SAVING MONEY WITH MAGNETIC ANCHORS BY DOW

The use of magnets is a proven technology in various professional areas. In the world of scaffolding construction, innovations lead to constructions that usually cannot be anchored to the object itself. Dow Terneuzen and Bilfinger Industrial Services have worked on a new type of scaffolding construction, that is faster, cheaper and extremely reliable.

Problem analysis

Usually, scaffolding erections alongside the wall of a storage tank cannot be anchored to the construction directly, as insufficient construction parts are present for the scaffolding to be anchored to. In such cases, an isolated, pyramid-shaped scaffolding is erected around part of the tank in order to provide stability. These constructions are large, labour-intensive and demand a lot from the subsoil. For one particular project involving an ethylene tank, Dow Terneuzen started looking for a safe alternative that was both quicker and more cost-effective. Also, no 'hot works' were to be carried out near the tank, like welding or grinding. Moreover, machines and lifting constructions had to be kept at a distance, for safety reasons. This means that erecting a scaffolding around the tank would involve a lot of manual labour. In consultation with Bilfinger Industrial Services, the company's regular contractor for isolation, scaffolding erection, rope access, asbestos removal and tracing, Dow started looking for alternatives. When it comes to anchoring scaffolding to the steel tank wall, the choice was made to use magnetic anchor points. The use of magnets is a proven technology in various industries. In the area of lifting technologies, for example, linkable permanent magnets are used.

Obstacles overcome

Before the magnetic anchors technology could be used, a number of obstacles had to be overcome. This technology, although being proven in many other areas, raised quite a few questions. For example, a magnet generates an 'invisible' force'. Is this a good thing? This has never been seen before in scaffolding construction, so it has no references. In effect, the technology had yet to prove itself. Also, there were quite a few questions about whether there are external causes that can influence magnetic activity, like temperature, moisture and the settling of the scaffolding, And people also wondered how long the anchor would remain in place. An answer was available for all of these questions:

CASE STUDY SCAFFOLDING

Client: Dow

Location: Terneuzen, The Netherlands

Period: 2013 / 2014

The problem: 'Normal anchoring' for scaffolding is not always possible with storage tanks - in those cases, large, pyramid-shaped scaffolding with additional ballast weight is erected. Dow went looking for a solution for placing a stable scaffolding construction on a ethylene tank in a safer, quicker and more cost-effective way.

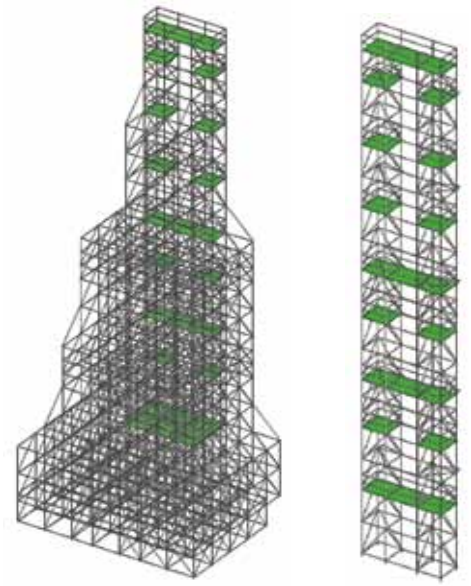
Solution: Bilfinger developed a solution involving magnetic anchor points. In the process, permanent magnets are used to attach a slim scaffolding construction to the steel tank wall. The costs savings are significant.

BILFINGER INDUSTRIAL SERVICES

– A 3D model of finite elements is made
  for every scaffolding, in which the forces for every individual anchor are determined.
– With the help of an external expert in the field of magnetism the type of magnet is selected.
– Test equipment was developed for this type of magnet with the help of external experts.
– A test protocol is being used, which is used to check and register the capacity of each individual anchor point. The results from the breakage and shifting tests were positive.
– A clear Task Risk Analysis (TRA) was set up.
– The tests, holding points and progress assembly were recorded in detail.

3D finite elements software

The scaffolding construction is worked out and calculated for this specific application using 3D finite elements software. With the help of this model, a calculation is made for each load situation and for every anchor point, in order to determine which forces may be involved on the connection point between the scaffolding and the tank wall. Also, external influences are also taken into consideration, like weather and wind conditions. This information is used to investigate whether the tank wall the magnetic anchors are set up against is strong enough to withstand the forces involved. If the wall is suitable for the magnetic anchor points, the work is further prepared from that point on.



Left: isolated pyramid-shaped scaffolding
Right: scaffolding with magnetic anchor points.

Risk control

The actual strength of the connection depends partially on the thickness of the coating on the tank wall , as well as its shape. In order to test the tensile strength and the shear strength of every magnetic anchor point, Bilfinger Industrial Services, in cooperation with external specialists, has developed two instruments. A calibrated meter is used to determine the maximum tensile strength for every magnetic anchor point. Additionally, another instrument is used to determine the maximum shear strength of each connection. These measured values for every anchor point are determined, recorded, compared to the calculations and secured. The connection is covered with a canopy, which also secures the handle that is used for switching it on and off.

Knowledge partners

During the commissioning and the calculation of the anchor points, Bilfinger used the expertise of its innovative partners on the market. In the process, the reliability of the magnets was tested and proved. Moreover, one of the partners contributed with a patented test method for the magnetic connections.

Using a measuring instrument for magnetic anchor points.

Points of interest

Regarding the use of magnetic anchor points, there are a number of issues:

- The magnetic function is not influenced by rain/moisture.
- The thickness of the 'parent material' and the strength of the magnet must be fine-tuned with one another in order to be able to guarantee the maximum magnet load.
- A minimum of about 6 mm thickness is sufficient for realising sufficient magnetic action to be applied in scaffolding.
- Magnetic anchor points can be used on surfaces with temperatures of up to 80°C.

This results in a slim, stable and safe scaffolding.

Benefits of this project

The magnetic anchors solution leads to significant costs savings compared to conventional scaffolding. This is caused by:

- A scaffolding construction that is smaller, by a factor of up to five, than a conventional construction around a tank wall. The result is slim, stable and safe scaffolding that is only 1.5 meters wide and 5 meters long.
- Fewer workers are required to erect the scaffolding.

Moreover, the magnetic anchors solution results in smaller loads for the sub-soil, as a result of the more compact scaffolding construction.
The application of the proven technology of magnetic anchor points within a new discipline makes for just the right innovation for the scaffolding construction industry. Less surface is required to provide a safe and stable working environment.
Every anchor point is calculated, tested and secured - and together with the client, we work on high levels of safety, more efficiency and lower costs.

‘MAGNETIC ANCHOR POINTS REDUCE COSTS’

Maarten Griep, engineering solutions construction manager with Dow, was enthusiastic about the idea of working with magnetic anchors. ‘One cannot carry out ‘hot work’, like welding or grinding, near an ethylene tank. Machines and lifting constructions must also be kept at a distance, due to safety regulations. This means that erecting scaffolding around such a tank involves a lot of manual labour. In other words: a quicker and cheaper alternative for the pyramid structure we would normally place around such a tank would be most welcome.’

‘We had our engineering colleagues at Dow calculate whether the construction of a storage tank would be able to bear the anchors,’ Griep recounts. ‘And Bilfinger calculated how heavy the loads on the anchor points would be. The solution involved a lot of calculating and testing in order to guarantee 100% safety. People will be standing on the scaffolding, so it has to be safe.’ The results were a success. Since then, a scaffold of only 1.5 meters has been solidly anchored to the ethylene tank over a length of 5 meters and at a height of thirty-five meters. Here, people are able to work safely on a new installation near the storage tank, which also involves the construction of piping that exceeds the tank in height.’

Michel van der Gracht, manager of the production planning department of Bilfinger Industrial Services, sees a lot more perspective for this technology: ‘This projects marks the beginning of a new development in scaffolding erection. In consultation with the partners, the standard magnets that are currently being used will be developed continuously for specific applications in scaffolding.’

Griep sees yet another advantage to this new method: ‘Since the set-up is getting smaller, fewer people would be required for a shorter period of time to erect the scaffolding. And due to the safety risks. we would rather see smaller groups of people we already know at the site, than large groups of people we don’t know.’

Insulation, Scaffolding and Painting

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april 2014