

# Professional Doctorate in Engineering (PDEng)

Faculty of Civil and Environmental Engineering

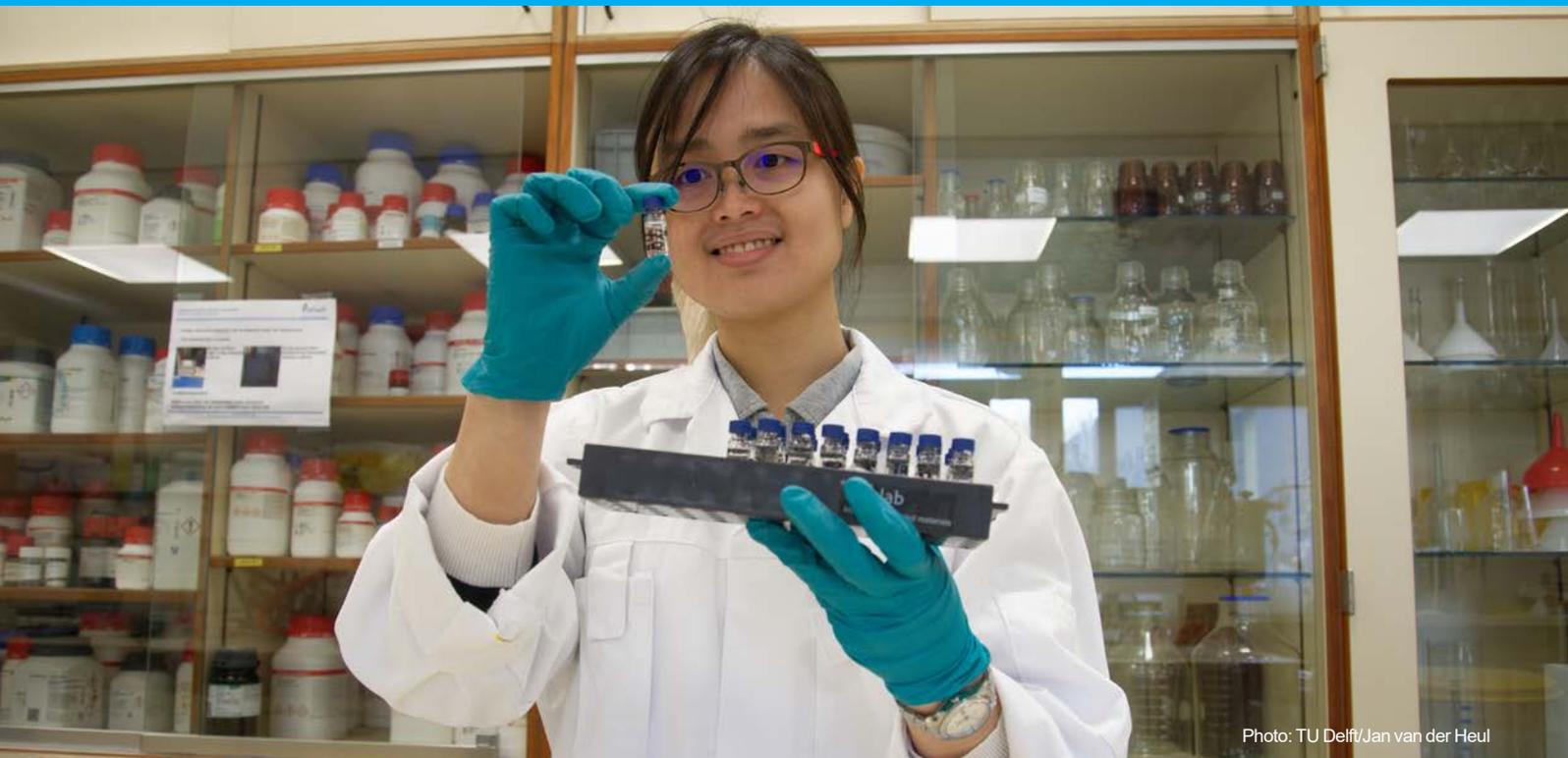


Photo: TU Delft/Jan van der Heul

Diploma	Professional Doctorate in Engineering
Credits	120 ECTS 24 months
Starts in	September
Language of instruction	English

More information & contact

[www.ceg.tudelft.nl/pdeng-ce](http://www.ceg.tudelft.nl/pdeng-ce)

PDEng-CEG@tudelft.nl

Faculty of  
Civil Engineering and Geosciences  
Stevinweg 1  
2628 CN Delft

## Working on strategic innovation

The two year Professional Doctorate programme in Civil and Environmental Engineering at TU Delft is the starting point of a successful career as a designer or engineering expert in industry or a company. The degree Professional Doctorate in Engineering (PDEng) will be awarded upon the successful completion of the programme in one of the three tracks.

The programme will help you to develop design skills for supporting strategic innovation. During the programme, you learn how to initiate, and develop a complex, innovative design project that is of interest to a company/industry or your own employer. A design project is the core of the programme and is carried out individually. It is supported by various courses as well as an integrated group project. The individual design project takes the innovation past the phase of prototyping to implementation and market introduction, where you demonstrate your ability to apply the knowledge, you have obtained during the course of the programme, in solving a real-life, complex design problem or developing a new system.

### Sanitary & Environmental Engineering

Focuses on water management challenges related to, amongst others, water collection and conveyance, water treatment, and resource recovery from watery streams and sludges

### Structural & Railway Engineering

Aims at innovation in civil engineering, for example smart buildings, new materials and sustainable railways.

### Subsurface Constructions & Engineering

Concerns the application of scientific knowledge for innovations in critical underground infrastructure and development of solutions for geo-environmental problems.



**Prof. Timo Heimovaara**  
Geo-Environmental Engineering

“Renewal and renovation of tunnels and waterways but also demands for safety and lifespan extension of crucial underground constructions require innovations in various areas. Successful steps from science to market introduction of these innovations, require involvement of talented designers who can combine engineering knowledge with business expertise and operational know-how.

With the track Subsurface Constructions & Engineering of our PDEng programme, we aim to develop systems, methods and applications to support maintenance and renovation projects and to find solutions for complex soil problems. Examples are: systems for early detection of tunnel subsidence, techniques for repairing damages in concrete walls and tools for assessment of geohydrologic risks in canal projects.”

# Direct response to market needs

## Collaboration with the industry

Various companies in the civil and environmental engineering sector are closely involved in the development of our education, so we can make the courses, projects and cases reflect the reality of tomorrow.

The water sector is closely involved in the PDEng programme with projects for the improvement of urban drainage, wastewater treatment and drinking water supply, but also for the recovery of resources from waste streams.

The railway sector has to work on a system leap that will allow building and maintenance of railway tracks without major disturbances of train services. In addition, the rising complexity of building and civil construction requires specialists with comprehensive knowledge of civil engineering and the ability to integrate new technology and disciplines.

As for subsurface constructions, the civil sector is in full swing as operators of public infrastructure have to deal with complex decision-making about asset management of essential underground structures, such as tunnels, bridges, railway embankments, highways and canal beds. Many of these constructions are halfway through their life cycle and need maintenance or renovation. This requires innovations to support reconstruction projects and to introduce durable solutions.

## Challenges for the industry

Our society is facing various social and environmental challenges, such as climate change, water pollution, ageing infrastructure, a rapid development of technology and increasing demands for mobility. These are all challenges that need innovative solutions by engineers and designers. As a response to this market need, the faculty of Civil Engineering and Geosciences at TU Delft provides a PDEng in Civil and Environmental Engineering that will deliver highly skilled design engineers who can succeed at the forefront of the civil and environmental engineering sector.

# Education

The PDEng programme in Civil and Environmental Engineering consists of the following components:

- Individual Project (60 ECTS)
- Compulsory courses (28 ECTS)
- Elective courses (20 ECTS)
- Group Project (12 ECTS)

1 ECTS = 28 hrs of workload, according to the European Credit Transfer System (ECTS). One academic year is 60 ECTS.



# Tools for practice

Arthur de Boom (Rijkswaterstaat) developed an entry-level risk assessment tool for technical advisors to evaluate groundwater-related risks in canal maintenance projects, and developed a suitable control measure based on project-specific objectives.

The added value of the tool is a swift risk assessment and control measure selection in an early stage. This supports decision making in risk management of costs and project delays.

Photo: Arthur (at the right) testing the robustness of a seepage control measure against passing vessels by means of flow velocity and (ground)water pressure measurements.

# Curriculum

## Compulsory courses

### Asset Management for Designers

The purpose of this course is to learn the skills needed to integrate acquired data, tools and new technology for the engineering of improvements in constructions and installations in an asset management context.

### Integrated Design

This course integrates different design approaches that are relevant for all disciplines entailing the creation of products and services in the areas of civil, geo and environmental engineering.

### Effective Communication for Designers

The objective of this course is to develop communication skills and to present ideas, models or new technology effectively to different types of audiences.

### Research Design

Support of the PDEng trainee in defining and planning of the individual project with appropriate scientific research steps and in a relevant theoretical framework.

### Risk Management for Designers

This course deals with the aspects of risk management in the individual project, with emphasis on methods and techniques for analysing and evaluating threats and failures.

### Advanced Principles in Product & Process Design

Development of knowledge and competencies in product & process design methods. You will also learn to critically review and evaluate conceptual product or process designs.

### Group design project

The group project is carried out jointly by the trainees working on a real case in the industry. The topic is determined in consultation with the companies involved in order to align the content as much as possible with the objectives of the sector.

## Elective courses

The elective courses meet the knowledge requirements of the trainee and are focused on a deeper understanding of the discipline related to the individual project. They can be chosen from the TU Delft curricula for the existing MSc programmes.

The courses will be selected in consultation with the supervisors of the trainees and must be completed successfully to the standards of Delft University of Technology.

## Prof. Luuk Rietveld Water Cycle Technology

"Innovation in the Sanitary & Environmental industry is complex. Proper modern water supply and treatment not only depend on innovative process design, but also on factors such as intelligent monitoring and control, social and economic aspects, safety, and environmental impacts of the installations. Therefore, a designer should be able to integrate all these aspects and perform a proper assessment of water infrastructures.

The process of designing better water treatment and construction systems, sustainable building materials or a high performance water supply or drainage system, starts with an understanding of generic design, risk and asset management principles, and the latest technological developments."



## Pilot plant design

The presence of potentially hazardous substances in wastewater, such as pharmaceuticals, personal care products, hormones, steroids and pesticides is becoming a serious threat to our environment, especially surface water.

Nessia Fausta (TU Delft) designed and built a pilot plant based on innovative Adsorption-Oxidation technology using high-silica zeolite as a successful proof-of-practice for the removal of micropollutants from treated wastewater.

The technology is expected to be suitable for general municipal wastewater treatment but also for dedicated installations in industrial wastewater treatment plants.

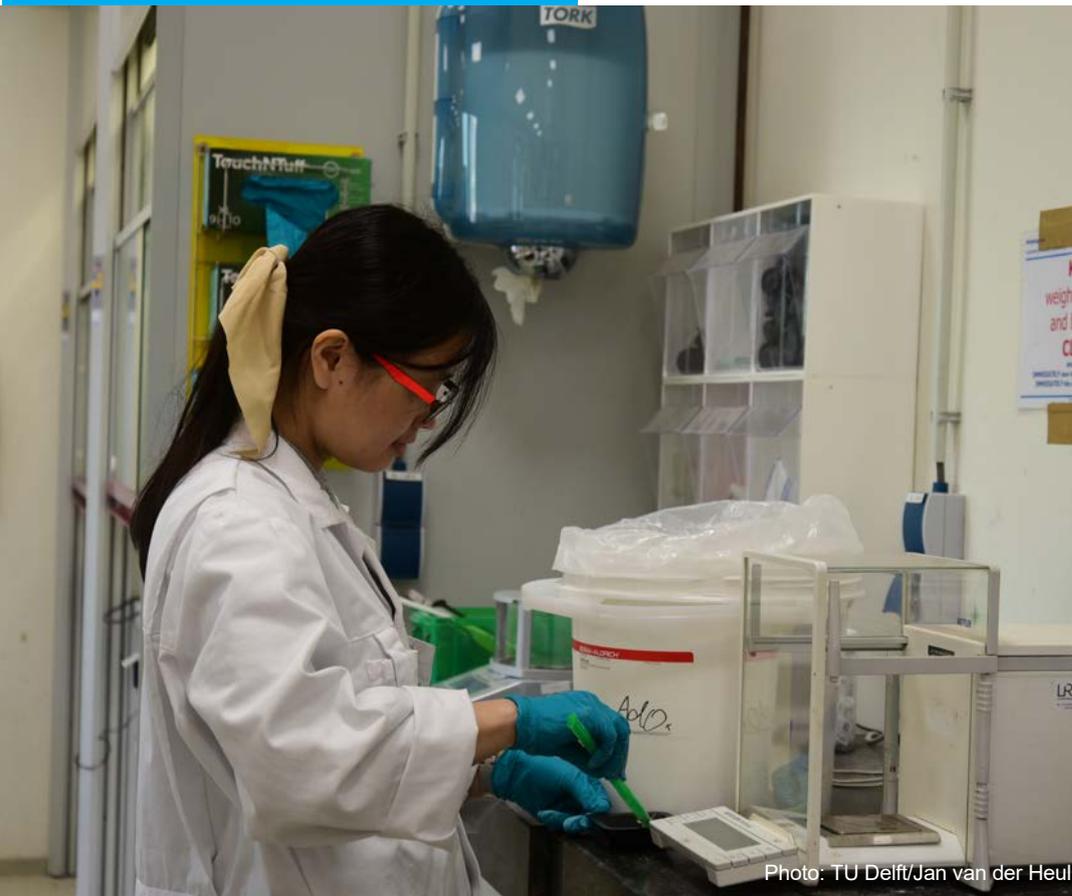


Photo: TU Delft/Jan van der Heul



**Prof. Rolf Dollevoet**  
Railway Engineering

"Creating new technology and methods for the building and construction industry or developing a rail system that can deliver a sustainable and robust train service, requires design engineers with integral knowledge and multiple skills. Innovations are not only the result of good ideas; they require an analysis of asset management and risks, they need to be sustained with a sound and solid business case. Besides this, an analysis of asset management, risks and the design steps must be carried out before technological innovations can be demonstrated and implemented.

As a PDEng trainee, you will work on an innovation in the civil engineering sector. Our Structural Engineering group will guide you to find a scientifically based solution to make your innovation project work."

# Admission

## Application

Application is open to university graduates. You will need at least a Master of Science degree or equivalent, preferably in the exact sciences.

Application is open to people

1. who are employed and whose company supports this programme and the innovation project, or
2. who are self-funded and have found a company willing to host them for the innovation project.

There will be an assessment and selection procedure before you can enter the programme. TU Delft uses strict selection criteria to ensure the required high quality of participants. Excellent marks, being highly motivated and a design-oriented attitude are vital. You should also have a good command of the English language.

## Selection

You can apply by sending your letter of application with a complete curriculum vitae and a letter of recommendation (in English) from your employer or from an executive in the industry, scans of your MSc certificate and transcript of records, and a proposal for the individual innovation project. Suitable candidates will be invited to an interview with the selection committee of the programme.

## Appointment

If you are selected for the programme, you will be appointed as a trainee for the duration of the programme (two years). Participants who join this programme as part of an in-company innovation project or other types of personal assignment remain employed by their employer.

## Costs

The costs for the PDEng programme are € 15.000 per year for education, supervision and use of the (knowledge) infrastructure of the university.

## Diploma and degree

On successful completion of the programme, you will receive a diploma. You are then entitled to use the academic title Professional Doctorate in Engineering (PDEng) and you will be registered as a Technological Designer in the Dutch register kept by the Royal Netherlands Society of Engineers (KIVI).

The quality of the programme is assured by an assessment and certification procedure by the Dutch Certification Committee CCTO (Nederlandse Certificatie Commissie voor Opleidingen tot Technologisch Ontwerper)

[www.ceg.tudelft.nl/pdeng-ce](http://www.ceg.tudelft.nl/pdeng-ce)



# Individual Design Project

The individual project is the main part of the programme. It is carried out in relation to the strategic innovation needs of the company. The outline is defined during the admission process by the candidate in consultation with the industry and the selection committee of the programme.

Prior to the start of the second quarter of the first year of the programme, candidates must develop a final plan that will be submitted to the selection committee. After approval the participant can commence with the individual design project. Spreading the individual design assignment over the two years of the programme will help the trainee to understand the theory of the courses by applying it in practice.

Transition zones in railways are of main concern to rail infra managers as extra costs are incurred to maintain track availability. Especially, hanging sleepers induced by differential settlements in ballast track are major causes of transition zone failures.

Based on scientific research on the origin and behaviour of differential settlements, Mário Diogo Carvalho (ProRail) contributed to the development of a Self-Supporting Sleeper, capable of automatically correcting height once a sleeper starts hanging. This solution helps reduce maintenance costs and does not require manual actions, which has a positive impact on track availability.

Photo: Mário at the On-campus Rail Lab