# **I. Subject Specification**

1. Basic Data

1.1 Title

Highway and Railway Laboratory Practice

1.2 Code

**BMEEOUVAI44** 

1.3 Type

Module with associated contact hours

1.4 Contact hours

71	Hours/week / (days)
Lab	2

1.5 Evaluation

Midterm grade

1.6 Credits

1

### 1.7 Coordinator

name	Dr. Nándor LIEGNER
academic rank	Associate professor
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### 1.8 Department

Department of Highway and Railway Engineering

1.9 Website

https://epito.bme.hu/BMEEOUVAI44 https://edu.epito.bme.hu/course/view.php?id=3595

1.10 Language of instruction

hungarian and english

# Highway and Railway Laboratory Course - BMEEOUVAI44 - 2024/25/2 1.11 Curriculum requirements Compulsory in the Specialization in Infrastructure Engineering (BSc) programme 1.12 Prerequisites Soft preliminary requirement: - Highway and Railway Structures (BMEEOUVAI41)

1.13 Effective date

27 February 2023

- 2. Objectives and learning outcomes
- 2.1 Objectives

The aim of the course is for the student to master:

the structural elements of the railway superstructure, the investigation of the longitudinal restraint of rail fastenings, the testing of static stiffness of the rail fastenings, the testing of the dynamic stiffness of rail fastening, the testing of the clamping force of rail fastening, cracking and fracture testing of reinforced concrete railway sleepers,

the main raw materials of asphalt mixtures, their expected characteristics and test methods, the compositional conditions of asphalt mixtures, the specifications for the design of asphalt mixtures, the design principles and methods of asphalt mixtures, the performance-related and performance-based characteristics, their meaning and standard European test methods, the basic principles of qualification, the quality category determined during production and installation the structure and meaning of standards, the main content elements of type tests of asphalt mixtures, the requirements for the built-in layers, the reasons for the requirements, and their test methods.

### 2.2 Learning outcomes

Upon successful completion of this subject, the student:

- A. Knowledge
- 1. knows the structural elements of the railway superstructure,
- 2. knows the testing of longitudinal restraint of the rail fastenings,
- 3. knows the testing of the static stiffness of the rail fastenings,
- 4. knows the testing of the dynamic stiffness of rail fastening,
- 5. knows the testing of the clamping force of rail fastening,
- 6. knows the cracking and fracture testing of reinforced concrete railway sleepers,
- 7. knows the main raw materials of asphalt mixtures, their expected characteristics and test methods,
- 8. knows the asphalt mixtures its composition conditions,
- 9. knows the specifications for the design of asphalt mixtures,
- 10. knows the design principles and methods of asphalt mixtures,
- 11. knows the performance-related and performance-based characteristics, their meaning, and standard European test methods,
- 12. knows the basic principles of qualification, the structure of quality categories determined during production

# Highway and Railway Laboratory Course - BMEEOUVAI44 - 2024/25/2 and installation, 13. knows the main content elements of type tests of asphalt mixtures, 14. knows the expectations for built-in layers, the reasons for the expectations, and their test methods. B. Skills 1. able to recognize and identify the structural elements of the railway superstructure, 2. able to analyze the longitudinal restraint of the rail fastenings, 3. able to carry out to test the static stiffness of the rail fastenings, 4. able to test the dynamic stiffness of rail fastening, 5. able to test the clamping force of rail fastening, 6. able to determine the suitability of given raw materials for the production of asphalt mixture, 7. able to actively contribute to the design of an asphalt mixture, 8. able to use a given asphalt mixture determine its design parameters, 9. able to adapts to the relevant system of regulations and standards, 10. able to compile the type test of the asphalt mixture, 11. able to distinguish between type test, mid-production and qualification tests and procedures, 12. able to establish tests the suitability of the asphalt mixture to be built into each track structure layer based on results, 13. able to establish the adequacy of individual track structure layers based on test results.

1. continuously cooperates with the instructor and fellow students during practical measurements and tests,

2. continuously cooperates with the instructor and fellow students during the analysis of the received data and

C. Attitudes

performing calculations.

D. Autonomy and Responsibility

1. performs the delegated laboratory tas
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### 2.3 Methods

### Railway part:

The reasons, needs, circumstances, methods and standards of the various tests are explained in a classroom. The tests are presented and performed as laboratory exercises.

### Road part:

The role of the main parameters of asphalt mixtures and their raw materials and the test principles of each characteristic, as well as European standard test methods will be explained in a classroom. The individual tests are presented in the laboratory and specific tests are performed under the supervision of the students.

### 2.4 Course outline

Week	Topics of lectures and/or exercise classes
1.	Railway lab: Presentation of the structural elements of
	the railway superstructure in the laboratory.
2.	Road lab: Description of the materials and properties of
	asphalt mixtures and the requirements imposed on
	them. Tests of aggregates.
3.	Railway lab: Measurement of the longitudinal rail
	restraint of rail fastenings.
4.	Road lab: Getting to know the types and characteristics
	of binders used in asphalt mixing, and the requirements
	placed on them. Testing of binders. Design principles of
	asphalt mixtures.
5.	Railway lab: Measuring the static stiffness of rail
	fastenings.
6.	Road lab: Preparation of asphalt mixtures in the
	laboratory. Preparation of laboratory specimens. Mass
	and volume ratios of asphalt mixtures.
7.	Railway lab: Measuring the dynamic stiffness of rail
	fastenings. Measuring the clamping force of rail
	fastenings.
8.	Road lab: Conventional asphalt tests.
9.	Railway lab: Cracking and fracture testing of reinforced
	concrete railway sleepers.
10.	Road lab: Performance-based tests of asphalt mixtures.
11.	Railway lab: Track measurement demonstration at a site
12.	Road lab: On-site and laboratory tests of built-in layers.

Classification of built-in layers.

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13.	Spare class.
14.	Spare class.

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

### 2.5 Study materials

### **Textbooks:**

- A. T. Papagionnakis, E. A. Masad: Pavement Design and Materials
- Asphalt Institute: Superpave Mix Design
- Asphalt Institute: Mix Design Methods

### Online materials:

- Presentations
- Electronic lecture notes

### 2.6 Other information

Participation in laboratory exercises is 100% compulsory. A student who is absent from one or more exercises cannot obtain credit for the course. In case of an absence, the department provides one opportunity to complement for the absence during the week of repeats.

### 2.7 Consultation

Due to the nature of the tasks, there is no need for a consultation outside of the timetable.

This Subject Datasheet is valid for:

### II. Subject requirements

Assessment and evaluation of the learning outcomes

### 3.1 General rules

The assessment of the learning outcomes specified in clause 2.2. above and the evaluation of student performance occurs via 2 tests (1 test of railway part and 1 test of road part) and active participation.

### 3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
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 1. test (railway part)
 ZH1
 A.1-A.6; B.1-B.5

 2. test (road part)
 ZH2
 A.7-A.14; B.6-B.13

Attendance and activity A A.1-A.14; B.1-B.13; C.1-C.2; D.1

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

### 3.3 Evaluation system

Abbreviation	Score
ZH1	50%
ZH2	50%
A*	0%
Sum	100%

ZH1: It is scoreless (failed) if it does not reach minimum 50% of the available score.

ZH2: It is scoreless (failed) if it does not reach minimum 50% of the available score.

A: Attendance at 100% of the lectures is compulsory.

### 3.4 Requirements and validity of signature

The requirements for fullfilling the subject are follows: achieve the ZH1 successfully (reach minimum 50% of the available score), achieve the ZH2 successfully (reach minimum 50% of the available score), in addition

<sup>\*</sup> Criteria requirement.

attendance at 100% of the lectures is compulsory.

# 3.5 Grading system

If the student satisfies the attendance criteria, his/her mark will be determined as follows. The final mark will be calculated as the average of the points received for the tests (based on 3.3).

Grade	Points (P)
excellent (5)	P=>87,5%
good (4)	87,5%>P=>75%
satisfactory (3)	75%>P=>62,5%
passed (2)	62,5%>P=>50%
failed (1)	P<50%

### 3.6 Retake and repeat

- ZH1 and ZH2 can be repeated during the week of repeats (both of them for 2 times).
- In case of an absence, the department provides one opportunity to complement for the absence during the week of repeats.

### 3.7 Estimated workload

Activity	Hours/semester
contact hours	12×2=24
preparation for the tests	2×3=6
Sum	30

### 3.8 Effective date

### 27 February 2023

This Subject Datasheet is valid for: