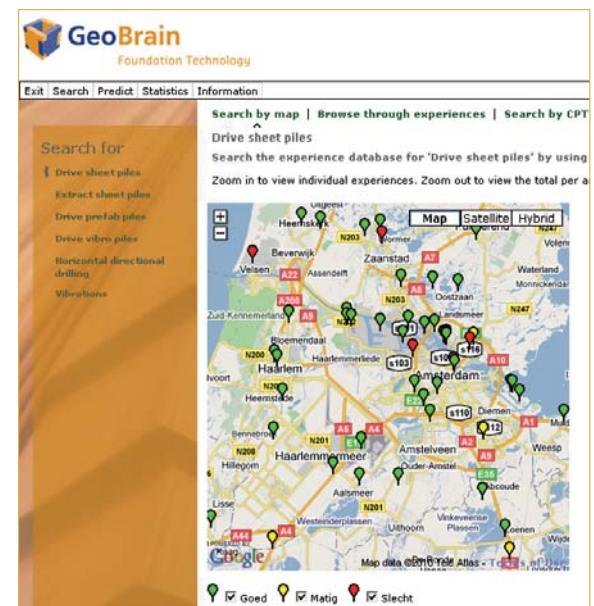


Figure 7 Map in experiences database. It is possible to search with a map in the experiences database.