

GEO-E2050 Bituminous Materials and Mixtures D

A.Y. 2023-2024. Period IV, Spring 2024. Course plan on April 8, 2024 (*Tentative plan*)

Content:

The class provides an overview of asphalt materials used in road engineering. The list of topics includes:

- Introduction to pavements.
- Asphalt binder, characterization, testing (conventional, Performance Grade (PG), Multiple-Stress Creep- Recovery - MSCR, Linear Amplitude Sweep – LAS, etc.), and simple modeling.
- Asphalt Mixture, components (aggregate, additives), mix design, characterization testing, performance.
- Production techniques and recycling.
- Construction and compaction.
- Current road engineering research thematics.

Prerequisites: *Basic knowledge of Civil Engineering Construction Materials and Road Pavement Design or equivalent: CIV-E1010 Building Materials Technology, GEO-E1030 Structural Design of Roads.*

Course mode: The course is offered face-to-face with a few sessions online when international guests will give their lectures or for particular exercises. We recommend attending classes and exercises to learn the contents of the course effectively. Lectures will be recorded and uploaded to MyCourses/Panopto (if Aalto University makes recording tools available). A Zoom link to each session will be available to attend online (when in-person participation is not possible). The links will be posted on MyCourses.

For volunteering students: This year, for volunteering students interested in performing a graduate class-level project, an extended HW01 assignment will be proposed. Detailed will be provided directly in the classroom.

Sessions: Lectures are on Wednesday (Room 266) and Thursday (Room R2-253) at 12:15-14:00, and Friday (Room R5-265) at 10:15-12:00. Lecture time will be used either for (or a combination of) theoretical explanations, exercises, or seminar guest lectures. Three lectures will be devoted to reviewing the main topics presented during the class.

Intended learning outcomes

After this course, students will be able to:

- Identify different asphalt binder, mixture types, raw materials, production methods, and mechanical performance;
- Select appropriate mixture types and raw materials based on performance requirements;
- Describe how material properties affect pavement performance: durability and deterioration;
- Conduct asphalt binder analysis;
- Perform mix design;
- Present results and analysis in a scientific way.

Schedule (Tentative)

Week	Lec#	Date	Topic	Assignments/EXAM	
09	1	We 28.02.	Lecture 1. Introduction. Overview of asphalt pavement (history) and materials (ACF)		
	2	Th 29.02.	Lecture 2. Intro to Asphalt Binder and Characterization (ACF)		
	3	Fr 01.03.	Lecture 3. Asphalt Binder Grading (ACF)	HW01 Assigned	
10	4	We 06.03.	Lecture 4. Intro to Asphalt Mixture (KK)		
	5	Th 07.03.	Lecture 5. Master Curves, MSCR, LAS (YS, FZ)		
	6	Fr 08.03.	Review 1. Lectures 1-5 (KK)	Quiz01 Assigned	
11	7	We 13.03.	Lecture 6. Asphalt Mixture and Design (ACF)	HW02 Assigned	HW01 Due
	8	Th 14.03.	Seminar Lecture 1. Overview of Diverse Research Topics (YP, GH, QL)		
	9	Fr 15.03.	Seminar Lecture 2. On Asphalt Binder Modification (JZ) - Online		
12	10	We 20.03.	Lecture 8. Laboratory Visit (FZ, YS)	Laboratory Report Assigned	Quiz01 Due
	11	Th 21.03.	Seminar Lecture 3. On Asphalt Pavement Abrasion and Wear and Related Environmental Aspects (JL) - Online		
	12	Fr 22.03.	Review 2. Lectures 7-13 (KK) & Take Home Exam introduced (ACF)	Quiz02 Assigned <u>Take-Home EXAM Assigned</u>	
13	13	We 27.03.	Seminar Lecture 4. Asphalt Mixture Design in Finland (TV) CANCELED		Laboratory Report Due HW02 Due
14	14	Th 04.04.	Seminar Lecture 5. Moisture Damage in Asphalt Mixture (SCS) – Recorded		
	15	Fr 05.04.	Seminar Lecture 6. Gravel Roads (AV) - Online		Quiz02 Due
15	16	We 10.04.	Seminar Lecture 7. On sustainability in Highway Engineering in Finland (TD - Ramboll) - Online		
	17	Th 11.04.	Seminar Lecture 8. Balanced Mix Design (MO) – Online Start at 12:45 pm		
	18	Fr 12.04.	Review 3. Lectures 15-17 and open questions (KK)	Quiz03 Assigned	
16	19	Fri 19.04.	<u>Take-Home EXAM due!</u> & Quiz03 Due		

Instructors

ACF	Augusto Cannone Falchetto, Assistant Professor	augusto.cannonefalchetto@aalto.fi
KK	Kateryna Krayushkina, Researcher	kateryna.krayushkina@aalto.fi
FZ	Fan Zhang, Doctoral Researcher	fan.3.zhang@aalto.fi
YS	Yuxuan Sun, Doctoral Researcher	yuxuan.sun@aalto.fi
QL	Qi Liu, Visiting Doctoral Researcher	liu.qi@aalto.fi
YP	Yi Pei, Visiting Doctoral Researcher	yi.1.pei@aalto.fi
GH	Guojing Huang, Visiting Doctoral Researcher	guojing.huang@aalto.fi

Guest Lecturer

JL	Joacim Lundberg, Professor	Lund University (Sweden)
TV	Tommi Valjakka, Peab Asphalt	Peab (Finland)
MO	Marko Orešković, Professor	The University of Belgrade (Serbia)
JZ	Jiqing Zhu, Senior Scientist	VTI (Sweden)
AV	Anne Valkonen	Finnmap Infra (Finland)
SCS	Silvia Caro Spinel	University of Los Andes (Colombia)
TD	Taavi Dettenborn	Ramboll (Finland)

Assessment

The grade (100%) is composed of the final exam (**FE**) 40%, 2 homework assignments (**HW**) 30% (15% each), a laboratory visit report (**LB**) 15%, and 3 quizzes (**QZ**) 15% (5% each). Grading is 0-5. The Final exam grade must be at least 50% to pass the course. Exercises are valid for one year.

Materials and resources

- Lecture Notes

Other reference material

- <https://pavementinteractive.org/>
- Doré, G. & Zubeck, H.K. (2009). *Cold Regions Pavement Engineering*. McGraw-Hill; ASCE Press (main textbook)

Loaning of textbooks at the Department of Civil Engineering is being arranged. More information will be provided during the first week.