IACDS seminar success at Bauma

The International Association of Concrete Sawers and Drillers (IACDS) hosted its first ever seminar dedicated to concrete drilling and sawing at the recent Bauma Fair in Munich. The eight presentations – given simultaneously in English and German – went down very well with an audience of around 100 people, a far greater number than the organisers had expected.

A brief summary of each presentation is outlined here in the order in which they were given.

Dry coring and dry wire sawing in reinforced concrete

Martin Godickemeier of Hilti

Typical applications for this were identified as the provision of probes to assess levels of contamination in chemical and nuclear plants, the removal of anchors to prepare surface removal in power plants and the rehabilitation of historical buildings. In all these cases, the use of conventional water cooling can lead to secondary damage to the sensitive environment.

The two options suggested were dry drilling with polycrystalline diamond (PCD) core bits and wire sawing with electroplated diamond wire.

Dry coring with PCD is a high efficiency cutting process producing coarse debris which allows for air cooling, whereas conventional drilling with diamond segments is a low efficiency grinding process which produces fine debris and always needs some form of water cooling. Hilti has developed a 400V electrical wire saw especially for dry cutting. With a short engaged length of electroplated wire, its 10 m length of internal wire storage allows for efficient cooling of the wire. Features include adjustable wire speeds and dust collection to a vacuum unit.

Hilti has demonstrated both these dry cutting methods in field tests, which claim to give overall savings in application costs of 20 times for coring and 4 times for wire sawing.

With the Hilti dry cutting wire saw dust is collected to a vacuum unit

Dry coring with Hilti PCD tools

Cutting methods using a minimum of water with efficient recovery of dust and slurry

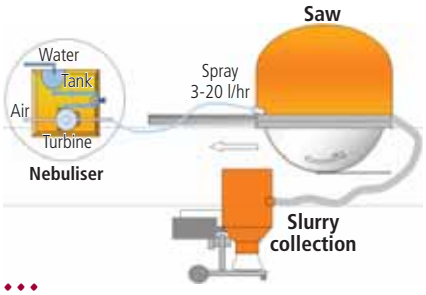
Thierry Gillet of Husqvarna Construction Products

This involved a proposal for an innovative solution to reduced the volume of slurry and dust when cutting concrete to give a better environment, in both ecological and economical terms. Conventional wet cutting produces between 10 to 20 litres of water per minute, which means that a one hour job can create more than 500 litres of slurry that has to be removed and uses up time, resources and equipment. There can also be problems of contamination.

Husqvarna's proposal was to capture the concrete debris in a mist under pressure under controlled and accurate conditions to create a dense slurry in the form of a paste which would have the ability to dry-up as quick as possible in a few minutes by evaporation.

The use of this nebuliser system would involve adjustment of the standard operating conditions such as rotational speed, cutting depth and feed as well as a re-design of the diamond segments. The use of this new system could bring water flow rates down from 500 l/hr to between 3 and 20 l/hr.

Conventional wet cutting of concrete can produce up to 500 litres of water slurry per hour



The use of Husqvarna's proposed nebuliser system can bring water flow rates down to between 3 and 20 l/hr

Remote controlled underwater wire sawing

Franz Zeindler of Tyrolit

Diamond wire sawing was described as a technique with a lot of potential in the offshore, heavy civil engineering and nuclear power plant markets. In many countries offshore structures need to be demolished after their useful life, and regions with a high occurrence of hurricanes offer an additional business opportunity through repair and cleanup. Nuclear power plants are built with a pre-determined life, after which there is a legal requirement to demolished them in a safe and secure manner. The next few years should see the opening up of a huge market for wire sawing in this area. With heavy civil engineering projects, the cutting work is no different to normal "day-to-day activities" for a drilling and sawing company; only the location and size/volume of the application are special.

An detailed example was given of a dam project in Australia which involved the cutting of a 2 m square opening in a 1.8 m thick concrete wall to create a deepwater outlet. The cutting work was carried out 90 m below water level. A special "cage" was designed and built to house the core drill and wire saw needed to do the work. This could be fitted with the appropriate cutting equipment and lowered down to carry out the coring or wire sawing.

An offshore oil rig damaged by a hurricane can be demolished using remote controlled wire sawing

A special hydraulic oil was used to keep the pressure loss to a minimum and total working time from setting up the machines and tools to lifting of the block was 14 days in a two shift operation.

Other examples were shown of oil platforms, pipes and various marine structures that were all successfully cut using remote controlled diamond wire saws.

Hydraulic versus high-frequency motor driven concrete cutting equipment - the pros and cons

Hydraulic versus high-frequency motor driven concrete cutting equipment - environmental considerations

Johan Hartvik of Tractive

These two presentations were given consecutively. High frequency is a popular term used to describe a certain type of electric current with a higher frequency than the standard 50 - 60 Hz found in most normal single or 3-phase supply. The higher the frequency, the higher the speed, which in turn means the higher the power available for the machine.

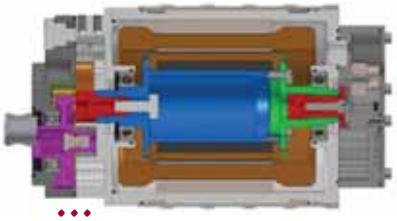
The first presentation gave a comparison between standard hydraulic motors and high frequency ones in terms of weight, dimensions, power (losses and sensitivities), reliability, profitability and user friendliness.

The small dimensions and light weight of a hydraulic motor gives a light weight of saw head. High frequency motors have small dimensions and a light weight of the complete system, although the saw head will be heavy if motor is non-detachable.

Hydraulic motors are reliable systems with well proven technology. They are forgiving during cutting so the operator doesn't need to react very quickly when hitting steel and they can be used in underwater conditions. On the downside, they suffer from relatively high losses in the hydraulic system, need a high input power and big fuses, are sensitive to fluctuations in incoming power and the hydraulic oil in the power pack and hoses can leak.

High frequency motors offer a very high efficiency over the whole lifetime of the equipment and give high power on the spindle.

A typical high frequency wall saw



Schematic of high frequency motor

They require small input power, small fuses and are not sensitive to fluctuations in incoming power. However, they can give interference back to the mains if not protected by filter and electrical connectors can be more sensitive than hydraulic couplings.

The second presentation demonstrated how the use of high frequency technology can lead to substantial energy savings, thus lowering the overall environmental impact of concrete cutting as well as improving the profitability for the contractor. This was based on a case history from a concrete cutting contractor in the USA who used both systems on a wall saw truck. It was established that his diesel generator costs fell by almost 50% when he switched to a high frequency saw.

Nuclear power plants - large decommissioning projects

Franz Zeindler of Tyrolit

This described the demolition of a partly constructed nuclear plant in central Romania. The base area of the building was 66 m x 66 m, with a height above ground of16 m and a depth below ground of 7 m. Total volume of concrete to be removed was 57,000 m^3 at a rate of around 150 m^3 per day. The estimated area of concrete cutting surface was100,000 m^2. The 10 month project would be carried out with a combination of wire sawing and drilling.

Romanian nuclear plant to be demolished had a building base area of 66 m x 66 m

The main Romanian contractor had little experience in diamond cutting so a close collaboration with the customer started during the tendering stage. In order to calculate the total costs, a work method had first to be established using data from test cuts carried out on the original concrete. Two distinctly separate methods were considered: firstly cutting into small blocks (10 t) with short lengths of wire and secondly cutting into much bigger blocks (100 t) using much longer wire lengths.

Schematics of the proposed cutting methods were computerised prior to commencing demolition

All the various advantages and disadvantages of each were considered before it was decided that the only way that the tight time schedule could be met was by using a combination of both options. It was agreed to start the demolition on two opposite sides of the building and demolishing it from the top down rather than floor by floor. A maximum weight of block of 100 t was set, which meant that heavy cranes had to be brought onto the site to cater for this.

28,000 m of diamond wire was used to cut the concrete into blocks as large as 100 tonnes

A total of 35 standard wire saws (25 or 35 kW) were used together with 3 quarry wire saws (60 kW), all of which consumed 28,000 m of diamond wire during the project (nearly 3,000 m per month). 12,400 holes were drilled with diameters of 52, 62 and 162 mm and every day 25,000 litres of water was used.

Post installed rebar - efficient methods of strengthening concrete structures

Dina Weichert of Hilti

All concrete structures are built with rebars (reinforcement bars) pre-installed within the formwork prior to pouring the concrete. However, in cases of concrete failure or where a new structure is to be attached to an existing one, post installed rebars provide a means for repair.

The two main causes of concrete failure that can be remedied by post installed rebars are where there is insufficient shear capacity at column/slab interface or where the slab itself has insufficient bending capacity which results in excessive deflections and failure.

Holes for interface shear reinforcement bars can be drilled quickly using Hilti's specially developed special multi-point drill wagons

Shear reinforcement rebars are normally around 16 mm in diameter, the holes being cored out with a diamond drill before inserting the shear rebar and an epoxy resin sealant. Holes are normally drilled at a 45° angle and once complete can lead to an increase in load bearing of up to 80% on the original value.

In situations where concrete suffers from excessive deflections due to insufficient bending capacity, the remedy is usually to add an extra overlay of concrete at the abutments and/or slabs and this has to be 'bound' to the existing structure using interface shear reinforcement bars. Where this involves large slab areas such as on long bridge spans, there can be hundreds if not thousands of holes to be drilled to take the rebars. Hilti has developed special multi-point drill wagons which make this process much quicker and more accurate.

Shear reinforcement rebars are installed at a 45° angle to increase shear capacity at column/slab interfaces of concrete structures

Typical shear reinforcement rebar

Floor grinding and demolition markets - new opportunities for growth

Thomas Nilsson of Husqvarna Construction Products

As its name suggests, this dealt with two areas into which sawing and drilling contractors can expect to expand.

Surface preparation (floor grinding and polishing) in particular has shown considerable growth in recent years. The reasons for this are that there are many competitors all offering similar services, most of them experienced contractors with a high degree of self-sufficiency. To start a business in this field, the start-up costs are quite small, which is one reason why there are many competitors.

Sawing and drilling contractors have many synergies with surface preparation techniques, not the least being that their existing customers require these services too. Also, due to the nature of sawing and drilling, contractors are often one of the first to visit a new building site or demolition/renovation project, thus getting the opportunity to discuss any surface preparation work that may need to be performed on that particular construction site – well before other contractors who only specialise in surface preparation.

In general, the barrier to entry is higher for surface preparation than it is for sawing and drilling, but there are many of these barriers that are not such a factor for sawing and drilling contractors. One is the set-up cost for equipment purchase – generally much higher than the equipment required to begin a sawing and drilling business. This favours the larger and more established contractors looking to enter this market. Skill level is another barrier that can be overcome. Since the surface preparation market is not that mature, it is significantly harder to find experienced operators and there are significant similarities with the equipment used in sawing and drilling to facilitate a transfer of skills by the operators.

Therefore, contractors who prepared to invest and develop this opportunity as an addition to their current core business will be able to develop a significant point of difference to their competitors who are not able or prepared to.

Floor grinding and polishing of concrete has shown considerable growth in recent years

Summary

IACDS President Peter White closed the meeting by thanking all presenters for the quality of the presentations, saying how pleased the IACDS was to have to attracted such a large audience for its first ever attempt at an event such as this. Its success has guaranteed that seminars of this kind will definitely feature as part of IACDS activities in the future. Copies of all presentations can be accessed and downloaded from the website.

www.iacds.org