



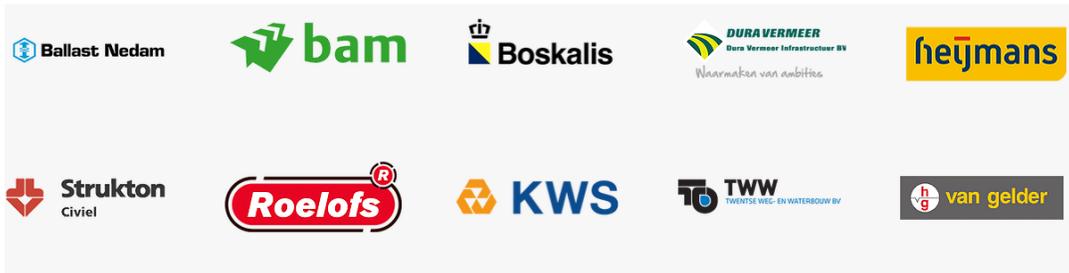
ASPARi

Paving the way forward

PAVING THE WAY FORWARD

The Asphalt Process Newsletter

Vol 1 - March 2019



Dear colleagues and friends,

It is that time of the year when our University of Twente students are searching for and starting up their final bachelor projects and of course, some are searching for master level projects to start. Bachelor students Chris van de Pol, Niels Hop and Sam Rutten introduce themselves in this newsletter. They will be undertaking their projects at Dura Vermeer, TWW and BAM respectively. Shihao Sun has started his Master project and will be conducting his research in the ASPARi unit. He too introduces himself and talks a little about his research and love for the Netherlands.

Of course, we would all our Civil Engineering students to undertake their projects with our ASPARi Founders. Alas, we are only able to attract small numbers to road construction research projects and are hopeful that we can attract more bachelor and master students in the future. Being able to attract students is a challenge everyone is facing throughout the sector. It is daunting and needs to be tackled in a holistic manner.

The ASPARi Founders are doing our bit in several ways. As you know, Janine Profijt is almost finished with her project developing educational materials for the MBO colleges. Her "minor" has already been tested and implemented at several MBO institutions throughout the country. This is great news given that the next generation of operators, estimators and planners will know about and would have worked with new Digital Technologies, new ways of approaching logistics, asphalt construction and related tasks. Babs Ernst recently started developing innovative educational materials for the HBO institutions and will be working closely with a few institutions and all Founder companies to make significant progress in this regard. The Founders have been steering this process along quite nicely with their involvement in the project advisory committees. These small committees ensure that all projects are tailored to the needs of the road construction and addresses the needs of the entire sector.

At the University of Twente, we recently developed and implemented a new Master Profile called Digital Technologies in Construction. It includes courses such as BIM & 5D Planning, Technology & Innovation in Road Construction, Simulation & Optimization of Construction Processes, Subsurface Infrastructure Engineering, Infrastructure Asset Management and others with a slant towards big data and data analytics. Digitalization in the construction industry is moving at a rapid pace. All future graduates need to be prepared for this explosion. This may be an opportunity to improve the image of our sector and in so doing, get more young people interested in all levels of road construction.

In closing, may I wish you well this year in your road construction efforts and may the asphalt gods smile upon you.

Best wishes,

Seirgei

In this edition — new students in the ASPARi unit introduce themselves, Farid gives some insight into our upcoming Virtual Reality Project and Denis shows some photos taken on the first PQi measurement of 2019.

Hallo ASPARi Netwerk!

Niels Hop

Mijn naam is Niels Hop, ik ben 24 jaar en ben momenteel bezig met de laatste fase van de bachelor civiele techniek. Ik kom uit Bunschoten-Spakenburg, een dorpje midden in het land, en sinds mijn studie ben ik in Enschede gaan wonen. Een hobby van mij is het maken van muziek, ik speel zelf vooral basgitaar en doe dit ook in een band. Voordat ik begon aan de opleiding civiele techniek wilde ik graag van deze hobby mijn werk maken. Civiele techniek was namelijk niet mijn eerste keus als studie, mijn eerste keus was een opleiding als sound engineer aan het conservatorium. Het is mij toen helaas niet gelukt om door de toelatingen van het conservatorium heen te komen, maar daar ben ik nu wel blij mee, anders was ik nooit begonnen aan deze opleiding. Wat de opleiding zo geweldig maakt voor mij is hoe breed het is. Als mensen vragen wat civiele techniek eigenlijk inhoud is het antwoord wat ik geef vaak iets in de richting van de drie stromingen binnen de opleiding: bouwen, water en infrastructuur. De opleiding voelt echter veel breder dan deze stromingen, een van de projecten tijdens de opleiding ging over het optimaliseren van de strategie om afspraken te plannen binnen een polikliniek. Vanaf dat moment was het voor mij duidelijk dat ik me wilde focussen op optimalisatie problemen.



Naast de optimalisatie problemen in de bouwsector wilde ik mij ook verdiepen in optimalisatieproblemen in andere sectoren. Hierdoor heb ik gekozen voor de minor 'Industry 4.0' waarbij nieuwe technologie in de productie-industrie ervoor moet zorgen dat er efficiënter en slimmer geproduceerd wordt. Het was interessant om te zien welke technologieën beschikbaar waren en hoe deze werden geïmplementeerd.

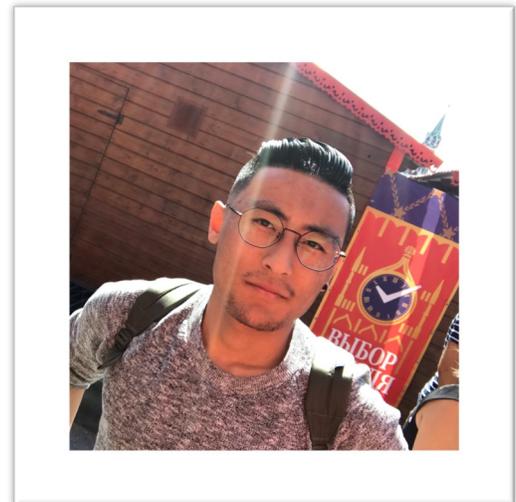
Voor mijn afstudeeronderzoek ga ik ook aan de gang met een optimalisatie probleem. Het onderzoek ga ik uitvoeren bij de Twentse Weg en Waterbouw (TWW) en zal gaan over de implementatie van een process management tool binnen de asfaltverwerkingsploeg. Het moederbedrijf heeft geïnvesteerd in WITOS paving, een process management tool dat de verschillende aspecten van de verwerking van het asfalt monitort en visualiseert. De implementatie van deze tool binnen de asfaltverwerkingsploeg loopt nog niet goed, omdat de ploeg de meerwaarde van de tool niet ziet. Het doel van dit onderzoek is het ontwikkelen van een implementatiemethode zodat het gebruik van deze tool standaardpraktijk wordt binnen de asfaltverwerkingsploeg. Voor dit onderzoek zal ik vanuit de Universiteit Twente begeleid worden door Denis Makarov, vanuit de TWW zal ik begeleid worden door Jeroen Grootenhuis.

All the way from China

Shihao Sun

Born in Taiyuan (a city in central China) and raised in Shanghai, I grew up near the Yangzi river and coastline. Delta area management has consistently been a key focus in Shanghai. Therefore, I went to study River and Coastal Engineering at the Ocean University of China. After completing my bachelor's degree in 2017, I followed in my friend's footsteps and started doing the Master's degree at the University of Twente in the Netherlands.

Since I came to the Netherlands, I was not only attracted by the landscape and lifestyle of this country, but also by plenty of awesome things which are worth exploring. Also during the study, I realized that Civil Engineering has many other sub-disciplines. Quality control and Management during the Construction Process has become more critical than before. My interest switched from the field of Coastal Engineering to Optimization of Construction Processes. More specifically, applying new technologies and innovations in construction projects to enhance quality, save time and reduce cost.



When I was searching for the graduation project, my supervisors Professor André Dorée, Dr. Seirgei Miller and Dr. Farid Vahdatikhaki introduced ASPARi to me. Shortly thereafter, I found a project that fits my interests. Currently I am working on using Unmanned Aerial Vehicles (UAVs) to monitor asphalt temperature during road construction. I will mainly be concerned with collecting and visualizing continuous stream of temperature data that combined with position information. Visualizing the surface temperature information at any given position on the paved road has two purposes: 1) help the roller driver to compact asphalt mixture within right temperature window and; 2) to be used as input of retrospective analysis and evaluate temperature homogeneity. I will be keeping you updated on my project.

Introducing Sam Rutten

I'm Sam Rutten, a third year bachelor student at the University of Twente. I was born in the Netherlands, Utrecht to be exact, but throughout my life I have moved between the Netherlands and the United States multiple times. I'm 20 years old and, cumulatively, I've lived 11 years in the US and 9 years in the Netherlands. I used to feel more American (because I went to high school there), but since I've been back, I've felt like a true Dutch guy. Apart from hanging out with friends, I partake in gymnastics at the university. I started when I started studying so I'm not an expert, but I enjoy it and it keeps me fit and healthy.



I also enjoy studying Civil Engineering. My reason for choosing this field might be a little of a cliché, but it's the truth. When I was young, I would always build, in my opinion, the best structures ever from Lego and blocks. From then on, my parents always joked about me becoming an architect or engineer. That has stuck and over the years it became what I wanted to do. Also, I've personally always enjoyed practical sciences over language and culture. Civil engineering is definitely a good fit for me. However, I am still not sure as to my plans for my master. I'm torn between traffic and construction. Therefore, I find it slightly ironic that I'm doing my bachelor thesis on asphalt, since asphalt can be seen as partly traffic focused and also partly construction focused.

As can be expected, my bachelor thesis will focus on gaining an increased understanding of asphalt. More specifically, the relation between the construction of asphalt during the paving process and the ultimate lifespan of that asphalt. I hope to find some connection between these two things. Maybe asphalt which was colder, relative to the rest of the road, has a greater likelihood to be distressed in the future. However, maybe it's the other way around. I hope to give answers to such questions. I will be doing this assignment for BAM since the roads I will be analyzing were originally paved by BAM.

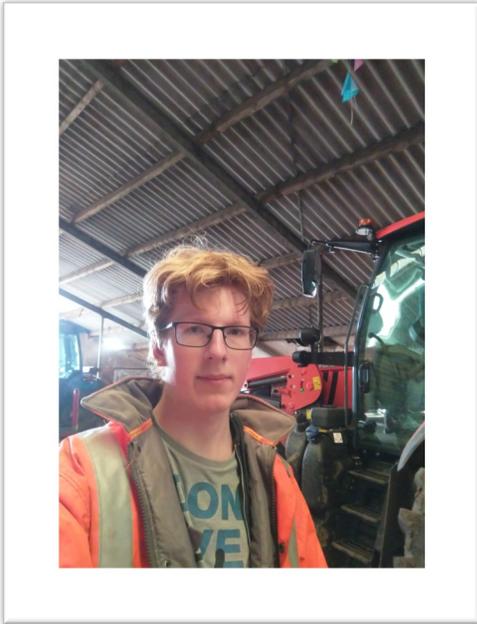
In 2007 part of the A35 highway was paved and in 2008 the Aziehavenweg, a road in an industrial area of Amsterdam, was paved; both projects by BAM. The picture below was taken during the Aziehavenweg PQi monitoring exercise. Both of these projects employed temperature profiling and GPS tracking of the asphalt construction vehicles to collect data on the temperature of the asphalt during paving and compaction data. Now that it is 12 and 11 years later, respectively, I will collect data on the various types of damage which have now affected both of these roads. I will attempt to quantify this damage to the best of my ability with the help of expert interviews and a literature study. The damage which I will observe will then be compared with the construction data of the roads from back in 2007 and 2008. From these comparisons, hopefully, a greater understanding of the phenomena at play will be gathered.



Both of these roads have been through different things throughout their lifespan. The A35 is used by large amounts of vehicles daily. Therefore, I expect a lot of damage. Part of the 500 meter stretch of road which was paved in 2007 has already been replaced. This also leads me to expect heavy damage. The Aziehavenweg will have seen much fewer vehicles over its lifetime. However, since it's an industrial area there is reason to believe that a large part of said vehicles were large freight trucks. It will be interesting to see the difference between the findings for each case after both comparisons. The opportunity to compare the two cases will arise. This might also lead to new insights.

Hallo everyone at the ASPARi network

Chris van de Pol



I am currently performing my Bachelor thesis at ASPARi. I was born and raised in Zwolle but now I live in Hengelo since the beginning of my study at the University of Twente. My main hobby is messing around with agricultural equipment at my grandfather's farm. Here, I am in the never-ending loop of breaking and repairing machines, which I like very much since it is very practical which is a nice variation besides my study.

Because my father works at a contractor involved in road construction and waterway maintenance, where I enjoyed the luxury of sometimes going with him to projects, I was inspired in the Civil Engineering sector from a young age. This led to performing a research on asphalt logistics as the final assignment on high school. Logically, this also led to choosing the bachelor Civil Engineering, of which I have no regrets.

Besides my study, I have a part-time job as process-controller at a distribution centre of Albert-Heijn, the leading food retailer in the Netherlands. Here, I work every Friday night controlling the inbound, production and outbound to the stores. Since high-school, I also

frequently perform administrative tasks for a contractor, such as submitting completion files to clients or requesting traffic measures on highways. Furthermore, I also perform other activities such as verge mowing with a tractor during my vacations. Last summer, I set up my own company, so I can serve more clients and do the billing myself.

So, about my Bachelor thesis. Via Seirgei Miller, I found a subject for a bachelor thesis at Dura Vermeer, one of the main contractors in the Netherlands concerning road construction. At Dura Vermeer, they have been performing research on the concept of the Asphalt Recycling Train since 2005. Now, after winning the "sustainable-asphalt" award in 2018 at Rijkswaterstaat, the Dutch main road agency, they are determined to design an implementation of the Asphalt Recycling Train which can be used for the 100% in-situ recycling of porous asphalt surfaces. At Dura Vermeer, I will be supervised by Messrs. Laurens Smal and Robbert Naus, both innovation managers with many years of experience in road construction and great interest in the Asphalt Recycling Train. From the University of Twente, Seirgei Miller and Denis Makarov, both researchers at ASPARi, will be my supervisors during my bachelor thesis.

The Asphalt Recycling Train is a concept to achieve in-place asphalt recycling of distressed road surfaces. The hot in-place recycling (HIR/HIPR) process provides a method of having a distressed road in front of the recycling train and a rehabilitated asphalt surface appear from behind the recycling train. The benefits of this method in contrast to conventional road maintenance is that there are no logistics needed between the site and the asphalt plant, since the old surface is 100% recycled. Furthermore, in conventional road maintenance, the old asphalt layer is cold-milled which leads to aggregate size reduction and devaluation. In the HIPR method, the old surface is first heated after which it can be hot-milled without reducing the aggregate size, thus achieving 100% recycling without devaluation. While it is still quite unknown in the Netherlands, there are many examples of usage in foreign countries like the USA and China.

In my bachelor thesis, I will contribute to the implementation of the Asphalt Recycling Train in the Netherlands to achieve 100% recycling of porous asphalt surfaces in-situ by assessing, evaluating and comparing different methods of heating porous asphalt surfaces in an Asphalt Recycling Train based on literature reviews, model calculations and experiments.

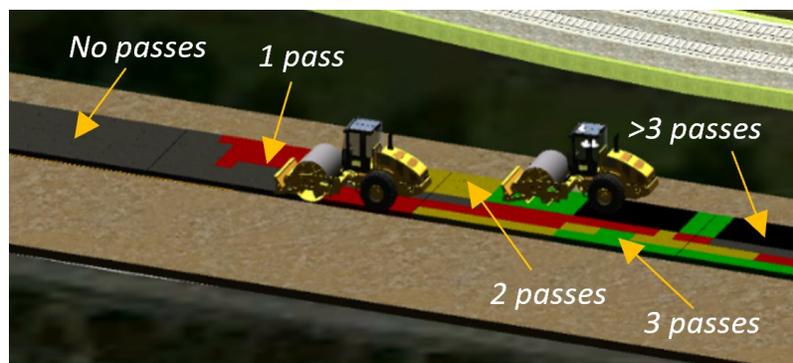
A new PDEng position for developing a context-realistic training simulator

Farid Vahdatikhaki

Is the quality and content of the professional training for paving equipment operators commensurate with the complexity and intricacy of their job? ASPARi research has indicated that there is still a considerable level of 'uncharted territories' when it comes to education and training of paving operators. The challenges stem from both the content and presentation of the education material. From the content perspective, we discovered, much of the new insights about process improvement in paving operation, which is engendered by ASPARi research in the past decade, has never found its veritable place into the relevant training curriculum. From the presentation standpoint, too, it became apparent that the exposure the trainees would receive to the educational content is either far from practice (i.e., classroom setting) or insufficient (i.e., limited time for on-equipment training). Given the complexity of the paving operations and limited time available for training with the actual equipment, there is much left for the trainees to learn on actual sites and projects (which directly translates into additional costs to the future employers).

In the past few years, ASPARi research unit has been vigorously working on developing, refining, and fine-tuning the content of the operator training educational content. Janine Profit and Babs Ernst from ASPARi team have taken the lead on the development of new content for paving operation training. Nonetheless, the issue of education presentation is still an under-attended topic. As a result, ASPARi joined UT faculty of Behavioral and Management Sciences (BMS) to define a new PDEng project on the development of Virtual Reality (VR) training simulators for asphalt operations. VR technology can bring realistic working situations to the classroom, helping students to experience the full complexity of work situations and train their situational awareness. However, often scenarios are not very realistic in terms of reflecting the dynamics of the actual paving sites. In order to create realistic context and scenarios that also reflect uncertainties, the aim of this project is to use ASPARi PQi data (images or sensors) to reconstruct the actual construction operation in the VR environment, as shown in the below figure. Based on the data collected from various types of operations, different training scenarios will be developed. Tasks and objectives are the same across scenarios, but conditions will vary. The main challenges in the project include:

- Understanding the mindset of teachers and students in order to identify the types of uncertainties that need to be reflected in the VR.
- Developing a solution to capture these uncertainties from actual construction operations.
- Translating the sensed data into VR training scenarios.
- Piloting an educational program based on the developed scenarios (in collaboration with teachers and students), including usability studies.



A schematic view of the context-realistic VR training simulator [1]

Our vision is that this project, when coupled with the results of other ASPARi PDEng projects, would revolutionize the way education is being approached in the paving sector. Besides, we will create another application frontier for the PQi measurements, making the use of the methodology even more indispensable and monumental.

[1] Vahdatikhaki F., Langroodi A., Makarov D., Miller S., (2019) "Context-Realistic Virtual Reality-based Training Simulators for Asphalt Operations" 36th International Symposium on Automation and Robotics in Construction, Banff, Canada

The 2019 asphalt paving season has started and that means we started doing PQi measurements. Here are some pics taken at TWW on 19 March!

