

Ecological building is building from the perspective of natural cycles

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Owing to the 'no budget' films he and group of enthusiasts made at the time, he had plans to become a filmmaker and head off to an academy in Italy. Instead, he turned to Civil Engineering, because "as a civil engineer, you also always work in a team". **Read more on page 2 >>**



Since 1999, TU Delft has been collaborating with road managers and industrial partners in the Regiolab Delft project. The aim is to collect traffic data for research. The project has already led to much new knowledge. **Read more on page 3 >>**

How can we prevent heavy showers from flooding our cities? Which options do we have for increasing the efficiency of sewerage management? And what form will the urban water chain take in the future? **Read more on page 4 >>**



Dear reader, I have seen the world both within and outside this faculty change at a rapid pace during the last nine years. The issues that occupy us (from New Orleans to the Noord/Zuid line, from drinking water to seawater and from drilling six kilometres into the ground to probing to six kilometres high in space) have become broader, more complex, more multidisciplinary and more international. Students and scientists are now more aware than before of the role of the engineer in society and are developing other knowledge and skills. All these changes have influenced both the direction and positioning of the faculty and the innovative power of our academic graduates.

One of the most conspicuous of these changes in direction is the relationship the faculty has with market and government parties. To give you an example, a year and a half ago we concluded a covenant with central government, the four large municipal engineering offices, the Association of Regional Water Authorities, the Port Authorities, ProRail, seven large private engineering offices and seven infrastructure contractors, the Association of Water Engineers and the commodity supplying industry to obtain greater support while also allowing these parties to exercise more influence on education and research.

Louis de Quelerij, Dean of the Faculty of
Civil Engineering and Geosciences



RECENT PHD AWARDS

Subsurface iron and arsenic removal for drinking water treatment in Bangladesh ir. Doris van Halem



Arsenic contamination of shallow tube well drinking water is an urgent health problem in Bangladesh.

Current arsenic mitigation solutions, including (household) arsenic removal options, do not always provide a sustainable alternative for safe drinking water. A novel technology, Subsurface Arsenic Removal, relies on the existing technology of Subsurface Iron Removal. The principle of this technology is that aerated water is periodically injected into an anoxic or anaerobic aquifer through a tube well. The injection water partially displaces the original iron and arsenic containing groundwater. The oxygen-rich injection water oxidized adsorbed iron on the soil grains around the tube well. Once the flow direction is reversed, the oxidized iron provides adsorption sites for soluble iron and arsenic. Subsequently groundwater with reduced iron and arsenic concentrations can be abstracted. This technology has the potential to be an affordable, robust and chemical-free arsenic removal solution for decentralized application.

Large-scale turbulence structures in shallow separating flows Harmen Talstra



In this PhD thesis the dynamics of quasi two-dimensional turbulence structures in shallow separating flows have been

studied both experimentally and numerically. The research work contained three parts: respectively laboratory experiments, three-dimensional simulations and two-dimensional simulations. A number of schematized flow cases have been investigated in a large-scale shallow laboratory flume, using the free-surface measurement technique of Particle Image Velocimetry (PIV). Subsequently, detailed three-dimensional Large Eddy Simulations (LES) have been performed on a parallel cluster, providing useful 3D data on the flow cases studied experimentally as well as on additional flow geometries. The conclusions drawn are useful for e.g. design purposes in engineering practice. Finally, the flow cases studied before have been revisited by means of 2D depth-averaged computations, testing a new approach to accurately resolve large-scale shallow-flow turbulence in a 2D schematization. The new approach has been coined Depth-Averaged Navier-Stokes with Large Eddy Stimulation. The thesis offers a complete picture of the turbulent flow cases that have been studied, both in terms of physical behavior and numerical modeling aspects.

Details of other doctoral dissertations can be found at: <http://repository.tudelft.nl>

Alumnus ir. Dan Bekker:

“We should show more pride in our profession”

What's unusual about Dan Bekker is that he generally speaks in terms of 'we'. That is not so much because of a sense of modesty as because of Bekker's constant drive to find projects in which he can cooperate intensively with others. He first did that as a filmmaker, subsequently as a development aid worker and currently as an urban engineer with the municipality of Utrecht.



In January 2011, the municipal engineering agencies of the four major cities in the Netherlands presented a plan for a university study programme for urban engineers to the deans Rikus Eising of the University of Twente and Louis de Quelerij of TU Delft. In the foreground: Dan Bekker.

Civil Engineering was a term he was unfamiliar with when he started studying. He intended to become a filmmaker and to attend an academy in Italy. He was making 'no-budget' films with a group of 'enthusiasts from all corners of society' at that time. However, the film industry collapsed and a grant for Italy was no longer an option. Through a friend, he ended up at an open day at the faculty of Civil Engineering. When he was leafing through the brochure in the train home, he read: "As a civil engineer, you always work in a team as you jointly carry out projects". "That was something I was familiar with from filmmaking. I made up my mind there and then."

From nowhere to nowhere

Perhaps the caption "the Netherlands is still a work in progress" accompanying a picture of the Flevopolder during a lecture had something to do with it. Bekker remembers that students said with concern, "it may very well be completed soon". Thus the seeds of his interest in development aid were sown. "We did an internship

“With the new 3D options, civil engineering and film come together. It's a fantastic resource for participation.”

in Suriname on a railway going from nowhere to nowhere," says Bekker. "And a friend and I graduated on the Chama Mushota Causeway in Zambia." A colourful career in drinking water and wastewater in developing countries ensued. From Suriname, where as a conscientious objector he organised a congress, to digging water wells in Sierra Leone following a considerable stint in North Yemen. "There we re-

introduced the original Arabic toilet system, with separate discharge of urine and faeces for reuse as manure and for irrigation purposes. It was fantastic."

From wide to large

This Peter Stuyvesant life lasted until 1996. "At a certain point in time you realise that your relationships are put at risk if your lives move too far apart and that you don't see your children grow up." He ultimately succeeded in exchanging "the big wide world with a small amount of civil engineering for a small piece of the world with a large amount of civil engineering." The construction of the largest VINEX (housing development under the Fourth Policy Document on Physical Planning-Plus) location in the Netherlands - Leidsche Rijn - but also the high quality public transport plans and the station area drew him to the Utrecht municipal engineering office (IBU). "Another factor was that I wanted to tackle the question of how to implement the plans you have conceived." Since becoming head of IBU's urban engineers, he is now in the thick of things and his

funding flows. Each party is held accountable for its own budget which, in my opinion, is not an ideal situation. But in the light of the current cutbacks, we now have the opportunity to highlight the lifecycle approach and to show what something can yield calculated over its entire lifetime." IBU is presently working on the station area. The Catherijnebaan motorway section - also, in fact, a tract going 'from nowhere to nowhere' - will be opened for water. It is a gigantic project that will be completed in 2030. The results can be seen as a 3D animation.

Climate-proof city

And then we return to Bekker's initial passion: filmmaking. "With the new 3D options, civil engineering and film come together. It's a fantastic resource for participation. If you are creating something for the public space then you must act as facilitator and turn to the people involved. Internet and 3D simulations are an excellent way of doing that." His underlying motivation is, as always, cooperation. "I have 135 people here whom I would love to see coming to work with a smile on their face at least three times a week. I have been told that I can inspire and motivate people with my enthusiasm. And if you are motivated you can do practically anything. I learned that from my no-budget filmmaking days. I really believe in teamwork. A good team creates added value for itself."

His greatest challenge at present is the future of the city. "Challenges such as making the city climate-proof inspire us to find solutions through new techniques. It's the same kind of passion I felt in Yemen introducing the sun boilers. I truly believe that you can create a better society with technology."

Urban engineer programme

As head of IBU, Bekker is a strong advocate of an urban engineering study programme. "In addition to good theorists, you also need people

- Secondary school: Gymnasium β , 1973, Arnhem
- Graduated: General Civil Engineering, 1981; Business Administration, 1999
- 1999 - present Department Head at IBU Urban Engineers, Municipal Works, Municipality of Utrecht
- 1996 - 1999 Bureau Manager / Deputy Department Head of Engineering Office, City Management Department, Municipality of Utrecht
- 1987 - 1996 Advisor in the field of drinking and wastewater and Project Manager at IWACO B.V., Advisory Agency for Water and Environment, Department of International Projects, Rotterdam
- 1984 - 1987 Assistant Expert at the Ministry of Foreign Affairs, Directorate-General for International Cooperation, The Hague. Stationed in North Yemen, Rada Rural Development Project.
- 1983 - 1984 Junior Advisor at Euroconsult B.V., Arnhem
- 1981 - 1983 Coordinator of Foreign Civil Engineering Committee, TU Delft
- 1979 Assistant Hydrologist at DHV Consulting Engineers, Amersfoort
- Civil status: Married with two sons



skilled in the different facets of civil engineering in order to have an overall view of the city's integral interests. You have to design a package in order to get those types of people. As G4 (the co-operative venture between the four major Dutch cities of Amsterdam, The Hague, Rotterdam and Utrecht), we try to stimulate that. The competencies you need as an engineer are changing. You have to be able to talk to people as well as being capable of overseeing people from a range of disciplines."

His dreams, Bekker concludes, have largely been realised. He looks back with pleasure and - he hesitatingly adds - pride on what he has accomplished. Also because from time to time he hears that his efforts in developing countries are still showing results.

"Actually, yes, pride is very important," he admits. "We should in fact be widely celebrating the fact that our profession is so rewarding. We don't just cause obstructions; we also make amazingly beautiful things that you can touch and see and that are moreover extremely useful."

Regiolab Delft: successful cooperation in action

Since 1999, TU Delft has been working with road managers and industrial parties on the Regiolab Delft project. The aim of this cooperation is to collect traffic data for research purposes. According to Hans van Lint, associate professor at the Transport & Planning department and the man behind Regiolab Delft, the project has already resulted in much new knowledge.

"When Regiolab Delft got started, our approach was unique. All kinds of traffic data were collected but each road manager did that individually and the data from the different managers were not combined. We were the first to decide to collate the real time data of all relevant roads in a region and look at them as a whole. That was the logical way to go about things, we felt. After all, if you want to manage traffic in a region, you can't base your approach on traffic data about the regional motorways alone. You also need information on the situation at the local and provincial levels. In order to gain that overall picture, we started working with the three road managers

in the Delft region - the municipality of Delft, the province of Zuid-Holland and Rijkswaterstaat - as well as several industrial partners, such as suppliers of measuring technologies."

Predicting travelling times

"Now, more than ten years' later, our cooperation is a scientific success. The analysis of traffic movement in and around Delft has, for instance, led to a series of new traffic models. Models with which, for example, we can pretty accurately predict travelling times. We have also gained greater insight into the choices drivers make to get to and from their destinations and what occurrences can influence these choices. We furthermore learned

Regiolab Delft makes the traffic data collected, as well as several algorithms, available for research purposes

a lot about optimising the utilisation factor of roads through dynamic traffic management using measures such as entry point calming, dynamic speed limits and informing drivers about alternative routes and anticipated travelling times. Such knowledge is extremely relevant to road managers."



Earning money

"For me, the most interesting outcome is that two of our graduates are going to try to make money with the knowledge that was developed within Regiolab Delft. Analogous to the shower radar, they want to market a traffic jam radar. That's a website that not only shows the current traffic situation but also predicts the situation in an hour's time. What makes it so good is that the predictions are based on up-to-date traffic data, such as the number of cars driving on local and provincial road networks leading to the motorway and

on which sections of the motorway the maximum capacity has been reached. This approach means that reliable predictions can be made."

Trying out

"We are now developing a real-time traffic simulation model that approximates the actual situation as closely as possible. We are working on it with other parties such as the National Institute of Informatics in Tokyo and the Queensland University of Technology in Brisbane, Australia. What makes this model so attractive

is that it offers an environment in which we can try out all kinds of new control algorithms, increasing our knowledge of the operation of traffic systems even further."

Further information

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In rounding off his nine years as Dean of the faculty of Civil Engineering and Geosciences, Louis de Quelerij wants to take one more opportunity to underscore the importance of this subject by holding an afternoon symposium. A significant portion of the symposium's programme has been earmarked for an interactive debate with the public, enabling the market, the government, knowledge institutes and students to dissect this issue to its bare bones. The new Dean of the faculty, Bert Geerken, will also be in attendance and will be presented with his first inaugural gift: our combined brainpower.

Golden Triangle or Bermuda Triangle?

Cooperation between market, government and universities: **opportunity or threat?** That is the theme of the **farewell symposium by Dean Louis de Quelerij** on 1 December 2011

"It is by trial and error that we chart our course in search of the golden triangle. But will this quest end in success? Does research improve through the intervention of the market, or are we striking at the foundations of real innovations that hinge on freedom of thought? Are we producing better engineers as a result of sector influences on our education, or will we ultimately end up with broad-spectrum theorists who can barely add or subtract?"

I am an impassioned advocate of more intensive collaboration between universities, government and market. And I believe that it is, in fact, in this partnership that the opportunities for true innovations lie. By investing in knowledge development, Dutch companies and the government can excel as leaders in the international market. No fleeting relationship, therefore, but a long-term commitment between science and society," according to Louis de Quelerij.



To register for this symposium, please visit: www.citg.tudelft.nl/afschiedssymposium



Urban water discharge high on research agenda



How can we prevent heavy showers from leading to flooding in our cities? What are the options for increasing sewerage management efficiency? And what form will the urban water chain of the future take? To answer these types of urgent questions, various projects are being carried out by researchers of the Water Management and Sanitary Engineering department. We spoke to three of them: Jeroen Langeveld, Marie-Claire ten Veldhuis and Jojanneke Dirksen.

Knowledge is crucial for more effective sewerage management

If you look at the sewerage sector you notice that a lot seems to happen by rule of thumb", says Jeroen Langeveld, associate professor of Urban Drainage and director of the knowledge programme of the same name. "Street gullies are cleaned once a year and sewerage inspections take place every seven years - we don't know if that is an optimal frequency but that's just the way things work. And that not only applies to cleaning the gullies and the sewerage inspections, but to practically all activities."

Savings

"For decades, there was no apparent reason to take a critical look at those rules of thumb. Now however, there are quite a few. For example, in the administrative agreement Water met Vuur ('Water with Fire'), it was set out that the effectiveness of sewerage care must be increased. The sector will have to save more annually in order to realize savings of 380 million euros by 2020. At the same time, the sector must anticipate the effect of climate change, such as heavier showers, as well as realising environmental targets. In the latter

case, this concerns the reduction of energy consumption and the re-processing of useful substances in wastewater, such as phosphate."

Four themes

"In practice, this means that the sector has to do more on the same or an even lower budget. Such efficiency improvements require that you are thoroughly familiar with the system's workings. That is, after all, a prerequisite for optimisation. With the Urban Drainage knowledge programme, we are developing the know-how that the sector needs to realise that. The programme has four themes: asset management, operational management, the dynamics of sewerage systems and the water chain of the future."

Replacement window

"Asset management is primarily concerned with replacing the sewerage system. That is a gigantic outlay for municipalities. At national level, this requires an amount of around 600 million euros annually. We are investigating which information on the state of the sewerage system is needed to determine when a convenient window for replacement arises. How can you tell if a sewerage system is approaching the end of its useful life, and how can you measure that? Inspections are now primarily taking place using cameras that are transported around the sewers. But apart from the unlikelihood of observing each and every weak point, is there not also the chance that errors may arise in interpreting the images? That's why we are also looking at other methods of measuring and inspecting. Subsidence measurements in areas with soft soil, for example, can provide valuable information."

Sewerage management

"Operational management looks at ways to improve sewerage management. That first entails primarily studying the 'forgotten' elements of sewerage systems - the street gullies and household connections. One aspect we are examining is the effect that blocked gullies have on discharge capacity. We are also looking at how subsiding and broken household connections affect sewerage operations. Defective household

connections can lead to the release of sand in the system, for example, and to a disruption in the effective ventilation of the sewerage system. All these negative effects can perhaps be solved through simple management interventions."

Smart measuring

"The third research theme - the dynamics of sewerage systems - follows on from existing research. Within this theme we are studying how we can gain insight into the dynamics of sewerage systems and their influence on wastewater purification, surface-water quality and flooding by means of smart measuring and monitoring. At what percentage of rainfall does water flow from the sewers through so-called overflow structures and reach the surface water? What effect does that have on the quality of the surface water? And to what extent does a wastewater purification installation's efficiency decline if tons of rainwater are discharged through the sewers? Knowing the answers to these types of questions means that you can determine, for instance, if it is worthwhile creating additional storage

capacity. Long-term measurement projects can also give us insight into the effects of climate change."

Hormone disrupting substances

"The water chain of the future is the fourth focal point within the project. Assuming that hormone disrupting substances could form a real problem in the drinking water supply, it may be necessary to capture urine - the most important source of these substances - and discharge and purify it separately. The question is what the best way to do that is. Another subject within this theme is how we can optimally prepare the urban water system for climate change."

Highly educated professionals

Langeveld continues: "Naturally knowledge development takes priority in the research programme. That is not the only goal, however. We hope that with our knowledge agenda we can interest more graduates and PhD students for this discipline, as there is an urgent need for more highly educated professionals within the sector."



"Assuming that hormone disrupting substances could form a real problem in the drinking water supply, it may be necessary to capture urine - the most important source of these substances - and discharge and purify it separately."



Better sewerage management through subsidence measurements

By regularly carrying out subsidence measurements, sewerage managers gain greater insight into the operation of their sewerage system, leading to improved management, according to Jojanneke Dirksen. She is researching the optimisation of the sewerage system at WaterNet in Amsterdam for her PhD. "Visual inspections with cameras have their drawbacks, so that's why it's a good idea to examine the state of the sewerage systems in other ways. In areas with soft soil, subsidence measurements can provide useful information, particularly if carried out with a certain frequency. That gives

you insight into the process of subsidence and allows you to determine maintenance times. In Amsterdam, our measurements include gauging the height of the inspection drains to see how they subside in comparison to each other. If necessary, we also verify the gradient of the sewerage pipes between the drains. That gives us a good idea where, for instance, the bottlenecks in the slope are located. Silt can pile up at these types of locations and ultimately lead to blockages. If you know where these weak spots are then you can prevent such problems with targeted management action."

How do we keep our cities dry?

Heavy showers that produce dense rainfall in a short space of time is a phenomenon we are more frequently facing owing to climate change. Particularly in urban areas, with their many paved surfaces, these downpours can lead to flooding. Marie-Claire ten Veldhuis, assistant professor at the department of Water Management, studies which places are vulnerable in case of peaks in downfall and how the consequences in these 'critical spots' can be minimised.

Ten Veldhuis has been carrying out research into urban water management for quite some time. For her graduation research - which she completed in May 2010 - she investigated flooding in Dutch cities. To determine how often flooding occurs in urban areas, Ten Veldhuis analysed thousands of reports made by inhabitants to municipal

Resilience Technology, Systems and Tools (SMARTeST). TU Delft works alongside research institutions from seven other countries in this project. The aim is not only to develop solutions to protect cities from flooding,

“Alternatives for discharging rainfall via the sewerage system are, for instance, the use of permeable paving and the installation of drainage systems so that the water can be partially stored underground.”

but also to increase the resilience of urban water management systems. The various participants each research a specific element of the project. “We look at flooding caused by rainfall,”

you need detailed rainfall predictions. Owing to the large area covered by paved surfaces in urban locations, a peak in rainfall almost immediately leads to a peak in water discharge. So you can only anticipate such a

peak if you know in advance where and when a lot of rain is going to fall. In view of the fact that, up to now, weather stations have always taken their measurements in rural areas, information for cities was lacking.”



reporting points. She studied the reports made in two medium-sized cities and deduced the probable causes of the flooding.

Blocked drains

The analysis resulted in some unexpected conclusions. For instance, it appeared that flooding in cities occurs far more often than the standards allow. It also emerged that the discharge flow capacity is almost always sufficient to discharge the rainwater. The fact that flooding nevertheless occurs can be attributed to blocked drains - so-called street gullies - or to silt-clogged sewerage pipes. Ten Veldhuis: “If you want to reduce

explains ten Veldhuis, “whereas others examine flooding caused by rivers that have breached their banks. Others again are looking, along with the industry in some cases, into smart technologies to prevent flooding. A method of quickly sealing off cellars, for example, or embankments that automatically rise in the event of rising water levels, as well as technologies to build in wet- and water-proof ways. All these solutions will be collected in a kind of catalogue.”

Damage reports

“Our contribution comprises research into the damage caused by flooding. A PhD student is looking at reports of

“If you want to reduce flooding in cities, you are therefore better off investing in maintaining the sewerage system than in expanding capacity.”

flooding in cities, you are therefore better off investing in maintaining the sewerage system than in expanding capacity. That sounds simpler than it is. A medium-sized town such as Haarlem currently has around 80,000 street gullies. You can't start an intensive programme of maintenance for all 80,000, so you have to identify which locations are vulnerable to blocking and why.”

Resilience

Urban flooding is also the focus of the European research project Smart

damage submitted to insurance companies and the relationship between those cases and the amount of rainfall and, for example, the ground level. In this way we hope to explain major and frequently occurring damage. After all, if we know what causes damage, we can then consult the 'catalogue' and see which measures are open to us to prevent or reduce that damage.”

Predicting rainfall

Ten Veldhuis continues: “If you want to avoid flooding and the ensuing damage in cities as much as possible, then

Rain radar

The objective of the RainGain project, which is being financed at the European level, is to change all that. TU Delft works together with British, Belgian and French parties in this project. Other Dutch parties are the municipalities of Rotterdam and the province of Zuid-Holland. Among other things, the project entails placing a special rain radar in Rotterdam. This radar covers an area with a radius of around thirty kilometres and has a far higher resolution than the rainfall radar of the Royal Netherlands Meteorological Institute KNMI. It can therefore lead to greater insight into local rainfall and can be used to determine, for example, whether a heavy shower is in fact the cause of the Coolsingel flooding.

Optimising

“We start by 'tuning' the radar. If we know which buttons we should turn to get the right information and can properly predict local rainfall, then we will be moving on to study the next step in optimising water management. For instance, is it possible to discharge certain volumes of water shortly before a shower so that the discharge capacity of the sewerage system is at maximum during a downpour? Or can you make use of temporary water storage to cope with the peak, such as the 'water squares' envisaged by Rotterdam?”

Challenge

“I hope that in the course of things we will also gain insight into the vulnerable spots in the city where optimising water management has an insufficient effect and the chance of flooding is high. We will have to find alternatives for discharging rainfall via the sewerage system for such places. The use of permeable paving, for instance, and the installation of drainage systems so that the water can be partially stored underground. This is already normal practice in newly erected neighbourhoods and I'm convinced that we will ultimately be shifting towards using these types of solutions for practically everything. The issue is how to switch to other kinds of discharge systems in existing urban areas where discharge occurs via the sewerage system.”

NEW PROFESSORSHIPS

Prof.dr. Steen A. Petersen
Chair Geoscience Integration



Normally the concept of Modern Times is linked to the introduction of the assembly line within manufacturing industries (for cars and similar products). Parts of the Oil & Gas industry operate along assembly lines, mainly those producing hardware components like instruments, platforms, boats etc. Another and as important part analyses measured field observations for the subsurface reconstruction in

order to forecast benefit or hazards due to human activities in the subsurface. This upstream part dominated by diverse strategies, workflows, concepts, implementations, (Earth Factories in general) is resembling in a way the situation of normal production prior to Modern Times. The question on how to unite, organise and visualise Earth Factories along a common assembly line is addressed in the inaugural speech.

The line is supported by two principles. The first principle says that (sparse) material or immaterial observations (continuums) are linked by processes causally. In order to reconstruct the subsurface a continuous sequence of artificial continuums and processes are created in such a way that a sparse set of these continuums simulates the continuums of the observation domain, which is the second principle. What now unites the Earth Factories is the Time Line across which simulated or observed continuums are compared. Along the Time Line we recognize traditional, now proper integrated, earth sciences disciplines like geology, geophysics, production engineering, drilling.

Prof. Jan Peter van der Hoek
Drinking Water Engineering -
Technology selection in relation to water quality



The primary focus of this research is the threat to the supply of drinking water resulting from emerging substances: these are new substances that are being found in drinking water wells such as residual pesticides and medicines, personal care products, artificial sweeteners, etc. Many purification processes can remove these substances, but owing to improved analytical methods, more and more of these substances can now be

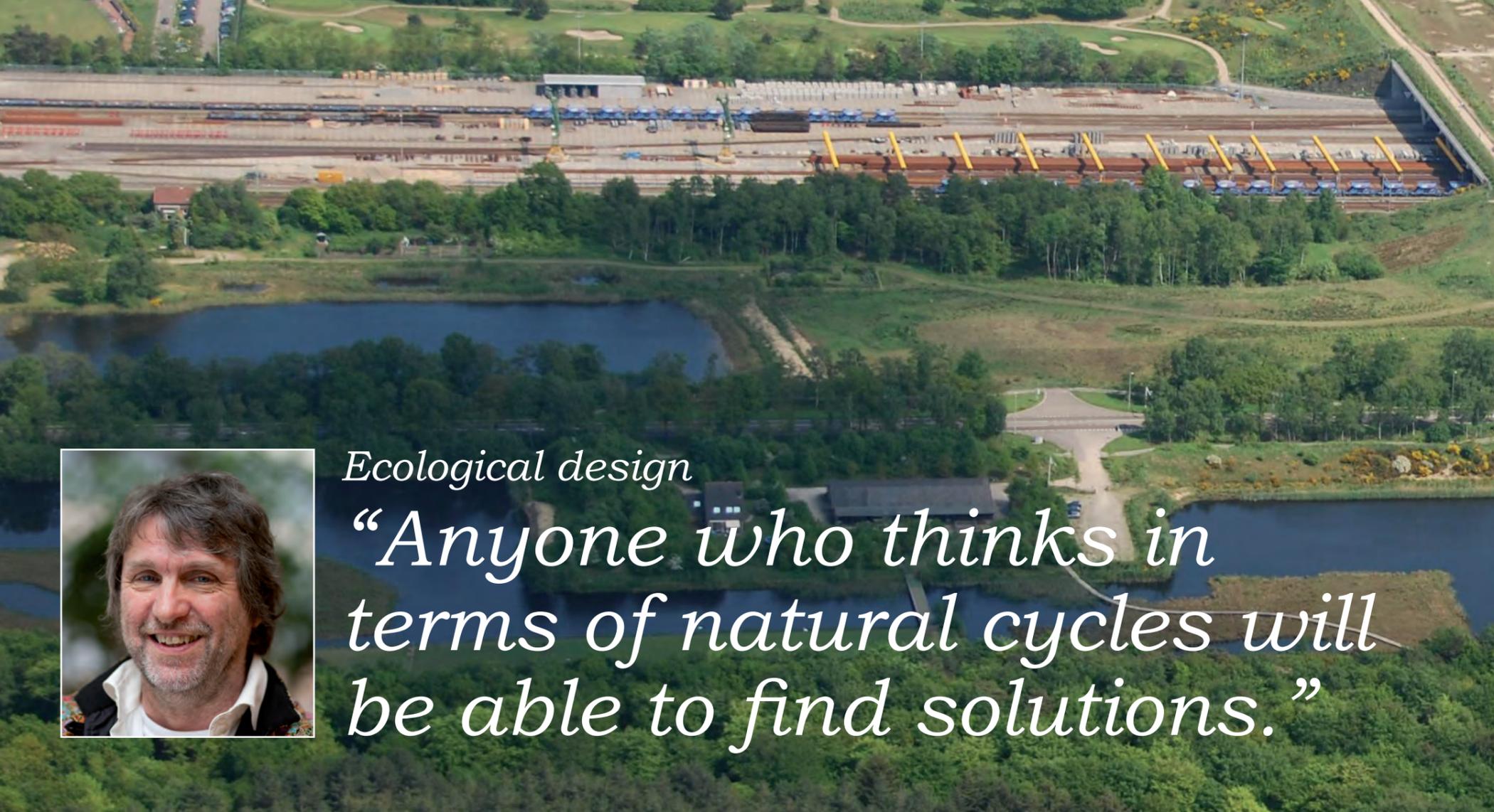
detected. That may undermine consumers' trust in the tap water. The question therefore is, how do these substances behave in the purification process, and can you predict behaviour on the basis of a substance's characteristics? If we know how they behave, can we then design an optimal purification system?

The research also looks at the effect of climate change on (the quality of) drinking water. Climate change causes a rise in water temperatures; surface water in particular is affected. As drinking water is prepared from surface water, what is then the effect on the quality of the drinking water that eventually flows from consumers' taps? And where are the effects making themselves felt? Is it at the sources, during purification or in the distribution network? And what can we do to maintain the quality of the drinking water?

A third aspect of the research is an element entitled 'drinking water supply 2.0'. In the Netherlands we have a centralized drinking water supply. A growing interest can be observed among those involved in the entire water cycle in decentralised concepts such as water supply at the district or even lower level. How can the supply of drinking water be adapted to suit such scenarios?



Further information
www.intreeredes.citg.tudelft.nl



Ecological design

“Anyone who thinks in terms of natural cycles will be able to find solutions.”

Nowadays, every company is sustainable. But sustainability to most people is often limited to CO₂ emission. A misunderstanding, believes Prof. Michiel Haas. “If you only focus on CO₂, then you are ignoring countless other opportunities for sustainable operations.” Ecological design means basing one’s thinking on the natural cycle of the entire biotope. And the poor shape of the economy need not necessarily form an obstacle. A symposium on the subject has been planned to inform interested parties.

Larger ecological structure

It’s difficult not to get swept away when you hear Michiel Haas speak with such passion. His company NIBE - Netherlands Institute for Building Biology and Ecology - is established in one of the most sustainable business properties in the Netherlands, a water tower near the Bussum-Zuid train station which is entirely self-sufficient. NIBE has been operating for 20 years, demonstrating that ecological building is not a new phenomenon, but one which many cities and municipalities are barely familiar with, despite the numerous advantages. “We will therefore be providing information on urban and rural ecological design during the symposium. This is very important, as it can form a basis for policy.” But it is also treading on thin ice, as the current central government’s administration has abandoned much of its ecological policy or left it in the hands of municipalities. “Take the larger ecological framework in which the different natural environments are linked together,” Michiel continues. “This ensures that species can propagate and remain genetically

strong. An influx will occur, often also leading to the arrival of more animals. The larger ecological framework has been a well-known fact at the European level for years and much has been achieved. Now, however, central government has pulled the rug from under our feet and matters are down to lower governments and volunteers. This is not the direction we should be taking. You could also decide to put a halt to further investments but still allow projects to run their full course as far as possible.”

New avenues of thought

Haas is clearly concerned. “We’re neglecting something that doesn’t even involve money. You can achieve a lot simply by setting out a longer-term policy. If you abandon that, then you also abandon a great deal more. What, for example? Well to start with, the idea that we want our grandchildren to be able to enjoy the things to which we ourselves now attach great value. Or that our grandchildren have the freedom to decide for themselves how they wish to shape their environment.”

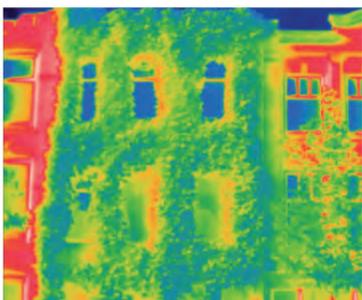
These are messages he also hopes to bring home during the symposium. To make it clear that a focus - a longer-term vision - is perhaps even more important than immediately making funds available. A vision is crucial but, as he is aware, does require entertaining new avenues of thought. “To fully realise, for example, what impact a new road or building will have on its immediate environment, you need to work with an ecologist. While I can nurture awareness among my first year students, it is our society that in fact needs a wake-up call. Particularly among policy makers at municipalities and businesses. Often it isn’t a matter of expenditure and can even lead to a drastic reduction of the participation procedure. There are so many opportunities for win-win situations.” A focus on nature, for example, produces visible results. Michiel points to initiatives such as Das en Boom (‘Badger and Tree’) which has resulted in a noticeably increasing badger population. Or the focus on water pollution - now no longer a major problem in the Netherlands, where

Man belongs in a biotope

The urban biotope is becoming larger, putting demands on the city. The quality of the air has to be good, people should feel at home there and the ecological footprint also has to stay within acceptable limits. Not only animals and plants but man, too, forms part of the biotope. “But that’s where things are going wrong, as people do not feel that they also have a place the biotope. In their view ‘there is man and there is nature’. They forget that we are one of the youngest species on earth,” says Amsterdam’s urban ecologist Martin Melchers.

Ecological building can be briefly summed up as building from the perspective of natural cycles. That involves taking the entire biotope into account - man, animals and plants - so each party benefits from the other. An example is the cooling of warmed-up cities. The temperature in cities is six to eight degrees higher than rural areas, as many elements of the urban environment (black roofs, paved areas) retain heat. By increasing the amount of vegetation in the city - literally through plants on external walls and roofs - the temperature can be lowered by four to six degrees. Plants absorb heat, meaning that less cooling is required and CO₂ emission is lower. That is both sustainable and ecological, as nature benefits too. Insects assemble in green areas and with them come more birds. Nature returns to the city, where not so long ago it had to increasingly make way for development.

Traditional facades (on the left and right side of the green building) accumulate more radiant heat (red) than the green facade.



Temporary accommodations for nature

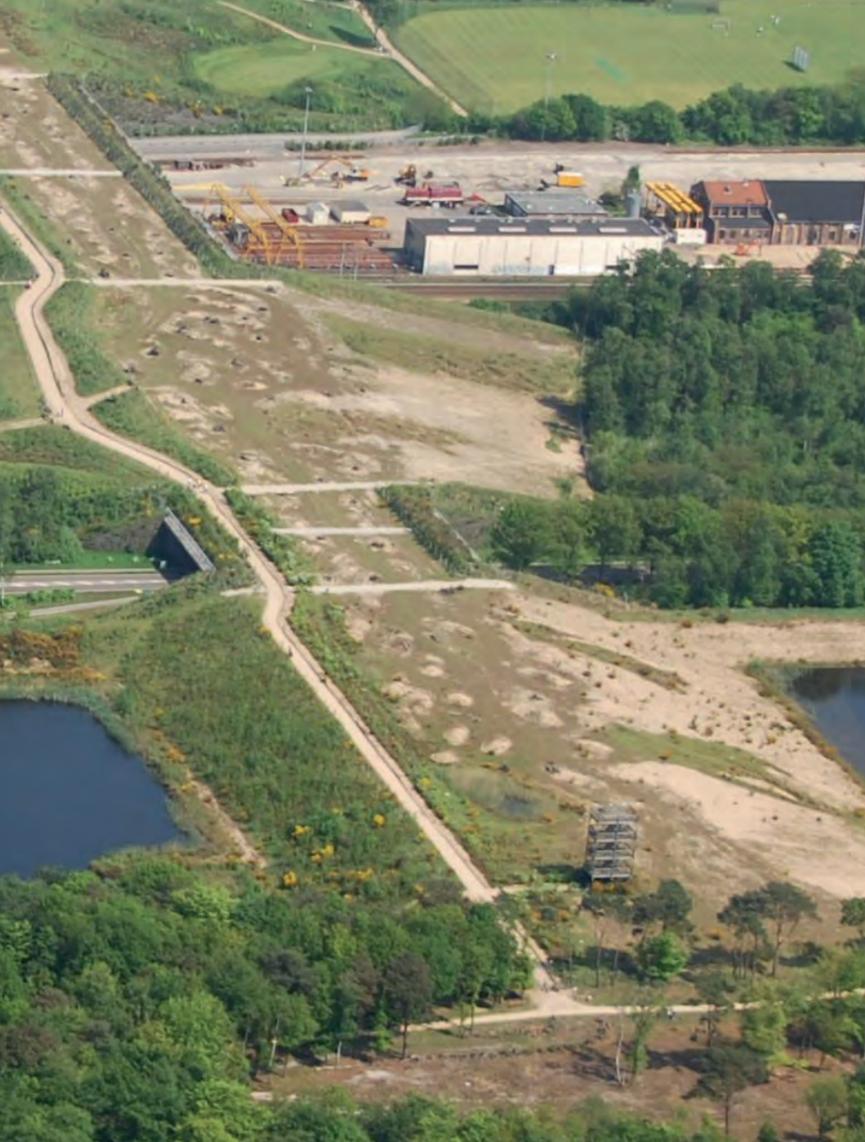
Temporarily returning disused areas to nature is gradually starting to gain ground in the Netherlands. For Martin Melchers, Amsterdam’s urban ecologist and one of the speakers at the symposium, it’s all in a day’s work.

Vacant sites awaiting financing detract from spatial orderliness. Nature is ‘squatting’ in such areas, providing a new habitat for a diversity of plants and animals. This prompted the Dutch Ministry of Economic Affairs, Agriculture and Innovation (formerly the Ministry of Agriculture, Nature and Food Quality) to initiate the Tijdelijke Natuur (‘Temporary Nature’) project, in which ecologists transform vacant areas into more attractive temporary

habitats for animals and plants as well as for the enjoyment of people living in the neighbourhood.

Melchers: “I carried out a zero measurement on a disused plot of land in the port of Amsterdam. I then made it more inviting for the animals I know from the port area by, for instance, digging a pond, landscaping it with some bare hillocks and removing a sand hill. And with results: in the spring it appeared that natterjack toads, breeding pairs of little ringed plovers, sand martins, skylarks, blue throats and butterflies nestled there. It has become an attractive site, where I take people on excursions and show them how you can entice nature with a minimum of resources.”

The areas are temporary, however - that is legally cut and dried. Melchers can therefore expect to receive a telephone call any day informing him that the area has to be closed down. “But I can relocate animals and plants. There is always another temporary accommodation for nature that I can make use of. It was unique but now there are several projects. People have realised that it’s not something to be wary of. It represents temporary added value and moreover works as a seed bank for nature. And it was also enjoyable for people. The port area covers a fifth of the city’s surface area, yet few people visit it. But that is now changing, with excursions and recreational cycling routes in the area.”



Green facades improve the city

Green facades are on the up and up. No wonder, as vertical vegetation improves the insulation properties of buildings and provides more biodiversity. And apart from the aesthetic and social added value, it also reduces air pollution.

Green facades and roofs are a trend in building. Researcher Marc Ottelé graduated last June on the theme of vertical vegetation. He demonstrated that plants on facades provide better cooling and insulation and moreover absorb fine dust. And that is a bonus for public health, as fine dust particles are breathed deep into the respiratory tracts and can cause health problems. Fine dust in densely populated urban areas is particularly problematic.

Research into green facades is taking place worldwide. The developments follow each other in quick succession as green facades appear to offer major added value. France (the home of the green facades) and Germany are taking the lead but in the Netherlands, too, more and more green facades are emerging.

The Eneco building in Rotterdam, for example, is an early example of the use of green facades and more projects are being realised in this city in the coming period.

There are two types of green facades. Facades covered with climbing plants have been around for some time; so-called 'living wall' systems are a more modern version. These are integrated or prefab systems that are attached to a construction or supporting frame in which the plants take root. This is quite a new technology, on which little research has been carried out but which is also suitable for horticulture. Pipelines for water and nutrients can be installed. There is even a strawberry wall in Australia.

Green facades and roofs add value to densely populated cities where there is little space for parks. Green roofs can, in addition, be used to form a

water buffer, an application that is becoming increasingly important. In addition to the aesthetic aspect, green facades and roofs create greater biodiversity and reunite man with nature.

A disadvantage is that these systems are still quite expensive to install and maintain. But as green roofs preceded green facades, developments are now accelerating rapidly and production optimisation should proceed quickly. Ottelé: "I see that young people starting out at work are eager to apply the technology. It's becoming a well established trend. Clients, and also designers, are now making greater demands for green facades and roofs. There are simply so many practical advantages for man and the city, making it a real win-win situation, particularly in view of the increasing warming up of cities."

rivers and lakes are again full of life. So we are on the right track. But you cannot decide 'to put things on hold' simply because of economic headwind. The pace need not be the same but awareness is essential."

Generating material

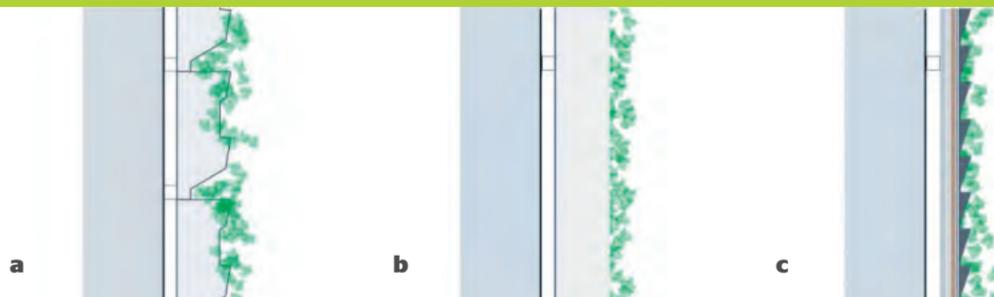
Ecological building is not restricted to adding more vegetation in and around the city or creating more natural areas. Another example of ecological thinking is combining companies to facilitate the reuse of energy. The residual heat from cooling supermarkets can provide 600 households with hot water. A swimming pool next to a skating rink creates an opportunity to save half the energy required through the smart use of energy. "These kinds of combinations will become a necessity if you want to generate energy sustainably. That is something you can reflect on as a municipality and align your policy with." The energy problem can be solved; Haas estimates it will take another ten to twenty years. "Then, however, a new problem will arise, that also requires ecological thinking: material scarcity. We can reduce our environmental burden in the field of energy but we can go no further than a factor of two or three where materials are concerned. And that is too little. That is something we should be thinking about now, as in twenty years' time it will be too late." A novel idea is the investigation into whether materials, analogous to energy, can be generated. "You can grow wood on your exterior walls with a view to your future accommodation. That's viewing things from the longer term perspective. But nature can offer us more. Bamboo, for example, can replace a lot of wood. Say, for instance, that we plant bamboo in all the median strips of our motorways, that would give us annual or biannual crops of materials and in the meantime we can make our motorways attractive while also reducing the blinding effect of the lights of cars on the opposite side. But there are so many areas for opportunities to create win-win situations by thinking in terms of natural cycles. Recycling metal and

concrete, for example, so that they continue to be used in the natural cycle." The process of awareness still has quite some way to go, he believes, although it is now being applied in rural environments. That is exactly what he means when he speaks of focus. "You should be concentrating on ecology and the natural cycle - the bigger picture. That way you arrive naturally at solutions."

Bigger picture

Despite faltering government policy, Haas sees many positive developments. "There is a growing awareness. Look at organic vegetables in the supermarket. Surely that is a sign that we want to move in a sustainable direction together. The next step is to motivate early adopters to carry the torch. That is emerging sporadically in infrastructure and building. Municipalities such as Apeldoorn and Tilburg are taking the lead. But it should be promoted on a much wider scale and take priority in policy. In the same way that the energy performance coefficient currently forms an important departure point in building policy, in 2012 a system for building materials will likewise be introduced. It's gradually catching on, but there is still a lot of hard work to be done as, generally speaking, rules and regulations always lag behind social developments."

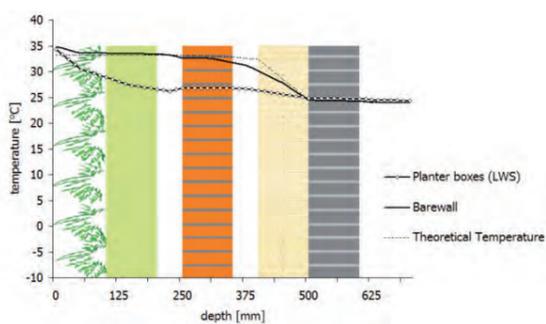
But having people who can view the larger picture and who incorporate all aspects of this professional field is an important factor for success. That kind of vision is somewhat lacking within the universities, Haas believes. "Nowadays, it's not just about building a sound and attractive bridge, you need the insights of other disciplines, such as public administration, architecture, ecology, communication sciences et cetera. These are among the disciplines that should be involved. After all, lots of people know a lot about something. Viewing a project in its totality, being aware of the options and knowing what to make use of is the road to success. It is this bigger picture that we wish to convey during the symposium."



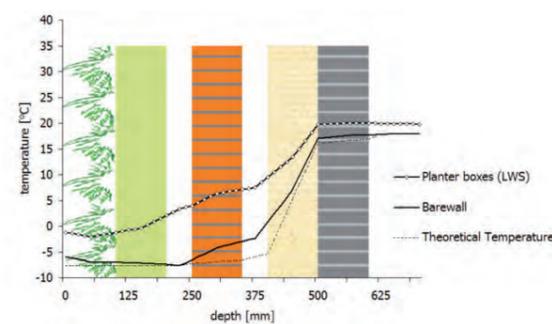
Typical configuration of prefab growing modules (a) on the basis of flower boxes (Greenwave systems), (b) living wall system on the basis of a foam growing medium (Fytowall), (c) living wall system on the basis of layers of felt (Copijn landschaparchitecten).



Real-world example of the abovementioned living wall systems (a) on the basis of flower boxes (Greenwave systems), (b) on the basis of a foam growing medium (Fytowall) and (c) on the basis of layers of felt (Copijn landschaparchitecten).



Measured temperatures of an ordinary cavity wall and a cavity wall with a living wall system (flower boxes) in a climate room on a simulated summer's day (35°C). The temperature difference in the outer leaf (red layer in the figure) amounts to approximately 10°C.



The measured temperature of an ordinary cavity wall and a cavity wall with a living wall system (flower boxes) in a climate room on a simulated winter's day (-5°C). The temperature difference in the outer leaf (red layer in the figure) amounts to approximately 9°C.



New director for Geotechnology department

For nine years, professor of applied geology Stefan Luthi headed up the Geotechnology department. He was succeeded on 1 September 2011 by Jan Dirk Jansen, professor of systems and control engineering for oil and gas reserves. We spoke to both men on the operation of the department, the research spearheads, the cooperation with the business community and the plans for the future.

"On reflection, I think that the quality of our academic staff has clearly risen in the past ten years", says Luthi. "We have a lot of excellent people and have become more international; not only do we have more foreign staff members, the number of international students has increased too. And given the strong global character of our discipline, this is an appropriate development."

Increasing number of students

Jansen adds: "What I find very pleasing is that we not only operate effectively at the scientific level, but are also successful at the interpersonal level. Most of the people in the department get on well together and there are no long-term feuds. Another positive factor is that for a number of years now, we have been seeing a growing number of first-year students. Our new building, with its modern laboratories and teaching rooms, which we moved into in 2007 has most certainly contributed

to that increase as well as the augmented oil prices and the starting salaries in the sector."

Financially healthy

When Luthi started out as department director in 2002, he was confronted with the ongoing decline in government funding budgets and for Jansen, too, this will be difficult to get around. Ensuring that the department is financially healthy is therefore the new department director's most urgent task. Jansen: "Following the repositioning of our faculty, we were faced with a gap in our budget owing to the TU Delft-wide revision operation. That is demanding a great deal of effort at the moment. I'm convinced, however, that we will have sufficient budget within the longer term. Up to now, we have always succeeded in compensating the decline

"I am convinced that it is also worthwhile for our faculty to interact with other TU Delft faculties. There is a lot of very useful information in our immediate environment."

of government funding with additional financing from the government through a funding allocation agency and by contracts with third parties. Now approximately two-thirds of our total budget comes from the latter two sources."

Pioneering

"There are a number of reasons for our success in obtaining funding", explains Luthi. "The most important is that we have been carrying out pioneering research for years, leading

to high-quality and useful knowledge. The industrial sector sees and values that and has a high opinion of the quality of our graduates. That means that we are regularly approached by companies requesting us to join forces with them. In recent years, for example, we worked with Shell, Statoil, Eni, ExxonMobil, BP, Maersk, Total and Petrosas."

Prominent role

Jansen: "Another reason is our participation in major research programmes. We take part in various projects of the top Dutch research school Integrated Solid Earth Science. We also play a prominent role in the research programmes Recovery Factory and ISAPP 2, both of which are aimed at developing technology to extract more oil and gas from underground

reservoirs. Participating in these types of programmes gives us the opportunity to optimise our expertise in specific areas and hence our reputation in these fields. And that again is important in obtaining new research funding. In the coming years I therefore intend to expand our participation in large research programmes."

Objectives

"There won't be any major shifts in our research objectives in the coming

years," Jansen continues. "Enhanced oil recovery and smart fields will always play an important role in petroleum engineering. We will also be going ahead with our research into new geophysical technologies, gas hydrates, shale gas and coal gas. Underground CO₂ storage and geothermal energy will also remain at the forefront of our research. Our geo-engineering research group will pursue their focus on soil mechanics, foundation technology and underground building. We will also be concentrating on geo-environmental engineering. Last year, we obtained funding from STW for our research programme 'Bio based geo- and civil engineering'. A new aspect of our research will be picking up where we left off with resource engineering."

Cooperation

"A theme which I, as department director, will be promoting strongly is cooperation. From long experience within our department, we have seen that joint efforts of research groups with a pronounced engineering leaning with those more closely engaged in fundamental research has been particularly fruitful. I am convinced that it is also worthwhile for our faculty to interact with other TU Delft faculties. There is a lot of very useful information in our immediate environment. Furthermore, cooperation offers the opportunity of examining issues at an integral level. To achieve results in our research into the oil and gas industry we not only need technical expertise outside the field of geotechnolgy, we also have to look at the social issues, such as the effects on the environment. That is greatly facilitated if you can work together with neighbouring faculties that have expertise in such areas."

Name:

STEFAN LUTHI

Stefan Luthi is 61. He completed his Applied Sciences study in 1973 at the ETH Zürich and graduated there in 1978 as a geologist on the mechanics of turbidity currents. Stefan has worked for more than twenty years in various positions at Schlumberger. Since 1999, he has been professor of Production Geology at TU Delft. In addition, he is senior technical advisor at Schlumberger. From 2002 to September 2011, he was department director. Stefan will again be fully focussing on research into sedimentological processes.

Name:

JAN DIRK JANSEN

Jan Dirk Jansen is 53. He studied Civil Engineering and obtained his MSc in 1986. Following his graduation, he took up a position as researcher at Shell. In 1993 he obtained his doctorate on nonlinear dynamics of oil well drill strings. Having obtained his PhD, Jan Dirk held a number of different positions at Shell. In 1999, as a researcher he obtained a joint appointment at Shell and TU Delft. His research looked at smart wells and smart fields, during which period he spent half his time at Shell and half at TU Delft. As part of this arrangement, Jan Dirk was appointed professor of Reservoir Systems & Control at the department of Geotechnolgy. Since September he has held the position of department head and is now fully employed by TU Delft.

COLOPHON

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