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## WP4 – Development of teaching and training resources with the use of remote teaching methodology

### IO.12 Development of resources for safety management of vulnerable road users

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## 1 INTRODUCTION

The COVID-19 pandemic has forced a departure from the current functioning of society in many aspects of the economy, travel, work and education, not excluding higher education. The necessity of remote education is one of the ways to maintain social distancing and protect our health and life.

A preliminary assessment of the situation at universities in European countries indicates that academic staff were not sufficiently prepared to conduct attractive and practical classes in a remote format.

The necessity to conduct classes remotely involves developing a dedicated didactic and training process project, considering the specific requirements of interdisciplinary engineering knowledge. Transferring this knowledge in remote education, due to its large scope, requires various didactic tools (lectures, fieldwork, design, practicals, laboratories, student assignments and assessment of the progress and knowledge of students and trainees).

The measurable expected final results are:

- Development of a remote learning methodology for Road Infrastructure Management (RIM) as a model solution to provide a basis for extending the methodology to include further aspects of civil engineering and transport.
- Developing an e-handbook for academic staff supporting the remote learning process.
- Development of model digital teaching and training materials dedicated to technical colleges and training for road management staff on RIM:
  - Road safety audit,
  - Roadside safety management,
  - Safety management of vulnerable road users,
  - Road pavement management.
- Developing an e-learning platform with access to project products.
- Appointment of a panel of experts in road infrastructure management.

The InfRO@D project targets the following groups:

- 1) Students, researchers, and academic teachers at universities.
- 2) Road authority staff at national, regional and local levels.
- 3) Experts, specialists, and practitioners involved in RIM activities, including staff who conduct training in various RIM courses.
- 4) All users of road infrastructure, as an indirect target group, for whom the risk of road accidents will ultimately be reduced by increasing the effectiveness and efficiency of RIM activities.

The project is also supported by a group of associates who will cooperate with project partners to consult and evaluate the results. They will implement final products and promote the dissemination and accessibility of the project results.

**ABOUT OUTPUT IO.12**

- **Objective:** Development of resources for safety management of vulnerable road users.
- **Work package:** The task falls under WP4 – Development of teaching and training resources with the use of remote teaching methodology.
- Target Groups:
- Research and teaching staff from institutions involved in the project and other European institutions.
- Students of civil and transportation engineering.
- Road authority staff at a national, local and regional level.

## 2 SUBJECT ASSUMPTIONS

### 2.1 Division of safety management of vulnerable road users lessons

The planned outcome of the task is the development of modern and innovative digital teaching and training content for remote education in the field of safety management of vulnerable road users, with the support of RISM tools. As part of the civil and transportation engineering course syllabus in partner universities. The work included a detailed breakdown of the issue into three chapters of 90 hours of lessons each:

- Chapter 1 - Safety management of vulnerable road users – Introduction (12 h),
- Chapter 2 - Safety management of vulnerable road users - Designing infrastructure for VRUs and traffic management (60 h) – **prepared didactic materials**,
- Chapter 3 - Safety management of vulnerable road users - Risk assessment and designing PC (18 h)

Following the assumptions made during the development of the methods of remote education (task IO.4 – IO.9), it is assumed learning by doing. Emphasis on practical activities, student collaboration, and knowledge exchange during group work or webinars. The planned division of chapter 2 is shown in Table 1.

*Table 1 The planned division of safety management of vulnerable road users lessons – chapter 2*

Types of classes	Chapter no.		
	1	2	3
<b>Lecture</b>	8	30	4
<b>Field works</b>		10	6
<b>Practical (remote)</b>		5	
<b>Design class</b>	4	15	8
<b>Number of lessons</b>	12	30	18

In line with the project's objectives, the work included preparing examples of didactic and training materials. Materials for Chapter 2 - Designing infrastructure for VRUs and traffic management were prepared.

### 2.2 Type of didactic and training resources

Safety management of vulnerable road users also includes specialist knowledge of the design and use of road safety devices. This knowledge is insufficiently imparted to students and infrastructure management personnel in curricula and various training courses. The materials

developed will make it possible to fill this gap in the learning process. The work includes theoretical and practical activities:

- lectures (about the human factor, various ways of moving, people with special needs, general principles of using point and linear infrastructure, etc.),
- fieldwork (assessment of shortcomings of the existing infrastructure, risk assessment, recommendation for improvements in the urban and suburban area ),
- practical classes (primarily consisting of learning how to design types of pedestrian crossings according to methods used in various countries),
- design classes (infrastructure for VRUs, designing comprehensive point and line infrastructure, taking into account the origin and destination of travel

As part of the project implementation, the following type of data was prepared:

- PowerPoint-teacher – presentation, which should be presented by the teacher (Figure 1).
- PowerPoint-audio – presentation with teacher soundtrack (Figure 2).
- PowerPoint with YouTube resources (Figure 3).
- Recorded national, regional, and local road sections.
- Excel files with prepared data (Figure 6).
- Interactive quiz.
- Discussions (different methods).
- Webinar, Q&A, PowerPoint - student presentation (Final discussion with the teacher, all groups together).



*Figure 1. Example of didactic materials - presentation*



## What might wait for us? Experiences of other countries



Equal increase in accidents on e-scooters, electric bicycles and electric skateboards by 70% between 2017 and 2020 (71 fatalities)<sup>1</sup>.



- Growth of electric bicycle sales from 11%(2011), through 29% (2016) to 52% (2021).
- Increase in injured e-bike users from 19% (2016) to 36% (2021).
- Among cyclists aged 12-17, medical attention after an accident increased from 4% (2016 ) to 22% (2021).
- Women over the age of 55 are the victims of 47% of accidents involving electric bicycles.
- The problem of increasing speed dispersion on bicycle roads, due to the production of ever faster bicycles.<sup>2</sup>

Sources: 1. <https://www.latimes.com/california/story/2022-08-05/e-bike-crash-death-daughter-manufacturer-to-blame-rapid-power-bikes> (27.09.2022)

Figure 2. Example of didactic materials – presentation with recorded voice

## Accessible Pedestrian Signals



Figure 3. Example of didactic materials – presentation with YouTube resources





Figure 4. Example of didactic materials – interview with the specialist

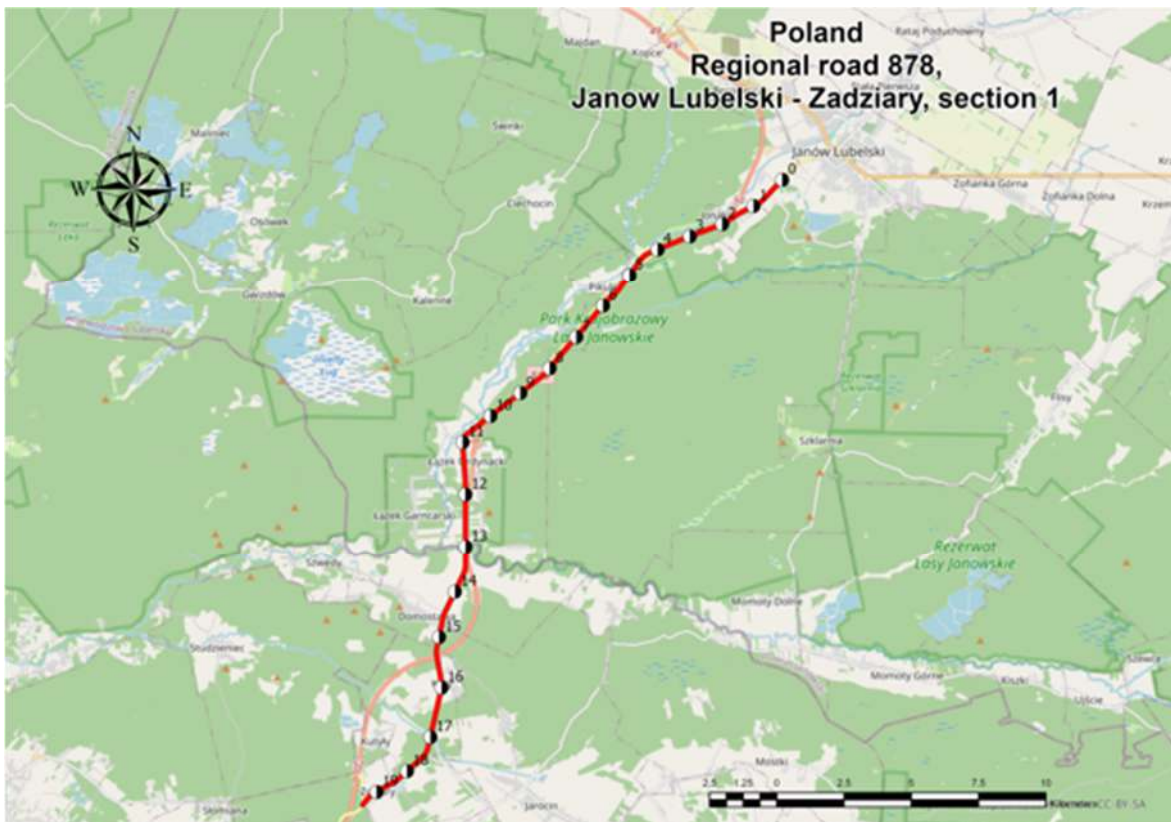


Figure 5. Example of didactic materials – maps of National Road 6, section 1

No.	Traffic volume		Vehicles	Req. stopping	Road cross-section
	Pedestrian	Vehicles	speed	sight distance	
	[ped/h]	[veh/h]	[km/h]	[m]	
1	330	550	30	YES	1x2
2	390	450	50	NO	1x2
3	90	700	50	NO	2x2
4	180	600	80	YES	2x2
5	390	800	90	YES	2x2
6	330	1000	60	YES	2x2
7	80	100	90	NO	1x2
8	340	450	80	YES	1x2
9	370	300	70	NO	1x2
10	270	400	50	YES	1x2
11	240	400	70	NO	1x2
12	60	100	80	YES	1x2
13	320	450	80	NO	1x2
14	480	400	40	NO	1x2
15	320	50	40	YES	1x2
16	340	300	70	YES	1x2
17	440	400	40	YES	1x2
18	400	500	40	YES	1x2
19	410	450	60	NO	1x2
20	140	200	60	YES	1x2

Figure 6. Example of didactic materials – prepared Excel with data

### 3 DIDACTIC AND TRAINING MATERIALS FOR SAFETY MANAGEMENT OF VULNERABLE ROAD USERS

Per the adopted assumptions, the material development is available on a publicly accessible e-learning platform.

#### 3.1 Gdansk University of Technology e-learning platform

GUT e-learning is a platform developed by the Gdansk University of Technology to provide remote education, conduct tests to verify knowledge, and access virtual laboratories. E-learning is integral to the university's education and virtualisation, utilising ICT (Information and Communication Technologies). The courses are available in electronic form via web browsers and mobile applications, created using Moodle - a popular software for eLearning.

At Gdansk University of Technology, it covers a fully remote form (e-learning) and a mixed form, in which traditional classes and distance learning complement each other (blended learning).

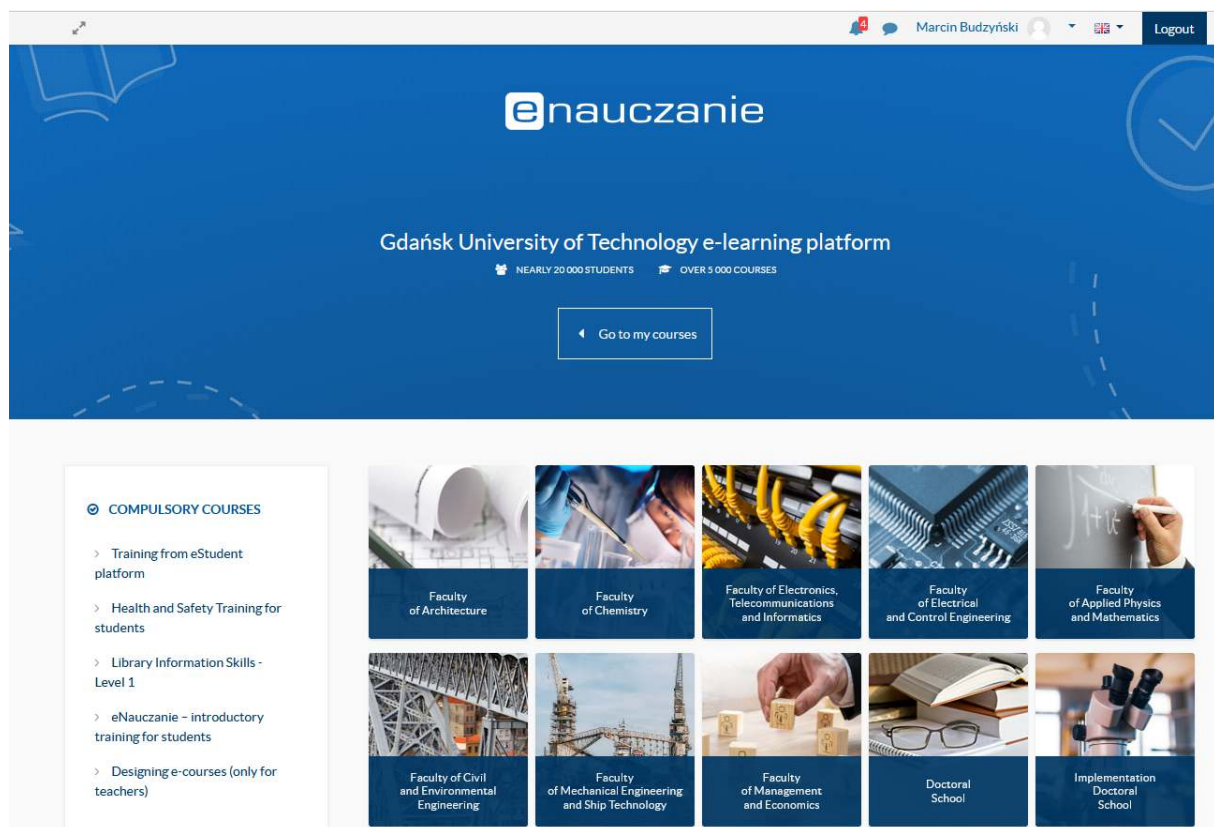


Figure 7 Start menu of e-learning

### 3.2 Introduction and purpose of the e-learning platform

The Moodle-based e-learning platform, developed under the project InfRo@d, is a comprehensive digital tool to enhance road safety education.

The e-learning platform is available on the Internet, which enables its use by research centres and road authorities throughout Europe. The e-learning platform contains road safety courses, all available to be applied to existing university course curricula. Through the e-learning platform, the project is committed to creating a one-stop solution for online learning on Road Safety by offering training on all aspects of the subject that cater to all levels.

The platform's content is a synthesis of extensive research on the impact of infrastructure on road safety, combined with established road safety methodologies. Users of the platform can:

- Observe Road Safety Audit (RSA) - Erasmus+ European Digital Education in Road Infrastructure Management INFRO@d.
- Observe Roadside safety management - Erasmus+ European Digital Education in Road Infrastructure Management INFRO@d.
- **Observe Safety management of vulnerable road users - Erasmus+ European Digital Education in Road Infrastructure Management INFRO@d.**
- Observe Road pavement management - Erasmus+ European Digital Education in Road Infrastructure Management INFRO@d

The platform with InfRo@d courses is accessible at: <https://enauczanie.pg.edu.pl/moodle/my/>

The didactic and training materials will be available after logging into the e-learning platform. Detailed information describing the process of registration is available at <https://support.pg.edu.pl/archive/display/HPPG/Access+to+eLearning+platform>.

A Chrome browser on a PC or Laptop is recommended for optimal performance. A user registration process is mandatory for full access. Post-registration, certain features may require administrative approval.

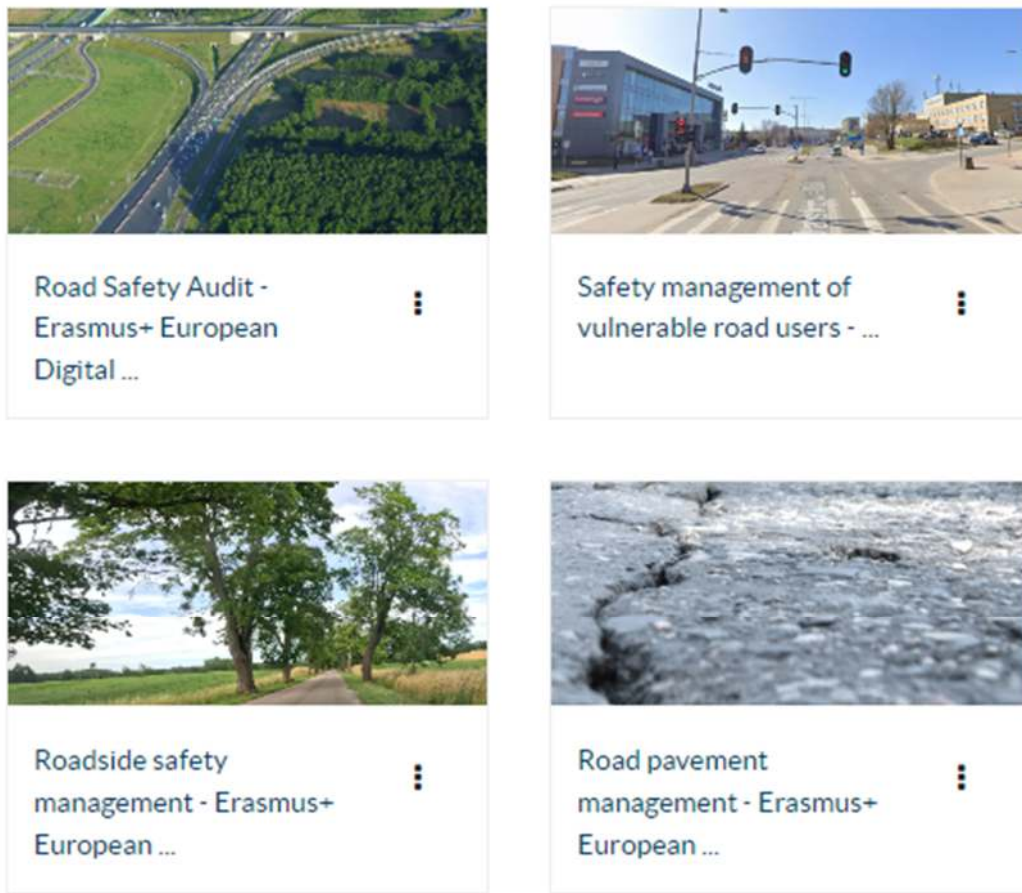


Figure 8 Overview of InfRO@d didactic materials and certification programme available on <https://enauczanie.pg.edu.pl/moodle/my/>

### 3.3 YouTube InfRo@d canal

A dedicated channel on the YouTube platform will complement the course on the platform. The platform with InfRo@d canal is accessible at: [youtube.com/@Infrod-EuropeanDigitalEducation](https://www.youtube.com/@Infrod-EuropeanDigitalEducation)

The platform's content is video, which is used in didactic materials divided into playlists:

- INFRO@d Road Safety Audit - Rural highways,
- INFRO@d Road Safety Audit - Motorways, Expressways
- INFRO@d Road Safety Audit - Rural Interchanges
- INFRO@d Road Safety Audit - Urban Interchanges (additional materials)
- INFRO@d Roadside safety management - National Roads
- INFRO@d Roadside safety management - Regional Roads
- INFRO@d Roadside safety management - Local Roads
- INFRO@d Interview.

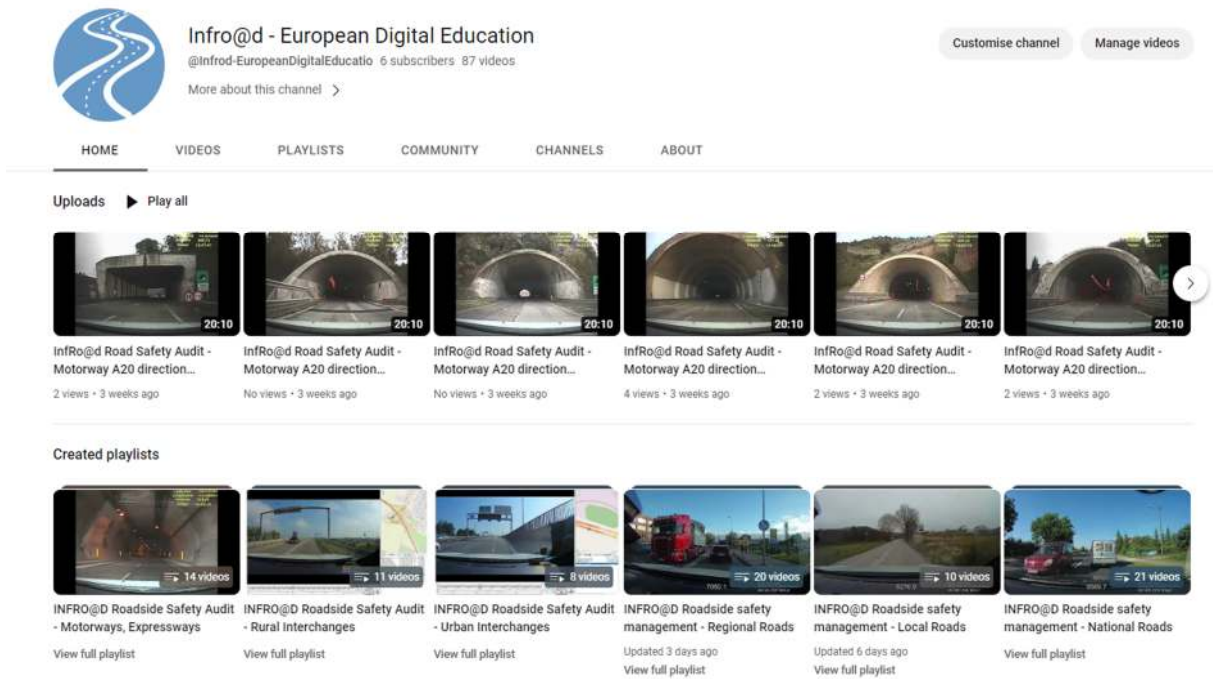


Figure 9 Overview of InfRO@d video didactic materials available on [youtube.com/@Infrod-EuropeanDigitalEducatio](https://youtube.com/@Infrod-EuropeanDigitalEducatio)

### 3.4 Detailed division of didactic and training materials

Table 2 provides a detailed description of the planned didactic and training materials under the roadside environment safety management issues.

Table 2 The planned detailed division of safety management of vulnerable road users lessons

Exemplated materials were prepared for chapter 2 (white colour of table).

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
<b>Chapter 1 - Safety management of vulnerable road users - Introduction</b>					
1	Lecture	1	Human factors and mobility	Human factors significantly impact the safety and usability of mobility systems, including vehicles and transportation infrastructure. Understanding driver behavior and ensuring accessibility are crucial aspects of enhancing the overall mobility experience.	Intro quiz, PowerPoint, video YT, Foto gallery with audio comments,
2	Lecture	1	Road perception	Road perception and situation awareness deficits for different categories of VRUs Classification of road safety related human related factors and other relevant issues	PowerPoint, video YT, Foto gallery with audio comment,
3	Lecture	2	Types of personal transport device	Road safety related education & information/publicity of/for VRUs Devices and equipments for c In-Vehicle Obstacle/VRU vulnerability classification	PowerPoint, video YT, Foto gallery with audio comments, Ending self assessment quiz,
4	Lecture	2	Road accidents Data Base	Database presentation, types of data	PowerPoint on basics Cideo - how to use DB
5	Lecture	2	Road accidents Data Base	Examples of database results: charts, tables, analyses	Pdf, annual country or EU accident report outro quiz,
6	Design classes	2	Road accidents Data Base	Training on how to use the databases	Cideo explanation of the task preparing of accident report

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
7	Design classes	2	Roadside studies (general)	Exercise of using the databases for a defined task	Preparing of accident report sending report to the teacher
<b>Chapter 2 - Safety management of vulnerable road users - Designing infrastructure for VRUs and traffic management</b>					
1	Lecture	3	People with special needs in public space Human factors and mobility	General information about VRU (UTO, Bike, ect.) Characteristic of people with special needs Classification of road vulnerable users (VRU) – e.g. w.r.t. age, gender, health, handicap/disability, training, experience, etc. Mobility related behaviours of different categories of VRUs Micro Mobility contexts and scenarios for VRUs	Interactive quiz, PowerPoint video / Interview
2	Lecture	2	Principles of universal design - assumptions	Assumptions for universal design	Interactive quiz, PowerPoint
3	Lecture	2	Principles of universal design - accessibility	Accessible elements and spaces: scope and technical requirements	Interactive quiz, PowerPoint
4	Lecture	1	Principles of designing public transport - assumptions	Assumptions for universal design in public transport	Interactive quiz, PowerPoint
5	Lecture	3	Principles of designing public transport - accessibility	Accessible elements and spaces: scope and technical requirements for public transport while considering different modes (Bus, Tram, ...)	Interactive quiz, PowerPoint, Group discussion scenario



No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
6	Lecture	2	Designing PC - Introduction	Criteria of designing, input parameters Characteristics of PC (pedestrian crossing)	PowerPoint, Group discussion scenario
7	Lecture	1	Designing PC - General rules and locations	Requirements of PC (location, geometrical parameters, users volume, lighting) Visibility	PowerPoint, Group discussion scenario
8	Lecture	4	Designing PC - Selection of the type of pedestrian crossing and detailed parameters	Procedure of choosing type of PC Rules of traffic lights controls	Interactive quiz, PowerPoint video / Interview Group discussion scenario
9	Lecture	3	Designing - Assessment and maintenance	Assessment and maintenance of PC	PowerPoint video / Interview Group discussion scenario
10	Lecture	1	Design and maintenance - criteria	Criteria of designing, input parameters Characteristics of LI (Linear infrastructure)	Interactive quiz, PowerPoint
11	Lecture	3	Designing - requirements	Requirements of LI (location, separation, parameters, users volume, lighting) Equipment requirements	PowerPoint
12	Lecture	2	Designing - Assessment and maintenance	Assessment and maintenance of LI	Interactive quiz, PowerPoint

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
13	Practical classes	5	Designing - Practical classes	Practical classes (procedure for selection of the location and type of solutions for vulnerable road users and the procedure for lighting selection),	PowerPoint Group working guide / Field working guide
14	Field work	10	Assessment of infrastructure for VRU	Assessing infrastructure for Vulnerable Road Users (VRUs), such as pedestrians and cyclists, involves evaluating the adequacy of crosswalks, pedestrian pathways, and cycling lanes to ensure their safety and accessibility within the transportation network. Additionally, considering factors like traffic flow, signage, and lighting is essential to create a supportive and secure environment for VRUs.	PowerPoint video / Interview Group discussion scenario
15	Design classes	15	Design of linear and point infrastructure for VRU	Explanation of the task Choosing LI location on cross-section Geometrical parameters selection Equipment Explanation of the task Finding proper location Designing proper PC and choosing equipment	PowerPoint
16	Lecture	3	Traffic signalling for VRU, traffic control, flashers,	Principles of management Rules of traffic lighting Signs and markings	Interactive quiz, PowerPoint video / Interview Group discussion scenario

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
			lighting, marking, signs		
<b>Chapter 3 - Safety management of vulnerable road users - Risk assessment and designing PC</b>					
1	Lecture	2	Risk assessment and analysis, rules for the identification and classification of sources of hazard and hazard, etc.),	Factor of hazards Case study about types of hazards Risk safety classification at PC	Intro quiz, PowerPoint, Conversation between students and teacher Foto gallery with audio comments,
2	Lecture	2	Effectiveness of the corrective solutions applied, cost - benefit analysis, CMF, technology, ITS, personal safety (reflective jacket),	VRU categorization regarding safety, mobility and comfort Methodology for safety impact assessment for VRU METHODOLOGY FOR COST-BENEFIT ANALYSIS of design options and equipment for VRU ITS technologies for VRU and their respective impacts	Power point, Conversation between students and teacher Foto gallery with audio comments, YOUTUBE video

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
3	Field work	2	Field visit in specific locations, (PC, CC, Crossroads, pavement), collecting film and photo documentation, including observation of the behaviour of road users),	PowerPoint, Field Cards, Fotto Gallery	Field visit , students
4	Field work	2	Identification and assessment of threats and sources of threats,	PowerPoint, Field Cards, Fotto Gallery, Repoert example	Field visit, students
5	Field work	2	VR - scenario. Identification and risk assessment. (rain, snow, dark, congestion, obstacle, speed).	PowerPoint, Field Cards, Fotto Gallery, Repoert example	Street view or other platform (metaverse, other)
6	Design classes	2	Warkshop after field visit	Discussions	Student field work presentation, discussion
7	Design classes	2	General practices	PowerPoint, Foto Gallery,	Workshops with teacher, discussions

No.	Types of classes	Hour	Short Name	Detailed description	Resource Type
8	Design classes	2	New - infrastructure (concept) - small crossroads, PC, CC,	PowerPoint, Foto Gallery	Workshops with teacher, discussions
9	Design classes	2	Redesigning (concept) - small crossroads, PC, CC, - connected to field work location	PowerPoint, Fotto Gallery,	Worskshops with teacher, discussons