



CONTACT

Faculty of Civil Engineering and Geosciences
Stevinweg 1, 2628 CN Delft
Tel. +31 15 2789034
E-mail: news-city@tudelft.nl

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Developing knowledge for sustainable, efficient ports

Read more
on page 6 >>



New kid on the block?

New? Definitely! I still feel a bit like Alice in wonderland. What a huge range of activities and what an enthusiasm the staff and students display. And then there is the select group of companies and organisations we have links to: CEG staff and students have both feet firmly planted in reality.

Kid? Well, I'm almost 60, what is the faculty letting itself in for? Luckily permanent education is part of an academic institutions policy: keep developing. This close to the appeal made by the international panel that recently visited us to conduct a visitation of four civil engineering departments. The gist of their findings? You have undergone impressive development and are about to lose some major players, but are you sufficiently prepared for the future? The societal problems that engineers need to answer are multifarious and complex, and demand an integrated approach. Aren't your research groups becoming sub-critical as far as their permanent staff are concerned, too dependent on particular individuals whilst themes seem to be developing more piecemeal, more autonomously? The Management Team will utilise this to arrive at a more detailed strategy in conjunction with the faculty and its surroundings.

On the Block? Indeed, our accommodation is a pile of building blocks, but that is set to change. Building 23 is to be totally overhauled. There is plenty going on in De Plint, along the park and there are a plethora of work, consultation and experimentation areas all on the basis of a fresh look at mutual interaction. It is good to see that many people are willing to help us conceptualise the new working method!

I have met plenty of people and I hope to meet more at the lunch meetings that are coming up so I can find out what people think and to discuss how to move forward with 'our' CEG faculty.

Bert Geerken,
Dean of the faculty of
Civil Engineering and Geosciences



After her master in Applied Earth Sciences, Asli Altintas' activities included 3.5 years working for Shell in Russia and she is now about to depart for New Zealand. Delft inspired her to use a multidisciplinary approach.
Read more on page 2 >>



Although we like to have a good moan about it, rail travel in the Netherlands isn't all that bad. However, the railways are reaching their limit. The Department of Transport & Planning is working on solutions together with other faculties, Prorail and NS.
Read more on page 4 >>

Robert Bertini is Professor of Civil & Environmental Engineering at the Portland State University in Oregon. Between 2009 and 2011 he worked for President Obama's government. His sabbatical started in August and he has been working at the Department of Transport & Planning as a visiting professor.
Read more on page 8 >>



RECENT PHD AWARDS

Design Concept for Ductile Cement-Based Composites with Wood Fibres

M.G. Sierra Beltran

In order to turn a brittle cement matrix into a ductile composite different types of man-made fibres such as steel, glass and polyvinyl alcohol are currently used as reinforcement, as well as some natural fibres. Compared to synthetic fibres, natural fibres are more easily available worldwide and they are friendlier to the environment since less energy is needed to produce them. They are also a renewable resource. In this project natural fibres from wood were chosen as reinforcement for cement-based materials. Three softwood species: larch, spruce and pine were studied. In the matrix, cement was partially replaced with other binders to achieve a low environmental-impact matrix as well as a matrix with a tensile strength compatible with the chosen wood fibre's strength. The wood fibre-cement matrix interface was studied. This thesis contributes to a better understanding of its properties. A lightweight cement-based composite reinforced with pine fibres was designed to exhibit deflection-hardening behaviour. This material developed multiple cracking prior to failure under bending stress. Due to this improved behaviour it can be considered for applications such as low-budget housing in countries subject to seismic risk, where ductility and low weight are desirable characteristics of the building material.

Risk-based planning and optimization of flood management measures

M.A.U.R. Tariq

About 95-97% of all deaths and a significant part of the economic losses caused by floods occur in developing countries. The objective of this thesis is 'to maximize land-use benefits and minimize flood damage with available resources in a floodplain'. A risk-based flood management framework is proposed, which provides the logical grounds for the selection and (optimal) design of the structural and non-structural measures. In the framework of this research, risk is the result of the combination of 'hazard' and 'vulnerability'. The Expected Annual Damage (EAD) is an important part of the basis of the risk analysis. Flood damage curves and EAD distribution maps provide detailed risk information. The concept of the Optimal Risk Point (ORP) is introduced to achieve the objective of this research. ORP is the state of flood management in a floodplain where 'flood deductions' are at the minimum. Dikes, dredging, flood zoning, and flood insurance are evaluated through a risk-based assessment in the Pakistani setting. The ORP concept helps in developing risk-based safety standards for flood management. In addition, it is concluded that flood management must be an integral part of the land-use development.

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

Alumna Asli Altintas, reservoir engineer:

“Working in the oil industry entails huge responsibility”

You really get to know your limits if you have to manage a bunch of tough guys in Siberia when it's 20 below. After her master in Applied Earth Sciences, Asli Altintas' jobs have included working for Shell in Russia for over three and a half years and she is about to depart for New Zealand. TU Delft inspired her to adopt a multi-disciplinary approach.

“The more you engage in it, the more fun it becomes.” Asli Altintas is a passionate reservoir engineer. She studied Petroleum and Natural Gas and Engineering at the Middle East University and then completed a master in Applied Earth Sciences at TU Delft. “The oil industry is so powerful and technically so challenging with all the uncertainties you have to deal with - that makes it exciting to me. Finding oil underground is akin to looking for the proverbial



equipment at the Salym Smart Well. “Real work finally and I used to drive out to the wells at night when it was 40°C below zero. Things don't get more real. At first the men that work there are astonished: that little girl is going to do what!? But once you show them how hard you can work and do so well people start to trust you. It was tough, but great. I think you really find out what you are made of under such demanding, stressful circumstances. I proved capable of surviving - 40°C and really appreciating the rugged, outdoor lifestyle. That I succeeded in doing so and was even appreciated was a massive compliment.”

Mindsets and datasets

Cooperation between geologists, geophysicists, petrophysicists and operators may seem pretty obvious in the oil industry where there are many uncertain variables. Altintas: “But people sometimes speak entirely different 'languages'. They basically do their work sequentially. There is a desperate need for a change in attitude. Because you get much

industry. In the end, she spent three and a half years in Russia because there soon proved to also be interest in the method on Sakhalinsk - a Russian island to the north of Japan. Altintas: “There we managed to expand the existing dataset with 4D-seismic data allowing us to do much more, much faster and therefore much more effectively. It is currently in use in a plethora of places around the globe.” The next step is four years in New Zealand where Altintas will be responsible for a gas field. “This is going to be exciting because not only will I have to estimate volumes, but I will also have to interpret real-time data. A huge responsibility even if you share it with others. If the calculations prove wrong people may die. This could of course have enormous financial consequences and impact the environment.”

Horizontal rain

Although Altintas has lived all over the world since she was very young, Delft gave her the most multicultural

“I think TU Delft's hands-on approach and multidisciplinary perspective are fabulous. You specialise, but simultaneously also gain excellent insight into the other disciplines..”

needle in a haystack and you also have to look after the environment.” She is very happy with the combination of the two universities. “In Turkey, the study programme was very theoretical whereas Delft was very hands-on. In other words a good match.”

Tough, but great

Reservoir engineering can briefly summarised as follows. Where are the wells? How much oil is there? How can it be extracted as efficiently as possible causing minimum impact on the environment? “That sounds simple, but it is an impressive chain which starts with ground scanning and ends at a chemical plant. It truly is a team effort.” In the field Altintas worked in the wilds of Siberia where she provided logistics and monitored

better results if you make people with different mindsets look at the same dataset.” At Shell she cooperated on the development of tools that enable this such as the Assisted History Matching tool - a methodology which helps optimise existing simulation models. It allows you to visualise problematic areas in the modelling of the subsoil. “It is an application that can be used in many ways and it's our specialty,” says Altintas. “We also found another way of working with it, namely as a sort of platform within which the various disciplines can communicate and cooperate to make models more accurate.”

Huge responsibility

Altintas was sent to Moscow to demonstrate the methodology to the

experience. “Delft really provides you with the opportunity to develop yourself and prepare for the world. There are so many influences and nationalities there. This automatically gives you a broader perspective. I think TU Delft's hands-on approach and multidisciplinary perspective are fabulous. You specialise, but simultaneously also gain excellent insight into the other disciplines. What could be improved is the cooperation between the faculties. We could, for instance, learn a great deal from mathematics. There is a lot going on, but there are no official platforms, you really have to go looking for things yourself. Another important thing I learnt in the Netherlands, she says - laughing - is that horizontal rain does exist.”

- High School: MER Anadolu Lisesi, Ankara, Turkey (2000)
- University: Bachelor of Science in Petroleum and Natural Gas Engineering, METU, Ankara, Turkey (2004)
- Master of Science in Applied Earth Sciences, TUDelft (2006)
Thesis Title: Screening of Reservoir Characteristics for the Applicability of Smart Field Technology to Water Flood Optimisation
- October 2006 to date: Shell International Exploration and Production in various groups and locations
- October 2006 - April 2008 Reservoir Engineer in Smart Wells Group (Rijswijk, The Netherlands)
- April 2008 - December 2008 Smart Well Production Technologist in Salym Petroleum Development (Salym, Siberia, Russia)
- January 2009 - March 2012 Reservoir Engineer in Quantitative Reservoir Management group under Reservoir Surveillance Technologies (Rijswijk, The Netherlands)
- April 2009 - February 2011 Reservoir Engineer seconded out to Salym Petroleum Development (Moscow, Russia)
- June 2011 - October 2011 Reservoir Engineer seconded out to Sakhalin Energy Investment Company (Sakhalin, Russia)
- March 2012 - Reservoir Engineer for Shell Todd Oil Services Limited (New Zealand)



Geopolitics

The environment has already had a couple of mentions during this interview and Altintas is conscious of her role. “Of course we have an impact, but oil is such a big part of our lives that we can't do without it. We know how to minimise that impact. I think I can have more of an influence here than by protesting outside. I know it sounds corny, but I would like to use my knowledge to make the world a better place. As an expert I can in any case make people conscious of the options. I have learnt and taken from the world, but I also want to do something back.”

Farewell to a passionate dean

Structural cooperation between universities, business and government. Something Louis de Quelerij is a huge proponent of. Which he reiterated at his farewell symposium 'De Gouden Driehoek of de Bermuda Triangle?' [The Golden Triangle or the Bermuda Triangle?]. There he made an urgent request to companies and the government to participate in a research programme on construction and infrastructure. At the end of the symposium he handed over his tasks to the new dean Bert Geerken.

Louis de Quelerij led the CEG faculty for nine years and bade farewell to this position on Thursday 1 December 2011. He did so at the farewell symposium 'De Gouden Driehoek of de Bermuda Triangle?'. This event centred on whether the cooperation between business, government and universities constitutes an opportunity or a threat. For De Quelerij it is very clear that this has great potential. It was on the basis of this conviction that, over the past two years, he concluded contracts with public and private sector representatives in the framework of the CEG renewal plans. In these contracts, the parties involved promise to provide financial support to the faculty until at least 2014 to the tune of thirteen million euros. As a 'reward' for this fourth source of funding, the sector parties will gain more of a say in the faculty's research and education.

Three conclusions

Looking back at his years as the dean and the cooperation between business, the government and knowledge institutions, De Quelerij comes to three conclusions. The first being that the faculty's performance has improved enormously over the past ten years. For instance, the influx of students, the number of publications and the number of PhDs have approximately doubled. Unfortunately this performance was not rewarded: basic funding from the Ministry of Education, Culture and Sciences was drastically reduced over the same period from 46 million euros in 2002 to approximately 28 million euros in 2012. According to De Quelerij, TU Delft should, in future, also primarily focus on the EU for research funding.

Earnings model

His second conclusion is that the faculty has managed to engineer a much more systematic collaboration with the business community. According to De Quelerij this does not mean that

companies should not invest more in long-term research such as research by PhDs. After all, the researchers the university trains are the source of future innovation. His third conclusion is that the 'triangle' as the driving force behind research and innovation could be strengthened if companies, with government support, can earn back their investments in research in the foreseeable future thanks to improved business results i.e. this demands an earnings model in which the government acts as an innovation stimulator or launching customer.

Disappointing

De Quelerij considers it very disappointing that the Ministry of Education, Culture and Sciences keeps lowering the basic funding. This decrease in direct funding is somewhat compensated for by an increase in indirect funding, but from a purely financial point of view this is a detrimental development. The financiers behind indirectly funded research do not pay the total research costs, just the researchers' salaries. In practice universities score better academically with indirect funding, but this also depletes their funds. Furthermore, more indirect funding

budget goes to 'curiosity driven', general universities than to the three technical universities which means the latter lose out in comparison. De Quelerij is not sure yet whether he is pleased with developments at the Ministry of Economic Affairs, Agriculture & Innovation. This ministry is an important source of contract funding. Now Fonds Economische Structuurversterking [economic structural reinforcement fund] funding is to be phased out and there is to be a redistribution of the existing funds - among other things via the top sector policy - it is unclear how much money will become available for research to be conducted by TU Delft. It is in any case positive that this ministry focuses on reinforcing cooperation within the 'triangle' and stimulating investments in university research by companies using new fiscal schemes.

Good prospects

De Quelerij is very pleased with the university's relationship with the Ministry of Infrastructure & the Environment. The latter accepts its responsibility and contributes to innovation as a sector party. For instance through the founding of TrafficQuest and InfraQuest,

knowledge centres within which Rijkswaterstaat [Directorate General of Public Works and Water Management] cooperates with TNO and TU Delft. Furthermore, Rijkswaterstaat provides financial support to the covenant with the faculty. The precondition being that other private and public parties in the civil engineering sector also contribute financially. The EU also offers good prospects according to De Quelerij. There are sizeable EU budgets for contract funding as well as grants for excellent researchers.

One good turn deserves another

De Quelerij is clear about the relationship with the business community. One good turn deserves another and as both the university and the business community have a lot to offer one another, this needn't be a problem. Nevertheless, not everything goes the way it should. The willingness to invest in long-term research - which is primarily conducted by PhDs and is extremely important for arriving at new solutions and products - differs markedly per sector of industry. For example, 80% of the PhD research in the field of maritime manufacturing and the dredging industry is funded by companies whilst the share of private funding for PhD research in the fields of delta technology, transport and construction & infrastructure amounts to a mere 10%, 8% and 4% respectively.

Willingness to invest

According to De Quelerij the major differences in the willingness to invest are directly related to who benefits from research results. If the beneficiaries are companies, the proportion of private funding is high because they will rapidly get a return on their investment. If the beneficiary is the government, as is the case with research in the field of

delta technology, transport and construction & infrastructure, then the proportion is low. In these research fields the government is basically the most important market party also with regard to intellectual property rights, but this is insufficiently reflected in the willingness to fund research.

Dream

De Quelerij hopes the situation in the field of delta technology and transport will improve thanks to (respectively) the top sector Water and the top sectors Logistics and High-tech systems. However, construction and infrastructure have not been defined as a top sector which he finds rather surprising. After all, construction contributes some 10% of the GNP, consumes 40% of all energy in the built environment, 35% of road transport is construction related, construction is responsible for 35% of waste production and 50% of raw materials consumption. It is clearly an important sector in which a great deal can be improved. For example, by conducting research into zero energy and zero materials buildings, into options for flexible lifespans and into built environment modelling. He therefore called on the government and the business community to help make his dream a reality by setting up a construction and infrastructure research programme with a 50 million euro budget in collaboration with the technical universities, TNO and Deltare.

After making this call, on the first day that he was no longer the dean, De Quelerij handed over the faculty sash and the chairman's gavel to his successor Bert Geerken. De Quelerij will continue to work at the faculty of CEG as a professor.



Rail traffic in the Netherlands. Simplicity or flexibility?



Although we like to have a good moan about it, the rail travel in the Netherlands isn't all that bad. However, the railways are reaching their limit. The Department of Transport & Planning is working on solutions together with other faculties, Prorail and NS.

Assistant Professor Rob Goverde of Transport & Planning talks about his field like a high-speed train. Rapid pace, few stops. He and his department provide support to the rail and public transport sectors, develop scientific frameworks and visions on the future. Naturally there is cooperation with other faculties such as the Mechanical Engineering, Mechanical, Maritime and Materials Engineering (3ME) and Technology, Policy and Management (TPM), because "the combination of various perspectives reinforces". But back to rail traffic - how are things here in comparison to the surrounding countries? "Actually, we're not doing that badly," explains Goverde. "This is because, since the 1970s, a good plan has been in place with a very uniform timetable that is the same every hour. This provides high quality to travellers. Rail traffic is more ad hoc in many other countries."

Travellers as the point of departure

Ultimately it is all about travellers. Frequent trains, as little changing trains

"Emergency measures demonstrate how inflexible the system is. The timetable is adjusted in the event of, for instance, impending snowfall, but if the latter never materialises then the former cannot be changed back and then you still have a problem."



as possible and good connections are the principal challenges. These prove to be difficult in the Netherlands because the rail network criss-crosses the country instead of having a central point that trains ride to and from. Goverde: "herkomstbestemmingen should be chosen in such a way that trains do not have to run empty whilst also ensuring that people don't have to change trains often. This is why the periodic timetable with its predictable pattern proved so suitable". However, train frequency is rising as is the number of railway companies. There is no flexibility left in the timetable. "According to the railway sector's Programma Hoogfrequent Spoor [High Frequency Rail Programme] (PHS) the Randstad conurbation will have to have six intercity services and 6 local services an hour by 2020 at the latest. The advantage will be that connections will become less important within the Randstad conurbation because the next train will be along shortly. However, rail traffic will have to be streamlined very well and connections to less frequent services to destinations outside the Randstad also remain important. These constitute major challenges."

Flexibility versus simplicity

'Major challenges' seems like a bit of an understatement. Due to the high occupancy levels on the railway network, a single incident can have consequences for the entire region. A simple problem with the points somewhere can lead to hours of delays for travellers. There are roughly speaking two approaches to solving this problem: to simplify the current - complex - railway system or to manage that complexity. At the moment, the simplicity approach seems to be garnering the most support. "ProRail envisages a sober railway network," says Goverde, "with more trains running on it. The existing - inflexible - system is the point of departure and the infrastructure will be laid out in such a way that there will be as few disruptions as possible. This entails, for example, fewer sets of points as these are a source of disruption. But points also make your system flexible." His tone betrays his opinion: as a mathematician, Goverde views managing the complexity thereby keeping the system flexible as a better option. "We are of the opinion that you can do more by actively controlling the traffic management and the drivers, by providing better decision-making support to them. At the moment, drivers only have the timetable

and the signals. They have no way of knowing that the train they are waiting for is too late and that they are going to spend three minutes waiting in vain. Of course, you can anticipate this. This would also enable things like energy conscious train utilisation. This demands more interaction with and also insight from the train dispatchers who set the paths at the stations. If you arrange this at traffic management level with good overviews and visualisations you can quickly estimate what the best solution would be."

Improved decision-making support

To enable this, T&P develops tools which guarantee cohesion between the transport flows and also reveal the limitations that have to be taken into account locally. Because what one train dispatcher solves at his station can cause problems for the next train dispatcher. The traffic management should provide information on this, but does not have the necessary decision-

making support to do so properly. "The current system for decision-making support dates back to the 1990s and is no longer up to scratch. In the event of increased frequency you want to be able to deal with a larger area at network level so you can make faster, better decisions. Emergency measures demonstrate how inflexible the system is. The timetable is adjusted in the event of, for instance, impending snowfall, but if the latter never materialises then the former cannot be changed back and then you still have a problem. What is really needed is a new, contemporary, flexible system," argues Goverde. "So that the railways provide a good alternative to transport by car at all times instead of issuing negative travel recommendations when the weather gets bad. Of course it would be fabulous if the algorithms we develop here would be utilised by, for example, ProRail. Not only during planning, but also in real-time in the event of disruptions. And that they work."

ProRail: Robust railway network

In order to retain optimum accessibility in the Netherlands in spite of a growing number of travellers, ProRail is using three methods to work on improving the railway network. Firstly, it should become more robust i.e. less prone to disruption. Secondly, more trains should run and thirdly, costs should be reduced. "That might sound contradictory, but simplification of the railway network could solve things across the board." So says ProRail advisor Alfons Schaafsma who works for T&P one day a week and also supervises two graduating students. "We have a railway network with a large number of junctions and destinations," he continues. "This is complex to operate, particularly if something goes wrong. We can simplify things by running trains through more strongly demarcated corridors with their starting and end points always on the same railway line. This would help limit the effects of any possible disruptions to that particular corridor. This system is comparable to the metro/underground services in Paris and London: you might have to change

trains more often, but so many trains run that you can travel without being aware of the timetable and you always make your connecting service." This will simplify not only the timetable, but also the planning of the location for new stations. After all, this system requires fewer sets of points. This is not just cheaper and less disruption prone, but also enables shorter intervals between trains and higher travel speeds. Furthermore, ProRail aims to carry out more intensive maintenance to the network and to engage in preventative maintenance. Schaafsma: "A good example of preventative maintenance is the 'self-aware railway lines': a set of points that reports whether it requires more power to operate as its action has been diminished. This is also interesting from a planning perspective because then you can work on the railway network according to plan and not be under pressure because you are trying to resolve a malfunction. We have lodged this question with the universities in the framework of the Explorail research programme."

3 CURRENT PROJECTS

What is Transport & Planning working on?

STW project rail traffic management

This project involves T&P and the Faculty of 3ME studying how improved decision-making support to train dispatchers can keep the national timetable up to date in the event of disruption as this keeps the national spread of delays manageable. ProRail, NS, Arcadis, Movares, DHV and Siemens are also involved in the project. There is also a T&P PhD working on the project and graduating students will also play a role.

Reliable, multimodal traveller transport

As part of the NWO programme Duurzame Bereikbaarheid Randstad [Sustainable Accessibility for the Randstad Conurbation] T&P - together with parties including the city region of Amsterdam, Stadsgewest Haaglanden, ProRail, NS, RET and the Ministry of Infrastructure and the Environment - is carrying out a project to improve connections between various forms of transport in the Randstad. Traveller behaviour is part of the research. Two T&P PhDs are involved in this project.

European standardisation project

A project has recently been started, as part of the 7e framework, to improve the quality of European rail. The project is being carried out by researchers from England, France, the Netherlands, Italy, Switzerland, Germany and Sweden. Infrastructure managers and knowledge institutions from five of these countries are also involved. Best practices are studied, but also the mutual harmonisation of timetables and the action of modifications.



Umbrella incident centre

In order to provide an improved response to major incidents, an umbrella incident centre was set up at the close of 2010, the Operationeel Controle Centrum Rail (OCCR) [Operational Control Centre Rail]. There train dispatchers, transporters, contractors and weathermen

collaborate which allows faster communication in the event of disasters. The OCCR has contributed to the fact that the effects of disruptions are less severe because an overview of the situation can be created more rapidly and the right measures can therefore be implemented more quickly.

The NS: Flexibility and variation

Whereas TU Delft is working on tools for adjusting the timetable, Leo Kroon, logistics advisor to the NS and Professor of Quantitative Logistics at Erasmus University Rotterdam (EUR) examines another bottleneck: adjusting the use of trains and staff. "A higher frequency of trains in the Randstad is a good thing for travellers," says Kroon. "But because that makes the system more 'sensitive' rapid adjustment in the event of disruption will become crucial. At the moment, any disruption is

isolated as much as possible resulting in train snot being able to complete all of their intended route. This leads to unexpected traveller flows and the trains running on the 'detour routes' isn't always capable of handling the 'overflow'. Furthermore, there has to be sufficient staff available - a train driver or a conductor's shift can't be extended for too long. This makes planning complicated, let alone making adjustments when time is of the essence."

According to Kroon the system should be flexible enough to accommodate unexpected travellers. "This demands good decision-making support in all fields and it is in this respect that TU Delft and EUR complement each other perfectly. Improved, automated timetable adjustment systems will already make a considerable contribution to improved quality. The ideal thing would be for the railway network to automatically be utilised in a different way in the event of disruptions, in a manner comparable to that of the internet where the network adapts

when a server goes down somewhere. We are heading in the right direction because our insight into traveller flows is improving and we are increasingly targeting adjustment in the event of disruption. Furthermore, we are trying to mitigate traveller inconvenience when disruption occurs in small ways by providing stranded travellers with coffee for example."

"Having to change trains should be limited"

To a certain extent, ProRail and the train operators are on opposite sides. Kroon: "Naturally, you should simplify things where possible. But to travellers changing trains is often a disqualifier for using this mode of transport and so changing should be limited. At the moment, well over 70% of all train journeys are made without having to change trains and that percentage shouldn't change too much."



NEW PROFESSORSHIPS

Prof. (Han) J.C. Winterwerp
Chair Sediment Dynamics



This chair focuses on the transport and fate of sediments in open water systems in general, and that of fine, cohesive sediments in particular. Fine cohesive sediments occur as flocs, containing large amounts of water. Fine sediment-water mixtures can therefore behave as a fluid, as a soil, and everything in between. In the natural environment, fine sediments are the primary responsible for the light climate in the water column, and play a crucial role in the health of benthic communities. More recently, we study the stability of large sedimentary systems, such as coasts, rivers and lakes. Some of these systems have been so heavenly engineered that they switched into another, often highly undesirable stable state.

Prof. Wim (W.) van Vierssen
Chair Science System Assessment (SciSA)



This chair focuses on the interaction between the knowledge system and society and was set up by the Rathenau Instituut. Science's value is an important perspective. Policy has made water a Top Field and valorisation has therefore become a spearhead. Collaboration between the public sector and Dutch SMEs is important. A second research perspective is sustainability. The water problem is a relatively unique environmental problem because the water sector is well organised and linked to citizens. The third perspective is that of the increasingly well educated population. Science has lost some of its authority and citizens are more self-assertive and better informed than ever. To a great extent, the above determine the playing field for water research.

Prof. Tiedo (T.) Vellinga
Ports and Waterways chair



The port of Rotterdam wants to be the most sustainable port in the world. Is that a pipe dream? Won't short-term goals focus on commercial gain due to the economic crises? Won't the government have to enforce sustainability due to pressure from environmentalists? Or, and this question is central to this inaugural lecture, is there sufficient drive in the private sector for a bottom-up process whereby green growth drives economic progress? A Greenport, is that even possible? And what does this entail for port managers, industry, government bodies, interest groups and knowledge developers including, last, but not least the universities of Delft and Rotterdam. This lecture addresses this challenge in the context of current societal dynamics on the basis of lessons learned among other things from the development of Maasvlakte 2.

Prof. Rob (R.A.) Zuidwijk
Design of Transport Networks and Infrastructure chair



The obliviousness with which we transport goods and the importance of accessibility and transport emissions cannot be incorporated just like that. Innovative solutions are required to meet the growing demand for transport in a sustainable manner. From the transporter's perspective goods are often packed into standard loading units and shipped from one place to another using tools as efficiently as possible. From the transshipment companies' perspective the shipment becomes a 'traveller' who seeks their way through the traffic network on the basis of their own preferences. How and to what extent can both perspectives be brought together? The emphasis is on the global transportation of maritime containers, but the discussion is also relevant to the chair's other areas of interest such as air freight and urban transport.

Further information
www.intreeredes.citg.tudelft.nl



Right job first time around

At the end of this year, in order to join together the harbours of Maasvlakte 1 and 2, the Yangtzehaven [harbour] will be broken open and widened. Pieter Nordbeck studied how this will affect the currents in the harbours for his graduation project. After graduating he started working for the Maasvlakte 2 project organisation. His dream job.



Quite soon after graduating I presented the results of my study to the Havenbedrijf [Port of Rotterdam],” says Nordbeck. “Afterwards I was asked what I wanted to do. I answered that I’d like to work for Maasvlakte 2. Although the company usually employs people with prior experience I was told they would love to add me to their team at the site hut their contract management organisation is housed in.”

Co-conceptualising

“Since then I’ve worked at the hut on Maasvlakte 2 and together with my colleagues I ensure that we get what

we paid for. In principle, we check whether the contractor has kept an eye on the agreements concerning quality, planning and budget, but in practice we do a whole lot more. For instance, we co-conceptualise the design and - in collaboration with the contractors - assess how they could work more efficiently thereby raising quality.”

Work culture

“The point of departure for our work is that we have to be at least as well informed as the contractor. I struggled with that to start with and wondered whether I had sufficient knowledge. I was the youngest there and was part of a team of people that had worked there for years. My doubts were soon erased however thanks to the pleasant work atmosphere. You are allowed to make mistakes and are given plenty of space to immerse yourself in new subjects and tag along with experienced colleagues. This enables you to rapidly acquire knowledge about new fields.”

Effects of segmented completion

“In the meantime, I have become involved in all manner of elements of the construction process. I am a member of the core Nautical team which examines which effects the various phases of activity have on the currents in the harbours and then informs pilots and other waterway users. I also monitor the quality of the stone cladding of the hard face sea defences and assess whether the geotextile and stone shore defences provide sufficient protection against the elements. I also see to it that these activities are carried out correctly.”

Amusing situation

“What makes this job so great is that you can come up with something in the morning and already see its effects by afternoon just by looking out of the window. I am also fascinated by how rapidly I was permitted to work independently here. A while back this

even led to an amusing situation. I manage a fund for the core Nautical team for the hiring of external advisors. This meant that, just a few months after graduating, I was suddenly commissioning a researcher at Deltares, who had supervised me and introduced me to the modelling of current patterns during my internship there.”

Seeking

“I really have to admit that I really love it here. The funny thing is though that this sometimes feels like a drawback. Now the first part of Maasvlakte 2 has almost been completed, work here at the site hut is decreasing and I therefore have to go in search of work within the Havenbedrijf organisation. But, that is tricky because I am so happy with my current position. Luckily other members of staff are helping me out and I have been given the space to indicate my preferences. What it is going to be I don’t know yet. I might perhaps want to do a project abroad for a while.”

Increasing insight into ‘coastal river’s behaviour

The Port of Rotterdam Authority is conducting an extensive monitoring programme into the environmental effects of the construction of Maasvlakte 2. One of the spearheads is the consequences of sand extraction on life in the North Sea and the Wadden Sea. Alongside extensive measurements, models are used to calculate the dissemination of swirled up silt. Research by Julie Pietrzak, Professor of Physical Oceanography at the Fluid Mechanics research group has generated knowledge which improves the predictive power of these complex models.

The initial phase of Maasvlakte 2 will be finished by 2013 at the latest. This will make a surface area of some 600 ha available for industrial estates and infrastructure. Creating this new land requires 240 million cubic metres of sand approximately 85 percent of which originates from sand extraction activities in the North Sea well over ten kilometres from the coast. The remaining sand will result from the breaking open of the Yangtze harbour and the deepening of the existing harbours.

Environmental effects

Sand extraction at sea has two clear effects. The first of which is the disruption of bottom life especially at the extraction site. To minimise this effect, the Port of Rotterdam has opted to utilise deep sand extraction wells to minimise the bottom surface area affected. The second effect is cloudy water. During sand extraction the dredgers also suck up silt particles which end up back in the sea

through overflow. Most silt particles immediately sink to the bottom again. However, some remain suspended in the water for some time turning the water cloudy. This water then spreads due to the tides and local currents. Cloudy water limits light ingress leading to algae growing less quickly and there consequently being less food for algae eaters and subsequently - further up the food chain - for the fish and birds.

Measurements

To ascertain whether construction has detrimental consequences for bottom life and the food chain, the Port of Rotterdam conducted extensive baseline measurements in the coastal zone between Vlissingen and Petten before work started. The Port of Rotterdam has repeated these measurements every year since construction started. The monitoring data will be evaluated in 2013 and a decision will be made as to continuing silt measurements until 2015 or whether these can be

halted sooner. The measurements concerning the recolonisation around the sand extraction wells will continue until 2023 at the latest. When analysing measurement data it is difficult to determine whether the effects measured were caused by sand extraction or can be attributed to natural variations. An attempt has therefore been made to catalogue how the silt released by the sand extraction distributes itself.

Very complex

“The way silt spreads is strongly dependent on the currents in the coastal zone,” says Pietrzak “and it is precisely in this zone that the currents are very complex. There are various types of water in this zone; salt water and fresh river water which sometimes do and sometimes don’t mix depending on conditions. Our research focuses on increasing insight into the currents and the interaction between river and sea water. The main outline of how this works has been well known for some

time. The water from the Rhine that flows into the sea through the Nieuwe Waterweg [waterway] is lighter than the sea water and floats above it. After it has flowed into the sea it ‘turns’ right towards Den Helder under the influence of the Coriolis effect. In other words a ‘coastal river’ develops, a flow of fresher water which travels past the Wadden Islands towards Norway more or less independently of the underlying salty sea water.”

Tides

“Our research has revealed that there are all manner of variations on this basic behaviour of the coastal river and that the water column is sometimes very layered and - at other times - fully mixed. The tides are a major influence on this. Normally the tidal flows run north, parallel to the coastline when the tide comes in and run south when it goes out. However, sometimes flows occur at right angles to the coast in a 30 km wide strip from Hook of Holland to IJmuiden. When this happens the lighter, fresher water moves away from the coast for six hours drawing up saltier sea water close to shore. This process, known as upwelling, was first



Developing knowledge for sustainable, efficient ports

This is what part-time Ports and Waterways Professor Tiedo Vellinga views as his principal task. For the past year, he has held the Ports and Waterways chair. Alongside his position as a professor (two days a week) he works for the Port of Rotterdam's project organisation Maasvlakte 2 (three days a week). In his opinion, opting for sustainability and efficiency enables being able to do as much as possible within the limited environmental space ports provide.

Vellinga is extremely satisfied with his two jobs. "After studying Coastal Engineering in Delft, I started working for the Port of Rotterdam in 1979. Since then, I have held all manner of positions and I still love working there. I started at a design department, then spent years in management and maintenance and, in 2004, I joined the management of the Maasvlakte 2 project organisation. I am currently responsible for monitoring all the effects of the construction and utilisation of the second Maasvlakte

[port expansion on land created on the coast]. In 2004, I also started working one day a week for my predecessor here at TU Delft, Professor Han Ligteringen. Early last year, I succeeded him as professor. It feels like the crowning achievement of my career."

Ambition

"The Port of Rotterdam sponsors my chair and two others at TU Delft and four at the Erasmus University. This investment in education and research are in line with the company's ambition

observed on satellite images. Six hours later the surface water moves back towards the coast pushing the saltier water back down towards the bottom. This process is of great influence on the way silt spreads."

Mixing

"The direction and speed of the wind also influence the coastal river's behaviour. When the wind speed measures five metres per second and comes from a northerly or easterly direction the coastal river fans out more widely along the coast of the province of Zuid-Holland, but remains layered. If the wind speed measures ten metres per second and comes from the north the water flows even more seaward at the Haringvliet and the Nieuwe

Waterweg, and the fresh water starts to mix with the sea water. When the wind blows from the south the coastal river is pressed closer up against the coastline and the various water layers mix well. Good mixing also occurs in the event of westerly winds. Moreover, the coastal river is then pushed slightly further south."

Better predictions

Pietrzak continues: "All these water movements affect silt distribution and the place the suspended silt settles. Incorporating this knowledge into the existing numerical models allows us to predict the effects of sand extraction and large-scale land reclamation projects such as Maasvlakte 2 much better."

to make the port of Rotterdam the world's most sustainable, efficient port. Access to new scientific knowledge is essential to make this ambition a reality. Think, for example, of knowledge in the field of port development, port management, traffic management, goods transport, ships, but also waves and currents. By cooperating with universities and sponsoring a number of port chairs, the Port of Rotterdam can tap into wells of new knowledge and can co-conceptualise the research agenda and indicate which problems it considers important."

Limited environmental space

"I think it is sensible of the Port of Rotterdam to focus so intently on sustainability and efficiency. The port of Rotterdam is more or less tied to emission ceilings for substances such as SOx, NOx, CO₂ and particulate matter as well as noise pollution. The available environmental space is limited and will only be reduced even further in the future. If you wish to generate as much economic activity as possible within that limited environmental space - which is the Port of Rotterdam's primary aim - your best bet is to opt for sustainable companies that use efficient processes. Incidentally, environmentally leading companies often also have their business operations in good order too."

Selection criterion

Vellinga continues: "Because the Port of Rotterdam strives to use the available space in the best way possible, sustainability is an important selection criterion when recruiting new companies for Maasvlakte 2. This worked really well for the first tender for a container terminal. In their plans, the participating companies indicated what they intended to do to limit emissions, how they wished to reduce road-based container transport and optimise their transport chain as well as which measures they wished to utilise to decrease their energy consumption. A number of companies even took things one step further than the sustainability requirements the Port of Rotterdam had envisaged."

Discount on port dues

"Another initiative for promoting sustainability is to provide a discount

on port dues to the most environmentally-friendly vessels. To this end the Port of Rotterdam developed the Environmental Ship Index with its international partners which allows you to assess the environmental performance of sea-going vessels. The objective of the discount, that is also used in other ports, is to stimulate ship owners to rapidly introduce more environmentally-friendly ships. Most contemporary vessels are extremely pollutant and the introduction of regulations aimed at the application of cleaner fuels and engines is moving far too slowly according to the participating ports."

"The introduction of regulations aimed at the application of cleaner fuels and engines for vessels is moving far too slowly according to the participating ports."

Dialogue

"It is remarkable that - from the start of planning onwards - the Port of Rotterdam opted for dialogue with those in the surrounding area thereby constantly assessing how both their wishes and those of the various stakeholders such as Milieudefensie [Friends of the Earth Netherlands], Natuurmonumenten [nature preservation organisation] and Faunabescherming [fauna protection organisation] could be fulfilled. This form of strategic area management booked great results. For instance, an agreement has been signed with Milieudefensie for the further improvement of air quality; among other things by means of the abovementioned discount for 'clean' ships and the use of very clean fuels by the Port of Rotterdam's vessels. Agreements have also been made with Faunabescherming about permanently setting aside space in the port area for Lesser Black-backed Gulls. This not only benefits nature and the environment, but also the planning process as a whole. Cooperating and consulting obviates engaging in convoluted legal proceedings at the Council of State to iron out differences."

Research projects

Vellinga assumes his chair can make an important contribution to the sustainable structuring and operation of ports: "All sorts of research projects have been planned for the coming years which will generate extremely useful knowledge. We are, for example, going to study how goods chains can be optimised and how containers can be transported by water to their destinations in the hinterland. We will also focus on the options provided by flexible port infrastructure, more efficient terminals and the opportunities for cooperation between the various ports. Another subject we will

be studying is value management. Which value can you create for owners, users or the company that invests in infrastructure? I am looking for a PhD who will examine how value management can be used to substantiate and compare investment plans better."

Logistics processes

"To me, it also seems worthwhile to study the opportunities provided by AIS (Automatic Identification System) for traffic management purposes. Nowadays, every ship is equipped with AIS, which uses a satellite transponder to transmit information on the vessel's position, speed and for example its name and characteristics. This data provides insight into the behaviour of ships, their mutual interaction and the utilisation of waterways, locks and terminals. For example, you can advise a container ship to slow down somewhat - which saves on fuel and cuts harmful emissions - if you see that it would otherwise have to wait due to the terminal being busy. And you can improve logistics processes if you also start transmitting data on the cargo using AIS. This allows logistics service providers to prepare for the specific cargo a particular ship is carrying."

The Fluid Mechanics research group is closely involved in cataloguing the effects of sand extraction for Maasvlakte 2 on silt distribution in the North Sea. For example, Pietrzak provides the Port of Rotterdam and research institute Deltares with advice on the approach to take. Two of her students have also recently conducted research into the coastal river's behaviour and Pietrzak has written a PhD proposal in order to further expand knowledge on the subject. This proposal is set to be submitted to the technology foundation STW in the near future.



Visiting professor from the U.S. loves cycling

Robert Bertini is the Professor of Civil & Environment Engineering at Portland State University in Oregon in the USA. From 2009 to 2011 he worked for President Obama's government. He was the Deputy Administrator of the Research and Innovative Technology Administration (RITA) of the Ministry of Transport. He has taken a sabbatical which started in August 2011 and is currently working as a visiting professor at the Department of Transport & Planning.

There's a bike up against the wall in Bertini's office, but it proves not to be his even though he's an enthusiastic cyclist. He rides to work every day and enjoys cycling in and around Delft. "The opportunity to do a lot of cycling in a country with an excellent cycling infrastructure definitely played a part in my opting for Delft," explains Bertini. "I do a lot by bike in Portland too, but there cycling isn't part of the culture as it is here in the Netherlands. In Portland it's primarily the academically educated who cycle and there are almost no cycling facilities. Here you see all ages riding bikes. I think it's great to be part of that larger cycling community."

World's best

"Naturally, the main reason for spending my sabbatical here was the fact that the department is one of the world's best and has large numbers of excellent researchers

and students. On top of that, I have been good friends with Professor Serge Hoogendoorn and Associate Professor Hans van Lint for years. Good personal contacts are important if you are going to spend a year abroad. Another important factor for my choice was the large number of PhD students that work at the department. At my faculty we have plenty of master's students, but almost no PhDs. I'd love to have more PhDs among other things to raise the quality of our research. That is why I really wanted to see how a model with lots of PhDs works in practice. Of course it is also cool to live in another country for a while particularly if it also provides easy travel to neighbouring countries."

Stimulating

"I actually wanted to take a sabbatical and come to Delft in 2009, but then I was asked to work for Obama's government. I was the Deputy Administrator of RITA, the agency at the Ministry of Transport that

"Other things I've noticed include the various forms of cooperation between the department and other parties."

is responsible for research for two years. The position entailed providing leadership to an organisation with approximately 750 staff who are responsible for research, education, innovation and data analysis in the field of transport. It was stimulating to work in close cooperation with creative, enterprising people. It was also very educational. For instance, I experienced how hard it is to make

research results impact policy makers. I am now also much more conscious of how difficult it is to change policy and how much time changes take. It was an extremely useful experience and one that I will definitely incorporate into my research and teaching once I get back to Portland."

Traffic management

"My university gave me two years of unpaid leave for my work in Washington. After those two years, I returned to my academic roots. Back in Portland I was granted permission to take a sabbatical and this enabled me to make my plan to spend a year in Delft a reality after all. I've been here for a few months now and I'm loving it. Just as in Portland I primarily conduct research into traffic management. For example, I'm collaborating with Hans van Lint on an international book about traffic flow theory. I also spend one day a week working at TrafficQuest, a TU Delft, Rijkswaterstaat [Directorate General of Public Works and Water

management] and TNO collaboration that focuses on the development and safeguarding of knowledge in the field of traffic management. I also informally supervise a number of PhDs and help them to, for instance, gain contacts in the U.S.."

Valuable

"A year working at a foreign university is valuable in my opinion because

it allows me to become acquainted with other methods and insights. To provide an example: in the U.S. research is often sponsored and sponsors usually want their own product at the end alongside the academic end product. That is quite tricky to achieve. In the Netherlands there is a lot less of this and I get the impression that sponsored research processes here lead to a single end product that both the sponsor and the university are pleased with. I've also noticed that here master's students and PhDs often take the end product of one of their predecessors, think for example of software, as their point of departure and try to further its development. Such continuous knowledge development is less common in the U.S.."

Cooperation

"Another difference is the researchers' backgrounds. In Portland everyone is a civil engineer while here at T&P there are also mathematicians. This enables problems to be tackled differently and means mathematical models are used a lot more. This can teach me a great deal. Other things I've noticed include the various forms of cooperation between the department and other parties. Think, for example, of TrafficQuest, but also the TRAIL research school which is a collaboration between TU Delft and four other Dutch universities which conducts high-level research into transport, infrastructure and logistics. Such cooperations are virtually non-existent in the U.S. and I hope I can convince people that it really works and provides results on the basis of my experience here in the Netherlands."

Name:

ROBERT BERTINI

Robert Bertini is 46. He received his MSc in Civil Engineering in 1991 from San Jose State University. He worked for a number of organisations and started his PhD research at the University of California in Berkeley in 1995. He successfully concluded his research in 1999. After working as a senior researcher at Daimler Chrysler Research and Technology North America for a year, he became a full professor at Portland State University in 2000. From 2009 - 2011, he worked for President Obama's government as the Deputy Administrator of the Research and Innovative Technology Administration of the Ministry of Transport. In his spare time Bertini loves to cycle and he plays French Horn in the Koninklijke Harmoniekapel Delft.

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