

Geoengineering

Wojciech Sołowski

Geoengineering Programme Leader

27th August 2024



Aalto University
School of Engineering



A?

	Tuesday 27th August 2023, R5	Wednesday 28th August 2023, R266
8.30-10:00	Chairman: Sanandam Bordoloi 8.30 Welcome! Introduction to Geoengineering Master Programme (Wojtek Sołowski) and presentation of the students Study paths, courses and teaching / research infrastructure:	Chairman: Sanandam Bordoloi 8.45 - 9.15 Rock Mechanics (Mikael Rinne) 9.15 - 10.30 All Well! (Sanni Saarimäki) 10.30 - 10.45 Geotechnical and Rock Engineers' club presentation (Otso Laurila, Juuso Eskelin) 10.45 - 11.15 Introduction to study services (Minna Marin)
10:00 - 11:30	9.20 Geotechnical Engineering (Wojtek Sołowski, Sanandam Bordoloi) 10.00 Highway Engineering (Yuxuan Sun) 10.30 Engineering Geology (Jussi Leveinen) 11.00 Photo session (Otto Hedström, Lauri Uotinen)	11.15 - 11.30 Selection of study advisor
11:30-12:00	Lunch break	Lunch break
12:00-13:00		
13:00-14:00	Tunnel and laboratories tour (Otto Hedström, Veli-Antti Hakala) ~13.00 Geotechnical Laboratory (Alejandra Lopez-Ramirez) ~13.25 General laboratory, testing hall	Chairman: Sanandam Bordoloi Presentations from industry (13.00-16.00) 13.00 - 13.25 Destia (Miia Paatsema, Kaisla Kivistö) 13.25 - 13.50 Ramboll (Piitu Kurtilla) 13.50 - 14.15 WSP (Emilia Köylijärvi?) 14.15 - 14.40 AFRY (Samu Portaankorva)
14:00-15:00	afterwards Highway laboratory afterwards Research tunnel	14.40 - 15.05 A-Insinöörit (Hamilkar Alava Bergroth) 15.05 - 15.30 Sitowise (Nina Tanskanen, Iikka Kronkvist) 15.30 - 15.55 SWECO (Juho Rahko) 15.55 - 16.00 Closure (Sanandam Bordoloi)

WELCOME TO AALTO!

Congratulations on your achievement!

Programme's international recognition

76-100

Mining and mineral engineering

Shanghai ranking 2024

101-150

Civil engineering

Shanghai ranking 2024



Aalto-yliopisto
Aalto-universitetet
Aalto University

Programme teachers

Who we are?

Wojtek Sołowski

Geotechnical Engineering

- Numerical Methods
- Soil Modelling
- Director of the MSc programme
- International Secretary of Finnish Geotechnical Society
- Member of Eurocode committee
- Member of TC 106, unsaturated soils, ERTC7 numerical methods and numerical methods in EC7



Sanandam Bordoloi

Geotechnical Engineering

- design of hazardous waste containment systems
- valorization of industrial waste in geotechnical and geo-environmental engineering
- applied clay science
- carbon capture in geotechnical engineering



Mikael Rinne

Rock mechanics and engineering

- project management related to tunnelling and geological disposal of radioactive waste.
- rock and fracture mechanics and their applications to rock engineering and mining



Jussi Leveinen

Engineering geology

- mineral composition and electro-chemical characteristics of low sulfide mining tailings
- mineral interactions in forest soils affecting growth of certain fungal species.
- use of remote laser-techniques in assessing mineral composition and engineering geological properties or rocks.



Augusto Cannone Falchetto

Highway engineering

- Asphalt mixtures
- Bitumen mixtures and their behaviour
- Modified binders
- Recycling and carbon neutrality



Mateusz Janiszewski

Lecturer in rock mechanics

- Photogrammetric methods
- Virtual learning environments
- Virtual reality and visualisations
- Solar thermal storage
- Risk management



Other teachers

Nina Raitanen



Topias Siren



Lauri Uotinen



Leena Korkiala-Tanttu



+ many other staff, from Aalto, as well as from industry

Other Key Staff

Minna Marin



Matti Ristimäki



Otto Hedström



Programme structure

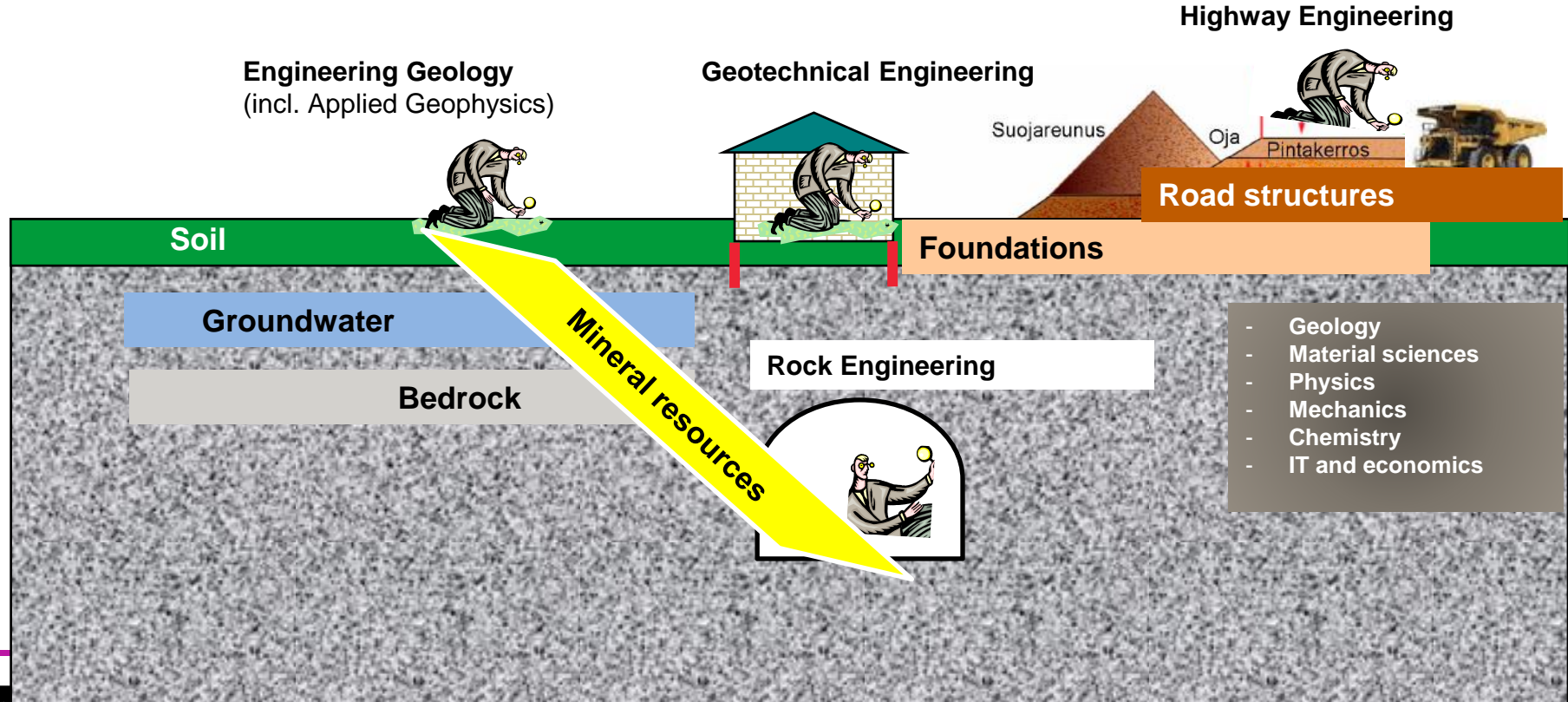
What are the courses and requirements?

Freedom to study

- **Common studies (4 courses, 20 credits), you must take those!**
- **MSc thesis – 30 credits (obligatory)**
- **Advanced studies (select courses for at least 40 credits, typically 8 courses)**
- **Elective studies (select courses for at most 30 credits)**
- **Common+ Advanced + Electives + MSc thesis = 120 credits**



Geoengineering study paths



Common studies (20 cr)

Obligatory courses, must take:

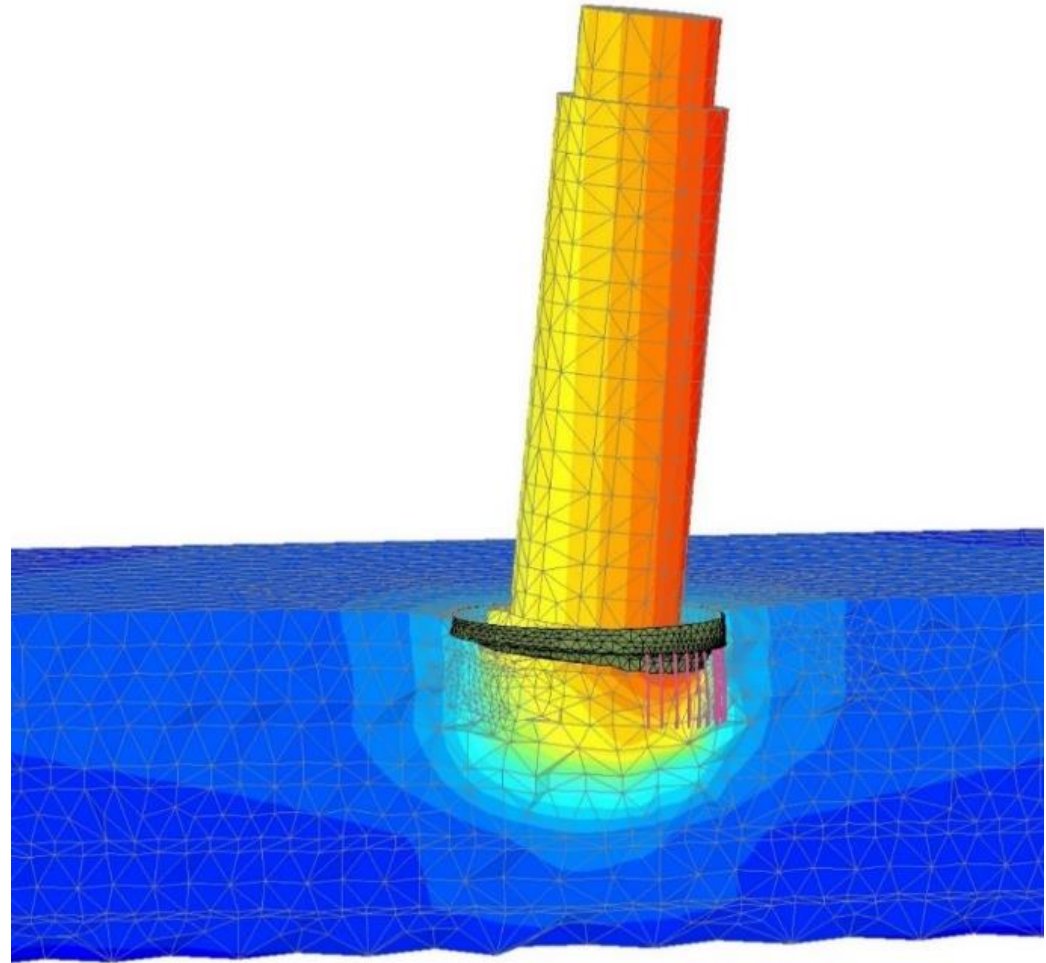
- **period 1: Geotechnics GEO-E1020**
- **period 2: Structural Design of Roads GEO-E1030**
- **period 3: Rock Excavation GEO-E1040**
- **period 4: Engineering Geology GEO-E1010**



Advanced studies (40 cr)

Geotechnical path:

- period 2: Foundation Engineering and Ground Improvement GEO-E2080
- period 4: Advanced Soil Mechanics GEO-E2010
- period 5: Numerical Methods in Geotechnics GEO-E2020 (5 - 10 credits, can be combined with Special Assignment in Geoengineering)



Advanced studies (40 cr)

Highway engineering path:

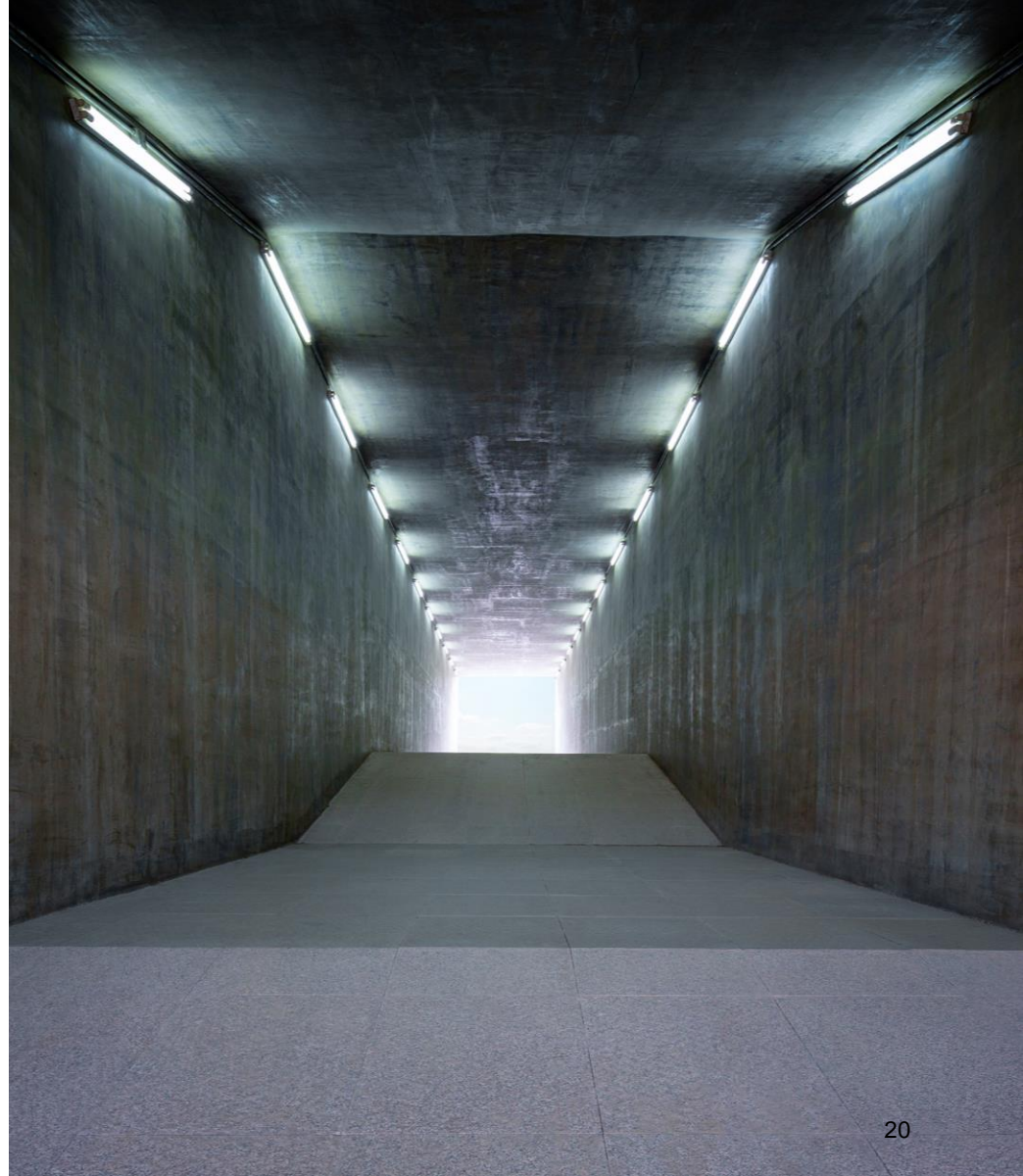
- period 3 Geometric Design of Roads GEO-E3040
- period 4 Bituminous Materials and Mixtures GEO-E2050 (every 2nd year)
- Period 4 Road Maintenance and Rehabilitation (every 2nd year) GEO-E3030



Advanced studies (40 cr)

Rock engineering path:

- period 5 Rock Construction GEO-E2040
- period 1 (Second year!) Rock Mechanics GEO-E2030
- period 2 (Second year?) Economic Geology and Mineral Economics GEO-E3010



Advanced studies (40 cr)

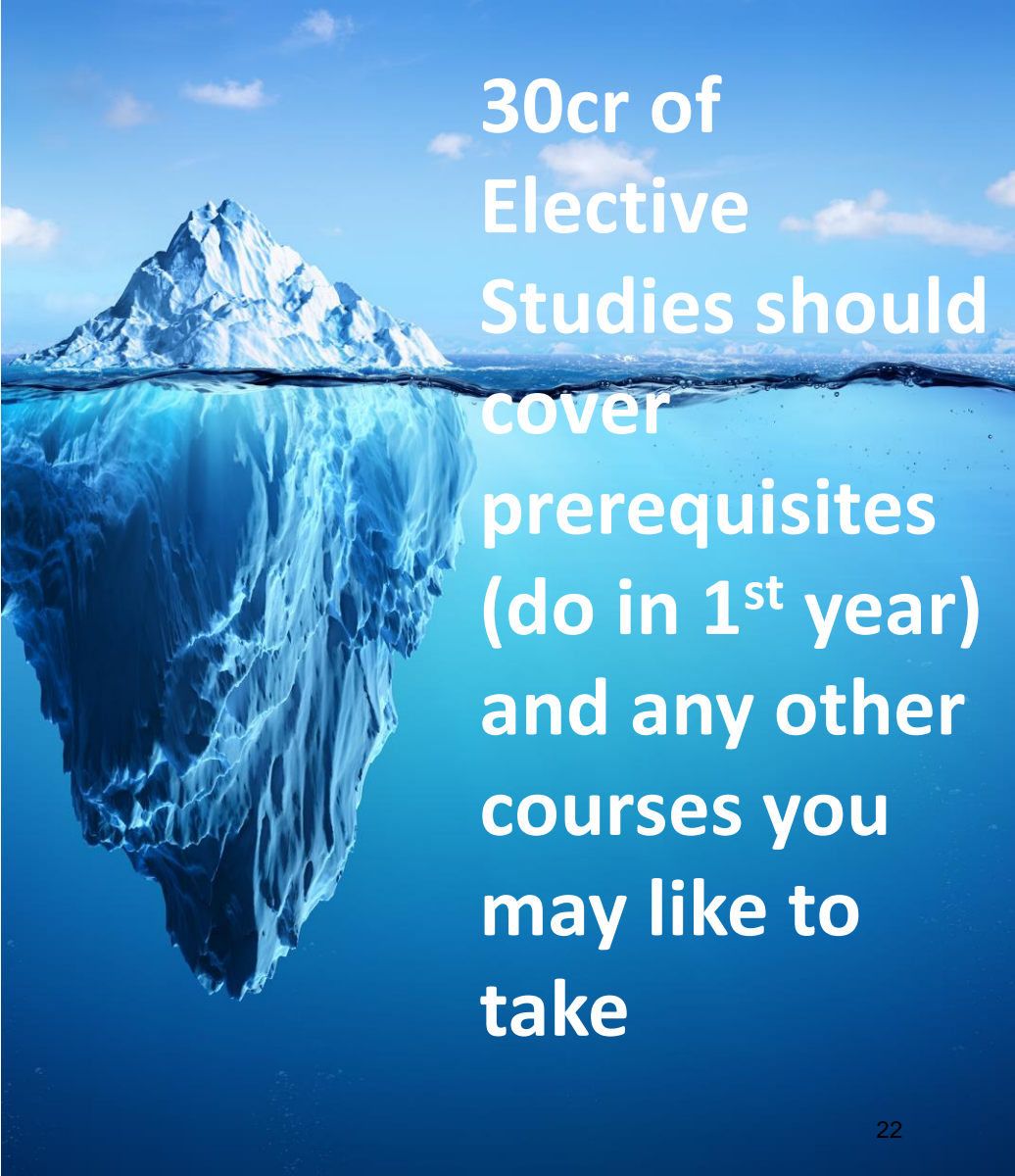
Civil Engineering courses:

- period 1 Fundamentals of Structural Design CIV-E1020
- period 3 (second year?) Sustainability and Circular Economy in Civil Engineering CIV-E6010
- period 3 (second year?) Reinforced Concrete structures CIV-E4040
- period 2 (second year?) Design Process Management CIV-E2080



Typical Elective Study courses

- CIV-E1020 Mechanics of Beam and Frames, needed for many CIV courses
- CIV-E1040 Construction Management and CIV-E2050 Operation Management in Construction, needed for CIV-2080
- CIV-E1060 Engineering Computation and Simulation
- CIV-E4010 Finite Element Methods in Civil Engineering D or MS-E1653 Finite Element Method D



30cr of
Elective
Studies should
cover
prerequisites
(do in 1st year)
and any other
courses you
may like to
take

Master thesis (30 cr)

Can be combined with Special Assignment in Geoengineering (1-10 credits)

- **For funded thesis (majority)**
 - Summer job
 - Part-time job
 - Thesis financing
- **There are some courses which may be helpful, you can take those as elective studies**
- **Talk with your academic advisor!**



FISE qualifications

- Designers in Finland use FISE qualifications as a certificate that they are professionals who can design certain structures
- Check fise.fi, patevyyspalvelu.fi
- Requirements: experience and credits in given areas
 - often: 10-15 CIV credits
 - often: 30-45 credits in the area
 - MSc thesis can be counted (not necessarily full 30 credits)



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F I S E

RAKENNUS-, LVI- JA
KIINTEISTÖALAN
HENKILÖPÄTEVYYDET



**LAADUKAS RAKENTAMINEN
TAATAAN PÄTEVÖITYNEILLÄ
TEKIJÖILLÄ**

image: (c) FISE.FI²⁴

First year

1. autumn I	II	1. spring III	IV	V
GEO-E1020 Geotechnics	GEO-E1030 Structural Design of Roads	GEO-E1040 Rock Excavation	GEO-E1010 Engineering Geology	GEO-E2020 Numerical Methods in Geotechnics
CIV-E1030 Fundamentals of Structural Design (CIV, Recommended prerequisite: CIV-E1020)	GEO-E2080 Foundation Engineering and Ground Improvement	GEO-E3040 Geometric Design of Roads	GEO-E2010 Advanced Soil Mechanics	GEO-E2040 Rock Construction
	CIV-E1060 - Engineering Computations and Simulations	MS-E1653: Finite Element Method D	MS-E1653: Finite Element Method D	
	CIV-E1020 - Mechanics of Beam and Frame Structures	CIV-E1040 Construction management	GEO-E2050 Bituminous Materials and Mixtures (Even years, next time 2024)	
			GEO-E3030 Road Maintenance and Rehabilitation (Odd years, next time 2025)	
			CIV-E4010: Finite Element Methods in Civil Engineering	
Colors:			CIV-E2050 Operations management in Construction	
Common studies (Compulsory)	Advanced studies (Select at least 40 credits, 8 courses)	Elective Studies		
ENG-E1010 - Practical Training V (Eg. Summer job; 10 weeks=5crs.)				

2nd year

2. autumn I	II	2. spring III	IV	V
GEO-E2030 Rock Mechanics	GEO-E3010 Economic Geology and Mineral Economics	Master's Thesis 30 op		
GEO-E2071 Special Assignment in Geoengineering 1-10cr				
	CIV-E2080 Design Process Management D	CIV-E4040 Reinforced Concrete Structures (CIV)	GEO-E2050 Bituminous Materials and Mixtures (Even years, next time 2024)	
		CIV-E6010 Sustainability and Circular Economy in Civil Engineering	GEO-E3030 Road Maintenance and Rehabilitation (Odd	
Colors:				
Common studies (Compulsory)	Advanced studies (Select at least 40 credits, 8 courses)	Elective Studies		

Tough but doable schedule – first year

1. autumn I	II	1. spring III	IV	V
GEO-E1020 Geotechnics	GEO-E1030 Structural Design of Roads	GEO-E1040 Rock Excavation	GEO-E1010 Engineering Geology	GEO-E2020 Numerical Methods in Geotechnics
CIV-E1030 Fundamentals of Structural Design	GEO-E2080 Foundation Engineering and Ground Improvement	GEO-E3040 Geometric Design of Roads	GEO-E2010 Advanced Soil Mechanics	GEO-E2040 Rock Construction
	CIV-E1060 - Engineering Computations and Simulations	MS-E1653: Finite Element Method D	MS-E1653: Finite Element Method D	
	CIV-E1020 - Mechanics of Beam and Frame Structures	CIV-E4040 Reinforced Concrete Structures (CIV)	GEO-E2050 Bituminous Materials and Mixtures (Even years, next time 2024)	
			GEO-E3030 Road Maintenance and Rehabilitation (Odd years, next time 2025)	
Colors:				
Common studies (Compulsory)	Advanced studies (Select at least 40 credits, 8 courses)	Elective Studies		

2nd year

2. autumn I	II	2. spring III	IV	V
GEO-E2030 Rock Mechanics	Master's Thesis 30 op			
Prestressed and Precast Concrete Structures D			GEO-E2050 Bituminous Materials and Mixtures (Even years, next time)	
			GEO-E3030 Road Maintenance and Rehabilitation (Odd years, next time 2025)	

Total: 45 credits, 5 credit CIV concrete

Such a curriculum gives the most comprehensive education we can provide. If I calculated correctly, the curriculum will give you option to get highest FISE qualification in design of geotechnical structures (45 credits of Geotech + 15 Structural CIV) and infrastructure (10 credits of road design covered) , plus it has 10 credits in concrete allowing for some FISE qualification in rock mechanics (the level depends on interpretation).

Workload



Workload **per course**

5 credits course = $5 \times 27\text{h} = 135\text{h}$

6 weeks course = 22.5 h per week

At the university = 4-8h

Leaving up to 20h per week of work for you

Aalto research (to be continued this year) shows that very few will exceed that workload... **Aalto aim is that the **AVERAGE** workload per course is 135h.**

Workload of each course can vary a lot

Some courses have average workload of 80h while some has workload of 140h, for an average student for grade 3

Workload does depend on your background

- Aalto background = lower workload in some initial courses for grade 3
- Other background = some initial courses easier than the other
- Doctoral level courses generally have higher workload for MSc level students

Workload depends on your aims: Aim high = higher workload

Workload depends on your attitude: Got stuck, don't ask for help = higher workload, attending classes and ask for help frequently = lower workload

Workload perception is different to actual workload: Procrastinate = higher perceived workload

Our aim at Geoengineering

We want to offer you a chance to be a world class engineer

- Some choices of courses will lead to a lower workload, but you also learn less
- Courses aim to teach you different skills and knowledge, acquiring some of those skills and may be easier for you - e.g. the course may focus on working and cooperating in a group and presenting results vs teaching the ability to conduct an advanced FEM analysis and make a design
- Some skills we teach are common among the workforce, hence a bit less valuable for employer, some are not common at all
 - you will graduate with the same final diploma, but with vastly different skillsets
- You should choose your path so it suits your aims and goals
- The companies offer very different initial and future conditions for our graduates, depending on their skills and courses taken
- Your study plan matters!!!

Workload when you work

Yearly workload is 60cr = $135 \times 12 = 1620\text{h}$

When linked with part-time / full-time job, things are getting tough (2400h +, 3200h +).

For comparison, to be successfully tenured, the tenure track professor has to work approximately 60 h a week, maybe 2800h+ a year (Nature, 27 Oct 2016)

High workload leads to higher chance of burnout.

However, part time job can complement studies well. We do not recommend more than 10-20h/month + 10 weeks of summer job, leading to around 2000h per year of total workload.

More work will likely negatively affect your performance during studies, as well as your life-work balance.

Remember: early courses are likely to have lower workload than the later courses, so estimates based on your first period are not very good

How to cope???



Work smarter!

1. Stay positive (80% of time)

‘can do attitude’, keep your mission and goal in mind

2. Have a good work routine 25/5, 45/15, 57/13

(more about that in the next slide)

3. Ask around when stuck or when you don’t know how to start.

Pro tip: asking a question is also good way to start a conversation with someone you do not know that well

4. Sleep long, eat well, meditate, do breaks.

sleep is essential for retaining knowledge, meditation helps managing stress (as does sport)

5. Aalto All Well! team can help – seek help early

Work smarter!

- Divide big tasks into smaller manageable chunks,
- Make sure nothing will interrupt you
- Focus on single task (multitasking lowers IQ in each task)
- Have good working routine

If procrastination is a problem for you...

... surely it used to be a problem for me...

Pomodoro method (work – break routine, during work you are fully concentrated on work) may be helpful

--- many apps for the phone exist, just search for pomodoro

Procrastination and interruptions are the main enemies of effective work – stay alert

I am sure that each and every of You is able to complete 60 credits per year...

Please, give us a chance to grade you high!



**KEEP
CALM
AND
CARRY
ON**

Feedback

Feedback

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Teachers working with you know a lot about giving and listening to feedback...

But we need your feedback!

Visual Notes by: @Rebezumiga 08.29.2014
Source: www.edutopia.org/blog

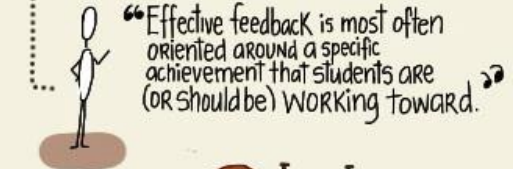
5 Research-Based TIPS FOR PROVIDING STUDENTS WITH MEANINGFUL FEEDBACK

by: Marianne Stenger
Edutopia.ORG

4 Present feedback carefully:
Situations in which feedback could be counterproductive:



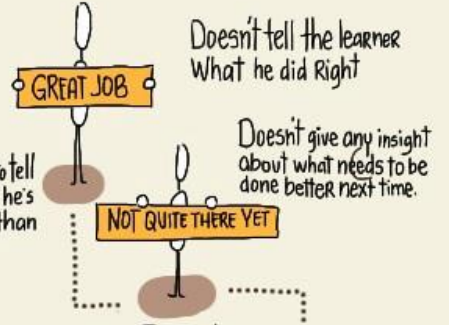
3 Address the learner's Advancement toward a goal:



5 Involve learners in the Process:

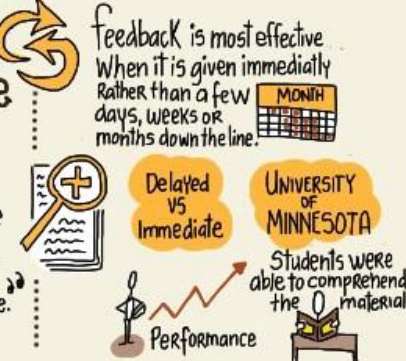


1 Be as specific as possible:



2 The sooner the better:
Taking time to provide learners with information on what exactly they did well, and what may still need improvement.

feedback is most effective when it is given immediately rather than a few days, weeks or months down the line.



Official feedback: take long-term view

Currently, the participation rate in the official feedback is around/below 30%

- with this participation rate, the official feedback cannot be trusted
- decision making based on such a feedback is risky
- hence teachers typically have other sources of feedback from students, used for the course improvement
- yet, the official feedback may be used by the university to assess teachers, courses, departments and schools



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PLEASE



SHARE YOUR FEEDBACK!

Official feedback

- participate in the official feedback, even if you used different channels of feedback and discussed the course development with the teacher
- **timing of the feedback can be challenging**
 - be as balanced as possible and think long-term, think about your future career, think about what you have learnt and what you have not learnt even though you should have
 - what can be done so you learn the subject easier?
 - please mention your ideas for change, but also tell us how the other students may think about such a change
- **critical feedback - give also before the end of the course, so the teacher can adjust the course immediately**

Official feedback

It matters a great deal for the teachers and for the university

- we need participation rates over 80%
- long term, your feedback may be decisive whether the course content is significantly changed, or whether it stays in the curriculum at all
- courses are adjusted each year based on your feedback

With current participation rate, the official feedback is more likely to contain extreme views, and if acted upon, the silent majority may suffer.

Procedures for official acting upon feedback vary at Aalto.

In the future Aalto may enforce consistent actions depending on the numerical feedback.

Please participate in the official feedback

<https://tenor.com/view/shrek-puss-in-boots-puppy-dog-eyes-cat-gif-4555944>



A small break?