Magazine of Dispuut Geo-Engineering “De Ondergrondse”
De Ondergrondse has been working together with the Dutch engineering association “KIVI Geotechniek” for quite some time now. In order to make this cooperation even better, KIVI Geotechniek is offering the students of the Geo-Engineering section the possibility to join the activities hosted by KIVI Geotechniek. These activities include excursions to conferences and more! For most activities you need to be a member of KIVI Geotechniek and most are organized in Dutch language.

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Dear readers,

At the moment of writing a lot of our students are enjoying their holidays, visiting home or preparing for their retake(s) in August. The study trip organized by the GETA committee just finished and when trying to summarize the part of Ron in this edition of De Mol, I am quite sure that I can say that it was an amazing, and definitely a well-organized trip. Thanks to the GETA and of course all students and staff members that joined.

In June we were having the chance to attend the CV check organized by Sentijn and with this CV check in mind a lot of students subscribed for the company dinner at Rossio Delft, where most of the students had the chance to talk with Fugro, Witteveen + Bos and Royal Haskoning DHV. Hopefully some nice contacts for future collaboration followed after this tasteful dinner!

Overall we can definitely look back at a year full of social and study related events, which we will take as example during the organization of the events for coming academic year. The new master students will already start on the 3rd of September and of course the first day will contain a presentation and tour at our faculty, a study related excursion and a barbecue to get to know each other better at the end of the day. Enjoy your master and do not forget to attend our activities throughout the year that will for sure make it already a wonderful year.

On behalf of the board I want to wish everyone a good start of the new academic year and see you at the openings barbecue or one of the many other events!

Jasper Snoeren
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Recent Activities

CV Check and interview training by Sentijn

On the 6th of June one of our partners, Sentijn, gave an interview training and CV check for the Geo-Engineering students. The interview training was in Dutch only, so unfortunately for our International students it was not possible to attend this training. The interview training was valuable thanks to the practical recommendations, but even more valuable were the one on one practice interviews. The representatives from Sentijn were really good at positioning themselves in different kinds of roles as interviewer, this resulted in different scenarios leading to useful tips and tricks. I do think that all of us learned a lot from this experience and all the lessons learned will help us with future job interviews. Furthermore, Sentijn gave feedback and advice on the quality of our CV’s individually. With help of a standard CV, Sentijn showed what can be done better and what parts are missing. Afterwards, this interesting afternoon concluded with some drinks in the sun, always good!

Company Dinner

The 14th of June, the annual company dinner took place in restaurant Rossio. This year Witteveen + Bos, Royal HaskoningDHV and Fugro were present among 30 lucky students. The evening started with a presentation by each company, which led to interesting dinner conversations. It was interesting for us, as students, to see the similarities and differences but also the professional alliances between the companies. A lot of projects which were presented were cooperative, either in the same, or in following phases of the project. When the dinner started, there were good discussions about personal experiences working for these companies, graduation projects and we had a good laugh. After each course, the companies switched tables, this way the dinner was kept dynamic. It also made sure that the company representatives were able to speak all attending students. We ended the dinner with some drinks, during which a lot of contact information was exchanged. It was a successful company dinner! See you next year!
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The summer break is something that every student looks forward to. It doesn’t matter how many points you have studied for or how many pints you have studied: The prospect of good weather and not having to do much is something that we have all been waiting for since September 2017. However, there is one significant thing that I don’t like about the summer break, and that is that the fun 25% of students go back to their native country for a few months, and that the other fun 75% of students get out of their native country for a few months. Since I like my fellow students, I wanted to try to postpone this moment of not seeing my classmates. For that reason I joined the GETA study trip.

Day 1

It already started off great. The time of departure was half an hour earlier than was communicated in emails the weeks before. Normally this isn’t disastrous, but at 4 AM this made my night about 20% shorter than I had previously anticipated. Of course, positive as I am, I imagined that it could have been much worse. For example, I imagined that, instead of being in Delft where we departed, I could have been biking drunk to the beach, wondering why my phone was vibrating the entire time. I quickly realized that this was only an absurd fantasy created by still being half asleep, but it got a giggle out of me.

When we were done counting sheep (20 enrolled on the website) and got to the conclusion that everyone was present, I was seduced into what they called the “party car”. I must have misheard this part, since it turned out to be more resemblant to senior transportation in these early hours than a wild party. Luckily I managed to wake up a few people with my eardrum piercing countertenor singing voice. A few hours later we were all singing along to Spice Girls and other absolute bangers coming from a dodgy Aux cord.

We were ahead of schedule when we arrived in Austria. Never before had I heard of a French made vehicle travelling with such speeds through German territory, except maybe in alternative 20th century history. The first thing we did when we arrived at the hostel was go to the local supermarket to buy some trays of premium grade orange juice. Since we had already seen some less fortunate citizens of Vienna under a bridge drinking this same orange juice, we knew that it was a good brand. We decided to skip on the antifreeze this time, though some people needed it after Russia’s loss in the FIFA World Cup quarterfinals.

Day 2

Because of the wisdom of others I felt great on Sunday morning, so we went to explore the city of Vienna. While we were doing this, our restaurant of that evening was robbing the local petting zoo of its pigs and chickens. It has to be said, petting animals did make the spareribs taste much better.

Day 3

This day was all about waste (not the wasted potential that I see in some of my classmates every day), since we visited a land remediation project, a landfill and a waste incineration plant. Most of these places were large dumps in the literal sense of the word, and fascinating to see. The only downside was that the smell reminded me of the toilets on the ground floor at Civil Engineering. If only CIG had a nice train to drive us around campus too.
Day 4
Since we’re all students of academia, this Tuesday the 14th was a nice day for science. It showed us an exemption to the rule that wisdom comes with age, since our very own Jeroen celebrated his birthday. According to tradition, some cold Russian presents were hidden by my fellow students. Though it has to be said, they were still hidden better than how he hides his report card for his parents.
This day we visited a hydropower plant in the mountains, which was a gorgeous sight. Most people used this opportunity to upgrade their Facebook profile pictures. After this visit we departed to Mittenwald, which rendered the previously taken Facebook pictures useless, since it was much prettier here. However, if I ever meet Jesus I will ask him if he wants to use the EU privacy regulations to get his face removed from all of the buildings.

Day 5
Because with my luck I assume that I’d break something when mountain biking, I decided to sign up for the mountain climbing group instead. As it turns out, this group was also quite fanatic, and the only thing rising faster than the front group was the gastric acid in my chest. If that doesn’t remind anyone of Adrian Vandenberg, I don’t know what will (hint: musician, year 1983).
The weather was not as good as the days before, so only some of the more mentally strong (or deficient, not sure which one it is yet) people went swimming.

Day 6
On Thursday we departed to Switzerland, but our van had lost about 15 km/h of top speed due to Johan’s father’s good cares. When we finally did arrive at the Test Gallery, it contained a lot less experimental modern art than I thought it would have. I should have seen it more in context with the study, I assume. Since I don’t like modern art, the visit was better than I had expected.
After the tour we had drinks with the company, and had dinner inside of a gallery that was refurnished to a restaurant.

Day 7
On the 7th day of the trip we had presentations at the university of Zürich. In the evening we were drinking free beers on a rooftop in the middle of historical Zürich, while watching the sundown. What were you doing that day?

Day 8
Once more I got smart people to convince me to go home early, so that we were all fresh enough to explore the city. Zürich was prettier than Vienna in my opinion (though if you are an Austrian and you read this, just switch the two cities around in your mind, or send an email to ondergrondse@tudelft.nl with your complaint). Of course, what do I know about things that are pretty. I have a Civil Engineering background. As long as it’s sturdy and made of concrete, I approve.
After exploring the city, we rejoined with our classmates who were not as fortunate to get convinced to go to sleep, but instead went to a nightclub. They were lying around near the lake, doing nothing (it was almost as if we were still in Delft). Though the Swiss lakes seem inviting, the lake bottom is worse than the shells on Dutch beaches. I went in once, and never went back in again. Next time I will bring my own tub of North-Sea sand.
In the evening, some people went to bed, while I wanted to do karaoke to practice for the final day. Unfortunately, we went to the center of Winterthur, where we had our hostel too. This was not too great, but the journey was a lot of fun. At least we weren’t in front of a closed zoo, like someone suggested we should do.

Day 9

Unlike the name Winterthur suggests, there was not much winter about it. After everyone woke up with sunburns they developed during the night because the blinds were up, some people went to the city center or the lake again. Others like myself went for a walk to the Rheinfalls, accompanied by Professor Gavin. This was a walk through beautiful, untouched nature. Except for the logging activities where we had to go off-road and a few German bunkers. Sadly we couldn’t attend the stadium where the Fifa World Cup was played on a big screen, and even more sadly the French won.

Day 10

The final day, and the final tunnel visits. Afterwards, a part of the group went swimming. I stayed at the hostel with the #girlsquad who made soup for us. Progressive as I am, I don’t like to enforce gender roles, but it is also hard to say no to soup. I spent most of this day walking around Winterthur, and being harassed by Swiss boy scouts while sipping my OJ.

Our final dinner was at the local Italian (sorry Matteo), where a distinction could be made between people who got the Lasagna and people who made a terrible mistake. It was about 50-50. As a thank you, the GETA commission got a fondue set. It was a bit cheesy if you ask me.

Day 11

After getting up early, we said goodbye to everyone and mentally prepared for another day with the same playlist. All cars were emptier now, but still filled with heavy memories, which is why we weren’t the first ones to get back. Because nobody waited for us, we ate all of their Marzipan treats.
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Last February, four Civil Engineering master students travelled to Ecuador to engage in a multidisciplinary project on the flooding of the city of Guayaquil. We, Bart-Jan, Floor, Tom and myself, were all looking forward to spend some time abroad during our studies, and found out about this project through Dr. Erik Mosselman from the Hydraulics department. Even though Floor and I were not too familiar with Hydraulic Engineering, and the project was mainly a hydraulic problem, we decided to take on the challenge. So, what was the problem?

Guayaquil, the largest city of Ecuador, has grown exponentially over the past years. During the growth of the city, the biggest issue which the city currently faces was not considered: excessive water. In times of heavy rainfall, which runs from January until April, rivers with a very large basin cause flooding throughout the inner city. Water from the rivers is not the only problem Guayaquil is facing. The city is also being threatened by the sea, to which it is connected by many small sea branches. Guayaquil is one of the most vulnerable to flooding cities in the world. The tide penetrates deep into the river, meaning that you can clearly see the difference between low and high tide far upstream. Due to the shape of the delta of the Guayas river, the amplitude of the tidal wave increases up to a very large height when propagating towards Guayaquil. This phenomenon, in combination with the global sea level rise, increases the risk of flooding of the Guayas river or one of the sea branches in the city of Guayaquil.

The city itself is not prepared for this volume of water. The short but very intense rain showers cause major pools on the streets where local drainage systems lack capacity. In addition, the drainage system is connected to either the river or sea branches. During high tide, it cannot discharge and sometimes backwashes, making the problems even worse. Many floods have had a lot of negative impact on the city. Therefore, there is a lot of social interest in finding one integral solution. During our time in
Guayaquil, we looked into one solution specifically: the (partial) closure of one of the sea branches. This could possibly hold two advantages: first, it could prevent flooding of the city during high tide; and second, the basin behind the closure could serve as a storage basin for rainwater from the city. This would disburden the city’s drainage system, and the stored rainwater could be discharged into the sea branch during low tide.

Our project was a cooperation between TU Delft and ESPOL (Escuela Superior Politécnica del Litoral) and supported by Boskalis. Our local supervisor, professor Mijail Arias, provided us with an office at the ESPOL campus. We were very warmly welcomed, with their international office immediately organizing all kinds of activities for us to make us feel at home.

Testing this possible solution consisted of a lot of programming. Luckily, Deltares provided us with a Flexible Mesh model of Guayaquil and we could extend this to our specific area: the sea branches. Tom used his programming skills to get the model running while Bart-Jan, Floor and I focused on processing all of the data. As input, the model needed discharge values, water levels, among other. Another big issue was determining the amount of rainwater that would run off towards the sea branch during a typical rain shower. We needed this information to determine what size the possible basin would need: this certainly was a challenge!

During our eight weeks in the city, we also had the chance to interview local authorities such as the Municipality. All of the authorities were so kind to provide us with the datasets we needed and also showed serious interest in our research. There was a bit of a language barrier, as none of us spoke Spanish, but our supervisor translated all of our questions and explained everything to us. He even made sure we got acquainted with the local ways, showing us where to eat, telling us about the history of the city and even taking us to a football match!

During our research, we realized that large barriers are not the only solutions. Local, very small-scale projects could also help reduce flooding problems. When you can store that water within the city without causing hindrance, the drainage system can still be disburdened and the discharge can take place at a later, well-advised time. We decided that those possibilities should definitely be considered too and could also be used in combination with our proposed sea branch closure.

In the end, our Delft3D model showed that (partial) closure of one of the sea branches is in fact a possible solution for part of the water problems that Guayaquil is facing. Multiple locations came up to be suitable and we presented our solutions in a report which has also been shared with the local authorities. Not one solution will tackle the complete problem at once, but this could certainly be a good start. However, local small-scale solutions should definitely also be considered when trying to reduce the flooding problem.

Of course, a lot more research has to be done, but we are very happy with our results and look back to such a great time in Ecuador!
Digital engineering is widely promoted within the Engineering business at this moment. Also within Tunnel Engineering Consultants (TEC), a joint venture of Royal HaskoningDHV and Witteveen and Bos, digital engineering, and especially parametric design of tunnels, is strongly supported.

Within our companies the first steps for parametric design were already undertaken for bridge design. The first results were promising which convinced the management to invest more in digital engineering. Because of this investment a group of around 20 developers are dedicated to digital engineering for a few days every week in our main RHDHV office. They are developing all kind of tools which can help others to go forward and reduce time and costs.

TEC is an expert on tunnelling and are therefore challenged to develop their own tools in their field of expertise. All the knowledge is available within the TEC office and the projects are there to test and to develop the tool. The shape of a rectangular immersed tunnel is also very much suitable for parametric development, e.g. coupling of the different calculation programs and the integration with the 3D design programs.

Our main goal is to develop a tool which can easy and reliable develop a conceptual design as part of an immersed tunnel feasibility study. The second goal is to make this tool available by our website to make potential clients interested in an immersed tunnel as alternative for a bridge (or bored tunnel).

The following objectives are demanded:

- an objective comparison between an immersed tunnel and a bridge/bored tunnel;
- a representative cross section of an immersed tunnel;
- a 3D geometric and dynamic design;
- a cost estimate with an accuracy of 30%.

The output at this moment is:
1. List of requirements (parameters);
2. Conceptual Design of the cross section;
3. Alignment Design based on 6 points on the map (Google Maps);
4. 2D cross section and plan/profile drawing;
5. 3D Revit model;
6. Cost estimate with +/- 30%.

Figure 1 - List of Requirements / Parameters

The requirements are based on the European Regulations and Guidelines for tunnels (EU-Directive) and results in a pre-defined list which can be changed by the potential client for some project specific functional requirements. The different tab shows also fixed data like the configuration of ships in the navigation channel.
2. Calculation cross section
Cross section design in accordance with the requirements list and by use of Scia Engineer and several spreadsheets which are coupled by use of Visual Basic. For example the dimensions of the cross section are determined by a spreadsheet to calculate the safety of buoyancy in all construction stages (construction, transportation, immersion and ballasting) of the tunnel element. These dimensions are used in the Scia-engineer calculations and checked in according to the applicable codes and regulations.

3. Alignment Design
The Client can point out a location on the Map with a suggested alignment between two points; one on each side of the river. We will modify the alignment by adding 2 points depending if the alignment is straight or curved. And 2 points to define the position of the navigation channel.

Figure 2 - Calculation Cross Section
Figure 3 - Alignment Design
Figure 4 - 2D Cross Section and Plan / Profile Drawing
Figure 5 - 3D Revit Model

TEC - Parametric Design Tunnels
After two South American guests, The International Geocorner has its first European Geodude who has experienced both, North American and European, way of living, thinking and studying. Through this piece, Luka tells us about himself, his decision-making process to end up at TU Delft and how his academic and personal life has been influenced by his life here and overseas.

I have been swimming for quite some time (roughly 15 years) and I always wanted to go the United States to experience their college life and of course to keep swimming for the next four years. On the other hand, in Croatia it is pretty hard to keep up with both your athletic and academic duties. Therefore, while I was finishing high school, I started applying for some universities and I was lucky enough to get a full ride athletic scholarship at Fairmont State in West Virginia.

Honestly, at that time I had no idea which programme to enrol, but I have picked the Civil Engineering, which eventually ended up a pretty good choice for me. Just to say that it was not easy to manage the swimming practices which was usually 20 hours per week along with 18-20 hours of school.

In the US, the undergraduate degree takes about four years to finish and, in the programme that I chose, we covered most of the subject areas, therefore after getting your degree, one has a wide spectrum of disciplines which can be utilised in any branch of Civil Engineering. From what I saw in the United States, it is a common thing for engineers to start working right after obtaining their BSc since the MSc degree would just mean additional investing and getting more loans (education is quite expensive over there). I think that
all of my colleagues started working after getting their bachelors and they are pretty satisfied with their positions. In my case, I had to think forward and one day if I wanted to go back to Croatia I would definitely need a master’s degree; therefore, I started looking for potential schools in the Europe. Also, since you have to choose your master track within the Engineering, I started thinking what I like the most and by then the choice was quite simple. Firstly, I started liking the geotechnical since my professor was really passionate about the subject (Soil Mechanics I and II). Following this I started thinking about future and geotechnics seems to be a really exciting field since its involvement within the projects will just get more important in the future. Just when you think that world population is rapidly migrating into big cities, this just means that there will be a lack of space and then of course we have to excavate deeper, build tunnels, go to places where the good soils are scarce, etc. Apart from this, with geotechnical you can work in the offshore industry, which is definitely having a big time now. So, there you go, my choice was geotechnical and I do not regret that I have chosen it.

I have applied for KTH Royal Institute in Sweden, Denmark Technical University and TU Delft. I got accepted in the latter two and although the DTU is a tuition free institution, the choice was simple and I decided for Delft. I was impressed by the academic standing of TU Delft (which at that time was second in the world in Civil Engineering track). Also, I was impressed with all the achievements by the Dutch regarding the amount of infrastructure done in these “unfavourable” soil conditions. Since I am graduating in the following month, I’ve talked to some engineers from Croatia regarding the situation in our field. This allows me to talk about differences in geotechnics in Croatia and Netherlands. In Croatia, most of the large-scale infrastructure projects are already done, we have built more than 1000 km of brand new highway system, which involves a lot of geotechnical involvement since the route goes through the rough and mountainous terrain. A lot of excavation, soil replacement, tunnelling, etc. was executed and now it seems the geotechnical projects are quite limited to small projects which are mostly related to the recent tourist growth (e.g. construction of new hotels and resorts). The current situation is not a perfect environment that a young graduate would desire since I would like to work on big projects and learn as much as possible, while in Croatia I would be limited to some small excavations, slope stability calculations and also, not less important, the salaries are quite low when considering the prices. Also, in the area where I live (town of Split), the geology is quite different when compared to the NL: we have a lot of karst mountains and on the coast the ground is mostly made of marlstone which makes it easy for the construction.

While being in Delft I have done an internship abroad, which was in Dublin, Ireland. I have talked to Prof. Ken Gavin which connected me to his company: Gavin and Doherty Geosolutions. During the internship I was travelling every weekend and also you get used on Monday to Friday working routine which introduces you to the adult lifestyle. I had a great time in Ireland and I would definitely recommended to do an internship abroad if that fits your schedule and plans.
As the summer holiday came to its end, the new study year at the TU Delft started with the Introduction Program, the faculty introduction days and finally all the master tracks could also welcome their new students. On Monday the 3rd of September, the Geo-Engineering section received its freshlings: approx. 35 new master students started their studies in Geo-Engineering, ready to rock and very enthusiastic about all the exciting experiences this study year has for them.

The first day of the year started with an introduction of the master track and study schemes given by Domrique Ngan-Tillard and Julia Gerbert. Afterwards the student association De Ondergrondse took over with their introduction and short announcement about upcoming events and activities. So far the day was mainly focused on the information about the studies, courses and exams. But it was just a beginning.

After a small coffee break where everyone had an opportunity to meet and talk to each other as well as to check out the lab facilities of the Geo section, the bus arrived and everyone was invited to join an excursion to an exciting project of construction of a new lock in IJmuiden. The IJmuiden project includes one of the biggest locks in the world and is currently in the construction stage consisting of a great amount of geotechnical works, such as foundations, retaining walls, caissons and piles. The new lock is placed directly in-between the existing lock structures, which are still in operation and letting through tens of huge vessels on a daily basis. Of course this fact adds a lot of pressure and responsibility regarding the safety and logistics. Also the soil profile in the area of the construction of the new lock is mainly consisting of loose silty sands, which makes the static liquefaction of the soil to a big issue for the design engineer. During the visit students went on a 2 hours tour with the boat Koningin Emma. The engineers Sander Steenekeen of OPENIJ and Robbin Sluijsmans of Hydronamic joined the tour as well and gave presentations about the construction of the locks and the liquefaction issue respectively. The students could see the existing locks in operations as well as the new lock being constructed, e.g. the sinking of the caissons, that will be later used as lock walls.

After the boat tour everyone returned by bus back to Delft and even then the day was still not over. In the evening the BBQ was organised just outside of the faculty building, where the entire section was reunited again after the summer holiday. The staff members, 2nd and 3rd year students and of course the new master and exchange students had a great opportunity to meet and chat with new and old friends, exchange the holiday stories while having a drink and BBQ.