Highway and Railway Design - BMEEOUVAI43

I. Subject Specification

1. Basic Data

1.1 Title

Highway and Railway Design

1.2 Code

BMEEOUVAI43

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	3
Seminar	2

1.5 Evaluation

Exam

1.6 Credits

5

1.7 Coordinator

name	Dr. Ákos VINKÓ
academic rank	Assistant professor
email	vinko.akos@emk.bme.hu

1.8 Department

Department of Highway and Railway Engineering

1.9 Website

https://edu.epito.bme.hu/course/view.php?id=3584
https://fiek2.mywire.org/course/view.php?id=3584

1.10 Language of instruction

english

1.11 Curriculum requirements

Compulsory in the Specialization in Infrastructure Engineering (BSc) programme

1.12 Prerequisites

- Railway Tracks (BMEEOUVAT41)
- Roads (BMEEOUVAT42)

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

To get to know the role of rail and road transport, the planning and decision-making process for infrastructure investment, basic principles of alignment design, operation, and control. In addition, students can deepen their understanding in practice from the concrete cases.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. will learn the alignment design principles of horizontal and vertical alignment on tramways
2. will learn the layout design of tramway track connections, the application areas of turnouts,
3. will learn the operation modes of tramway turnouts,
4. will learn the widely applied tramway track superstructures and their construction methods

B. Skills

1. will be able to identify the different types of track structures
2. will be able to design the horizontal and vertical alignment of the tramway route.
3. will be able to calculate and design track connections as well as select the proper turnout type
4. will be able to use the loading gauge and kinematic envelope concepts in the design of tramway lines integrated into an urban landscape
5. will be able to perform complex modeling tasks using CAD software,
6. will be able to represent his digital model with a graphic representation that complies with the standard,

C. Attitudes

1. cooperates with the tutor/lecturer and with fellow students, develops his/her co-working skills during the teamwork [HF1 – Homework 1.]
2. continuously extends his/her knowledge.
3. develops precise problem-solving skills.

D. Autonomy and Responsibility

1. will be able to work autonomously and/or with individual research to complete his/her tasks.
2. is open to the comments and critics of teachers and fellow students.

3. co-operates with his/her fellow students.
4. is able to think in a total system.

2.3 Methods

Lectures with slides, seminars, case studies, self-made small projects,

2.4 Course outline

Week	**Topics of lectures**
1.	The design process, phases: Feasibility study, Study Plan, Construction Plan. Content and formal requirements of plans
2.	Elements and design of horizontal and vertical alignment (straight sections, transition curve, circular curve). Spatial coordination of horizontal and vertical alignment. Self-explaining roads.
3.	Elements of the cross-section: rural and urban roads. Function and design. Facilities for pedestrians and cyclists.
4.	Traffic planning. At-grade intersections, elements of intersections.
5.	Traffic regulation on rural roads: road signs and pavement markings, traffic lights.
6.	Details of horizontal alignment elements: pavement edge rounding, compound curves, parking lots, stops of public transport services.
7.	Traffic regulation on urban roads: traffic calming, traffic calming on through-passing sections, settlement gate.
8.	**Introduction**: Rail transport systems and their classification. Basic Aspects of railway route (*center line of track, center of alignment, structural and loading gauge, distance between track axes*). Track layout guidelines, elements of the railway horizontal and vertical alignment;
9.	**Tramway route and line design I.:** Railway Alignment Optimization in Tramway, analytical descriptions of· track geometry variations (*flexible tramway track alignment design, distance variation between the axes of two tracks, comparison of multiple alignments*)
10.	**Tramway route and line design II.:** Tramstop and terminus Platforms layout design, track connections, tram depot (operational principles, Organisation of Space & Tasks)
11.	**Tramway Turnouts and crossings:** standard turnout forms, design parameters, geometry, structural components
12.	**Modern Tramway Track Structures and its elements**: conventional ballasted tracks, slab tracks, embedded rail system (*Concepts and functionalities with*

	mechanical-, / fastening based indirect-, / without Track gauge control), green track solutions, construction and maintenance technologies
13.	**Special railway systems in an urban area I**: Cog railways, Cableways, Funiculars,
14.	**Special railway systems in an urban area II**: monorail systems, and rubber-tired trams

Content and formal requirements of plans. I.

Week	**Topics of exercise classes**
1.	Study plan. Orientation on the map, forming neutral lines.
2.	Study plan. Elements and design of the horizontal alignment.
3.	Study plan. Elements and design of the vertical alignment.
4.	Study plan. Elements and design of the cross-section.
5.	Cross sections. Superelevation. Drainage. Horizontal curve with symmetrical and asymmetrical transition curves. Superelevation. Superelevation runoff.
6.	Consultation - workshop
7.	Designing the horizontal alignment of tramway tracks I.
8.	Designing the horizontal alignment of tramway tracks II.
9.	Turnouts, track connection, and tramstop platform design
10.	Consultation - workshop
11.	Cross-section design: Integrating Tramway System into the Urban Landscape
12.	Content and formal requirements of plans. I.
13.	Content and formal requirements of plans. II.
14.	Consultation - workshop

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

Lectures and slides.

2.6 Other information

Attendance of lectures is compulsory. The credits from the subject will be refused to students missing more than four times.

2.7 Consultation

Teachers are available for consultation during their office hours, as advertised on the department website.

This Subject Datasheet is valid for:

2023/2024 semester I

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes is specified in clause 2.2. above and the evaluation of student performance occurs via two midterm tests, two homework, and a written exam in the exam period.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
1. Midterm test	ZH1	
2. Midterm test	ZH2	A.1-A.2; B.1-B.4; C.2
1. Projectwork	HF1	C.1
2. Projectwork	HF2	A.1-A.4; B.1-B.6
Written exam	V	A.1-A.4; B.1-B.6; C.1-C.3; D.1-D.4

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
HF1	15%
HF2	15%
ZH1	10%
ZH2	10%
V	50%
Sum	**100%**

3.4 Requirements and validity of signature

To be present at least 70% of the classes and seminars. The student must achieve a result of at least 50% (=performance threshold) separately for all performance evaluations carried out during the semester. submit the homework and receive a grade of at least pass of it.

3.5 Grading system

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

3.6 Retake and repeat

1. The homework can be given with delay till a pre-defined date – usually one week later – by paying a fee.
2. The homework given in and accepted can be amended till the pre-defined deadline without paying a fee.
3. The two midterm tests can be repeated –without fee – at a previously determined date given in the course

schedule. One midterm test can be repeated twice by paying a previously defined fee.

4. The new result of the repeated test always overwrites the former results.

3.7 Estimated workload

Activity	**Hours/semester**
contact hours	14×5=70
preparation for the projects	24
preparation for the tests	2×14=28
preparation for the exam	28
Sum	**5x30=150**

3.8 Effective date

1 September 2022

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2023/2024 semester I