Co-funded by the
Erasmus+ Programme
of the European Union

InfRO@D
EUROPEAN DIGITAL EDUCATION IN RIM

WP3 – Development of techniques for the implementation of the remote teaching and training process with the use of support tools

IO.6 Development of methodology for conducting practical classes

This project has been funded with the support of the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

GDAŃSK UNIVERSITY OF TECHNOLOGY
Università di Catania
ALPEN-ADRIA UNIVERSITÄT KLAGENFURT | WIEN | GRAZ
Cracow University of Technology
SZÉCHENYI EGYETEM

List of authors:

Gdansk University of Technology

Wojciech Kustra, Marcin Budzynski, Joanna Wachnicka, Tomasz Mackun, Lukasz Mejlun, Alina Guzik

Cracow University of Technology

Mariusz Kiec, Remigiusz Wojtal, Krzysztof Ostrowski, Stanislaw Gaca

University of Zylina

Miroslava Mikusowa, Patrik Hrkut

University of Gyor

Attila Borsos, Daniel Miletics

University of Catania

Salvatore Damiano Cafiso, Giuseppina Pappalardo

Alpen Adria University

Kyamakya Kyandoghere, Jean Chedjou, Patrik Grausberg

Contents:

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 enormous scope, requires various didactic tools (lectures, fieldwork, design, practical classes, 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.6

- **Objective:** Development of methodology for conducting practical classes.
- **Work package:** The task falls under WP3 – Development of techniques for the implementation of the remote teaching and training process with the use of support tools.
- **Target Groups:**
  Research and teaching staff from institutions involved in the project and other European institutions.

2 PRACTICAL CLASSES IN AN ONLINE ENVIRONMENT

Online practical classes in the field of engineering education (in the case of the InfRO@D project - focused on Road infrastructure management) offer a highly adaptable and technology-driven approach to education.

These classes enable students to access instructional content at their own pace and convenience, effectively eliminating geographical constraints. This flexibility proves especially advantageous for adult learners and those with busy schedules, as it empowers them to harmonise their education with professional commitments.

Additionally, online practical classes harness innovative technology and resources to enrich the learning experience. By utilising virtual simulations, interactive multimedia and digital platforms, these practical classes make intricate concepts more accessible and engaging for students. They can use different types of resources, from video tutorials to interactive discussion forums, tailoring their learning journey to personal preferences and learning styles.

Within the framework of online practical classes, teachers possess the capacity to engage with students actively. They can monitor student responses, deliver timely feedback and cultivate participation and engagement, similarly as in a traditional classroom setting. Augmenting verbal communication, teachers can seamlessly utilise features like chat boxes, digital whiteboards and screen-sharing capabilities to provide clarification and interact with students. The timing of feedback can be adapted to the specific nature of the practical classes, either deferred until the conclusion of a task or promptly delivered to support real-time learning.

One of the most notable advantages of online practical classes is the possibility of recording the sessions. Recordings allow students to revisit and review lessons (as often as needed) for deeper understanding and skill improvement. This aspect underscores the importance of meticulous class content preparation and delivering high-quality, practical sessions. The following text should assist teachers in achieving this objective most conveniently and effectively.

3 PLANNING AND PREPARATION OF PRACTICAL CLASSES

3.1 Key consideration for effective practical classes planning

Efficient planning and the thoughtful design of practical classes are essential in ensuring a productive and enriching learning experience for students, particularly in the realm of online educational courses. While flexibility remains a core tenet, a structured plan should be a basis for achieving established objectives of practical sessions.

Another fundamental aspect of practical session planning is the accurate time. Teachers should determine how long each activity or exercise will take, allowing for effective time management during the session. This ensures that the practical stays on schedule and meets its learning objectives.

Successful practical classes frequently require a delicate balance between utilising existing resources and adapting to specific course goals. In this context, structured planning takes on a central role. Systematic practical planning is critical in facilitating a cohesive and engaging learning educational experience for students. Several key considerations should be taken into account during this process – the sequence of practical sessions, the general preparation, the flexibility and the interaction and feedback strategies:

- Sequence of practical classes: Defining the sequence in which practical sessions will be conducted is an essential first step. This establishes a clear course trajectory for students, offering them a roadmap for their practical experiences.
- General preparation: The initial preparatory phase should not be overlooked. Adequate preparation sets the stage for a successful course. It ensures that all required materials, resources, and teaching methods are in place to support effective practical delivery.
- Flexibility: While having a well-defined plan is crucial, a degree of flexibility is equally valuable. Instructors should be ready to adapt and improvise during practical sessions to accommodate student reactions and address specific learning needs. This adaptability ensures that the practical experience remains engaging and responsive to students' requirements.
- Interaction and feedback strategies: Teachers should also consider their interaction and feedback strategies that align with the practical session's specific nature and learning objectives. These strategies may include providing timely feedback, encouraging active participation, and addressing student questions and concerns throughout the session. Establishing routines and maintaining a structured approach is critical for effectively delivering practical sessions. Teachers should set clear routines that students can follow, which helps optimise their learning experience and engagement.

3.2 Methodology of practical classes preparation

To ensure the success of practical sessions, teachers must prioritise thorough preparation and organisation. This includes planning the various stages of the practical in advance to create a well-structured and engaging learning experience for students. When planning practical sessions, it is crucial to outline the sequence of activities, considering which activities are best suited for the entire class and which work effectively in smaller student groups. This approach

allows for a coherent flow of the practical sessions and ensures that students can fully engage with the learning materials and activities.

In the context of preparing practical classes, the sequence of the following steps is highly recommended:

1) Preparation for practical session:
   - Preparation of content: Begin by creating a clear and structured outline for the practical session. This should include a breakdown of the content into logical sections, identifying the main objectives to be covered.
   - Creation of teaching materials: Develop the necessary materials and resources for the practical session, such as handouts, readings, and references. Ensure that these resources support the practical's learning objectives and are readily accessible to students.
   - Platform setup: Ensure the chosen online platform (e.g., Zoom, Microsoft Teams, Moodle) is well-prepared for the practical session. Test the audio, video, and screen-sharing features to ensure they function correctly. Additionally, set up online forums or discussion boards for student interactions.

2) Starting the practical session:
   - Introduction: Commence the practical session with a brief personal introduction, emphasising your expertise in the field of road infrastructure management. Provide an overview of the session and outline the topics and content students can expect to cover.

3) Delivering the content:
   - Practical Activities: Deliver the practical session with enthusiasm and clarity. Encourage student interaction and address any questions or concerns that may arise.
   - Practical Instructions: Introduce the practical topic, highlighting its significance and relevance. Clearly define the specific objectives of the practical and identify the key concepts, principles, or skills that students are expected to grasp. Provide explanations of fundamental theories and terminology pertinent to the practical. Consider incorporating practical applications, emphasising the roles and responsibilities of participants, and offering examples of both ineffective and effective practices. Discuss common challenges and potential mitigation strategies, utilising real-world case studies and success stories to illustrate key points. Introduce any relevant tools, software, or technologies associated with the practical content and offer practical demonstrations when feasible.

4) Interactive Activities. Promote student engagement through a variety of interactive activities. This may include:
   - Discussion Boards: Initiate discussions by posing relevant questions about the practical topic, encouraging student debate and discussion.
   - Quizzes: Use brief quizzes to assess students' understanding of the practical content.

5) Multimedia Resources:
   - Enhancing the practical session: Consider using multimedia resources such as images, videos, infographics, and interactive content to enhance the experimental session.

These visual elements can help clarify complex concepts and maintain student engagement.
- Videos: Showcase real-life situations or field interviews and facilitate discussions by analysing key aspects of the content.
- Animations: Utilize animations to explain intricate procedures or scenarios.

6) Student participation and engagement:
- Group Work: Organize students into groups and assign tasks, mini-projects, or topics for group discussions.
- Question & answer Session: Allocate time within the session for students to ask questions, encouraging interaction. If student presentations are part of the session, consider scheduling 10 minutes for each presentation and 5 minutes for post-presentation discussions.

7) Assignments and assessments:
- Homework: Assign readings, research tasks, or projects to reinforce learning.
- Assessments: Design a brief online quiz or test based on the practical's content to evaluate students' comprehension and progress.

8) Concluding the practical session:
- Summarise the key points covered in the practical session and underscore their practical application. Additionally, provide an overview of what will be covered in the next session.

9) Post-class duties:
- Review and adjustment: Before delivering the practical to students, thoroughly review all materials, slides, and activities. Make any necessary adjustments to enhance clarity and coherence.
- Uploading materials: Ensure that all presentation slides, readings, and other materials are promptly uploaded to the course platform for students' access.
- Engagement on discussion boards: Actively participate in student queries or discussions to maintain engagement.

Preparation for the following practical session: Use feedback and insights from previous practical experiences to prepare for the next session effectively. Stay adaptive and responsive to students' needs, regularly checking in to ensure they are on track and deriving value from the course. The online format demands active measures to maintain student engagement and a responsive approach to ensure effective learning outcomes.

4 METHODOLOGY FOR PRACTICAL CLASSES

4.1 Type of resources – practical classes

Description of each of the mentioned resources in relation to their use in an online educational course on Road Infrastructure Management is the following:

Student PDF report and presentation: This resource typically consists of reports and presentations created by students. It is a versatile tool for student assessment and engagement. Students can use PDF reports for individual assignments, group projects, or research tasks. The presentations are often used for sharing findings, discussing topics, and presenting their work to peers and instructors. These reports and presentations are valuable for conveying complex information and demonstrating comprehension of the course material.

PowerPoint-teacher (project details): These are PowerPoint presentations created and provided by the teacher. They serve as a valuable resource for instructors to share detailed information about course projects, assignments, or specific topics. These presentations can offer a structured overview of project requirements, expectations, and guidelines. They are an effective way for teachers to convey important information and ensure students clearly understand course-related tasks.

Group discussion: Group discussions involve students interacting and collaborating on course topics. This often occurs through discussion boards or forums in an online course. It is a valuable resource for encouraging peer-to-peer learning, critical thinking, and exchanging ideas. Group discussions can foster community and help students engage with course content collaboratively. Instructors can use discussion topics to explore essential concepts, share different perspectives, and encourage active participation.

PowerPoint – students: This resource refers to PowerPoint presentations created by students. These presentations are a means for students to demonstrate their understanding of course material and share their insights with peers. They can be used for individual or group projects, class presentations, or showcasing research findings. PowerPoint presentations created by students facilitate visual communication and effective presentation skills.

Self-directed Group Work: Self-directed group work refers to collaborative activities where students work together without direct instructor intervention. Students often use digital platforms in online courses for project collaboration and discussions. This resource encourages students to take ownership of their learning, develop teamwork skills, and collectively explore and apply course content.

PowerPoint - student presentation (Final discussion with teachers in all groups together): This PowerPoint presentation is created by students for the final discussion, where they present their findings and discuss their work with teachers and peers. It allows for a structured and visually engaging way to communicate their project outcomes and key takeaways. These final presentations often serve as a culminating assessment and an opportunity for students to showcase their understanding and achievements.

Video/maps data: Video and maps data can include visual resources such as videos, maps, and geographic data. These resources are used to illustrate real-world scenarios, provide visual examples, and support understanding topics related to road infrastructure management. Videos and maps can make the course content more engaging, practical, and relatable.

Statistical data from the country (roadside accidents): Statistical data is used to provide factual and numerical information related to roadside accidents. In the context of road infrastructure management, this data can be used for analysis, case studies, and understanding the impact of accidents on road safety and design. It supports evidence-based learning and helps students apply theoretical knowledge to real-world situations.

Data for the Student Project: Data for student projects includes information and datasets that students can use for their assignments or projects. In road infrastructure management, this data could be related to road conditions, traffic patterns, or safety records. Students can analyse, interpret, and apply this data to address specific project tasks or research questions.

Picture gallery/video: Picture galleries and videos are visual resources used to convey information and examples related to road infrastructure management. They can showcase real-life situations, road designs, safety measures, and best practices. These visual resources enhance the understanding of complex concepts and provide practical context for the course material.

Data collection pertaining to roads and Vulnerable Road Users (VRU), including traffic parameters (volume and speed): Data collection resources are used to gather information related to road conditions, traffic parameters, and the behaviour of vulnerable road users (such as pedestrians and cyclists). This data supports practical research and analysis in road infrastructure management, helping students explore safety and traffic issues in real-world contexts.

PowerPoint-teacher: PowerPoint presentations created by the teacher are used for delivering course content, explanations, and lectures. They provide a structured format for presenting information, visual aids, and organised explanations. Instructors use them to guide students through course materials and ensure effective content delivery.

Map collaboration for network classification: Map collaboration involves students working together to classify and analyse road networks. This resource is valuable for practical assignments that involve network classification, routing, and design. It fosters collaboration and allows students to apply theoretical knowledge to real-world scenarios.

Peer-to-peer presentation: Students create and deliver peer-to-peer presentations to their peers. These presentations encourage students to teach and learn from one another. They promote knowledge sharing, communication skills, and active participation in the learning process.

RSA Final report (team collaboration): RSA (Road Safety Audit) final reports are collaborative projects where students work together to assess road safety and propose improvements.

These reports summarise the findings, recommendations, and conclusions of the audit. They often involve teamwork, data analysis, and practical application of road safety principles.

The selection of the type of resource is ultimately at the teacher's discretion, and it should be made carefully considering several pivotal factors. These factors encompass the relevance of the resource to the course content, its alignment with the learning objectives, the pedagogical needs and preferences of the students, the degree of interactivity and engagement it offers, the capacity to facilitate comprehension of complex concepts, and its capacity to meet the specific instructional goals and outcomes. Moreover, the teacher should weigh the resource's suitability for the online learning environment, its accessibility, and its potential to enhance the overall quality of the educational experience, thus ensuring that the chosen resources contribute effectively to the success of the course.

4.2 Road Safety Audit

Road infrastructure safety management (RISM) involves various control activities, such as Road Safety Audit (RSA) management. The main objective of RSA is to identify infrastructure faults during the design process to reduce risk for all user groups. This methodology includes: motorways, dual and single-carriageways, intersections, interchanges, and elements of VRU infrastructure.

The practical activities can be implemented using the following scenarios:

- A includes practical activities on prepared design maps of selected road infrastructure elements: road sections (motorways, rural highways), intersections, interchanges, and elements of VRU infrastructure.
- B combines fieldwork activities with a comprehensive analysis of the calculation results obtained.

In both cases, the work will look similar. The main objective will be developing reports on the audits carried out on selected infrastructure elements using prepared checklists of control questions (depending on country regulations).

4.2.1 Teacher preparation

The teacher's preparation for the practicals is an important element in the teaching process. If the teacher prepares the materials, the following are recommended:

- Review of all road infrastructure elements,
- Prepare appropriate didactic materials depending on the number of students and road authority staff.
- Initial RSA using hazard checklists or control questions.
- Consultation of evaluation results with other RS Auditors or Specialists.

The work must be done using the materials provided by the teacher. The design maps should show vertical and horizontal markings, road gradients, slopes, and elements of the accompanying infrastructure (ditches, culverts, footpaths, cycle paths, lighting, etc.), as well as the route and the route itself (Figure 1). A checklist or list of control questions covering the scope of the audit work should be prepared for the assessment (Table 1).

Figure 1 Example of design map with an audited road section

Table 1 List of control questions – Stage 1 Preliminary Design

List of auxiliary control questions when performing Road Safety Audit - Stage 1 Preliminary Design

Problem	Nb	Follow-up questions
1. Function, technical class, design speed, road accessibility	1	Are the basic technical assumptions for the road compliant with the road safety requirements for motorway
	2	Are the adopted assumptions regarding accessibility (distances of interchanges, intersections and entries to passenger service areas) correct with regard to road safety requirements?
	3	Is the design and reliable speed correctly established for: elements of the road plan and longitudinal profile of the road?
	4	Is the design and reliable speed correctly established for: elements of intersections (e.g. additional lanes at intersections) and traffic light parameters?
	5	Is the design and reliable speed correctly established for: determining the necessary visibility?
	6	Is the design and reliable speed correctly established for ramp design?
	7	Are the design solutions well adjusted to the adopted traffic volumes and other characteristics of traffic flows, including the atypical share of heavy goods vehicles, cyclists and pedestrians?

4.2.2 Practical based on field activities (scenario B) or practical activities (scenario A)

In this exercise, the student must create a report summarising the analyses conducted during the fieldwork or practical classes.

Generally, ensuring that the audit is described understandably and substantively is important. Therefore, it is intended to be divided into several parts:

- Part A – general data about the Project.
- Part B – detailed characterisation of road section/intersection audited.
- Part C - an overall assessment of the project.
- Part D, E - an assessment of the project in detail.
- Part F – Auditor's conclusion.

Part A is general information about the road infrastructure elements and detailed characterisation of the RSA stage. The student should provide a detailed characterisation of the road infrastructure elements under audit in this section.

In Part B, you should characterise the audited road section/intersection in detail, etc, which is the subject of the audit.

- It is useful to describe where the object is located (a map with the location can be added (Figure 2). Indicate within which framework the audited solution is planned and in which environment it is located in terms of the type of development.
- You should describe the design characteristics of the elements to be assessed, such as road class, design speed, expected traffic volume, type of cross-section or other geometric parameters such as curve radii and gradients.
- Depending on the materials available and their detail, it is worth describing the audited facility at this point in such a way as to make it easier to understand the context of the errors, defects and risks indicated in the following sections.

Figure 2 Example of the map with an audited road section

In Part C, we make an overall assessment of the project, describing general comments regarding deficiencies, shortcomings and ambiguities recurring in the project.

- In fact, this element arises after a detailed audit has been carried out when the auditor will point out in detail the individual errors, faults and risks.
- After such detailed work, the auditor will notice a repetition of the solutions that raised concerns.
- This point helps the audit reader understand the general problems of the designed elements.

In parts D and E, we assess the project in detail, pointing to specific places and describing observations concerning the designed solutions which raise doubts and reservations. When pointing out problems, we also recommend solving the observed problem.

- It is a good idea to supplement the description with pasted photographs (taken by yourself if you have done so) or print screens from a film or Google Maps. If you are working with a graphic design (e.g. printed to pdf), annotating print screens at the point discussed in the text (Figure 3, Figure 4).

Figure 3 Example of hazard recognition during the RSA process – video

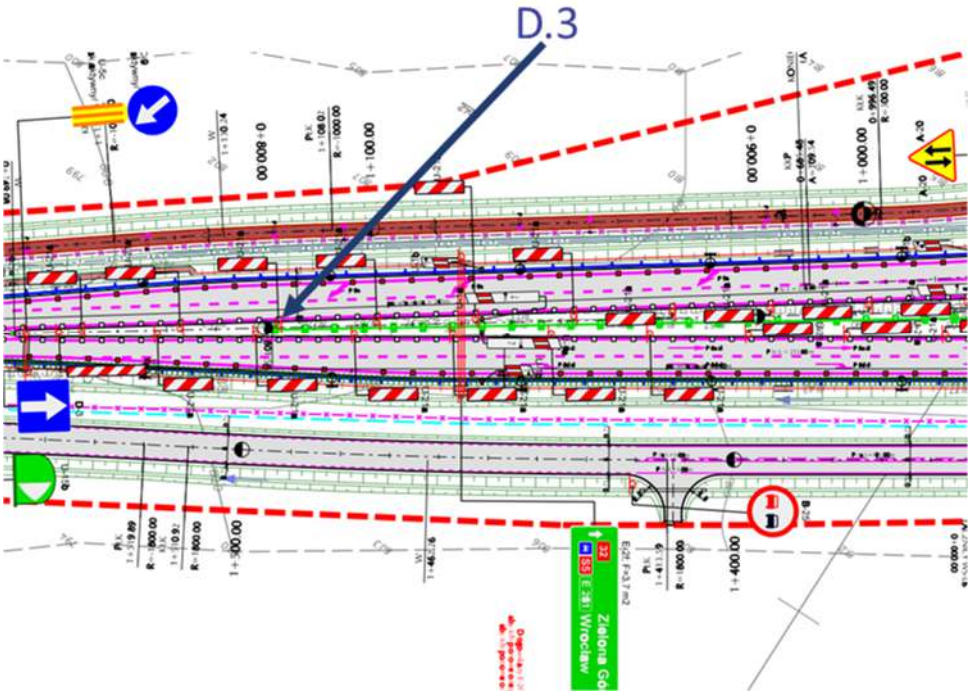


Figure 4 Example of hazard recognition during the RSA process – design map

Part F

- At the end of the study, we write the auditors' conclusion, pointing out the errors and faults among the problems described above.

4.3 Roadside Safety Management

Road Infrastructure Safety Management (RISM) is a process that involves various inspection activities, such as Roadside Safety Management (RSM). The primary objective of RISM is to identify and rectify any deficiencies in existing road sections to reduce risk for all groups of

users. RSM is a collaborative effort, and to facilitate this, additional techniques will be provided to allow group members to work remotely under the guidance of a teacher. This procedure shall cover single carriageways.

The practical activities can be implemented using the following scenarios:

- A involves exercises that rely solely on theoretical data and risk level calculations.
- B combines fieldwork activities with a comprehensive analysis of the calculation results obtained.

For Scenario A, tasks should be completed individually by one student. In the case of Scenario B, all work should be conducted in pairs to facilitate collaboration and mutual monitoring, enabling students to check each other's work.

4.3.1 Teacher preparation

The teacher's preparation for the practicals is an important element in the teaching process. If the teacher prepares the materials, the following are recommended:

- Preparation of data for theoretical calculation
- Review of all road sections.
- Initial RSM using hazard identification and classification sheet.
- Consultation of evaluation results with other RS Auditors or Specialists.

4.3.2 Theoretical practical (scenario A)

This is an exercise in calculating the risk indicators for roads in a region or on a selected road section. The student will understand how to calculate risk indicators and compare areas or stretches of road that differ in population or annual traffic.
The student will learn about indicators such as:

- Social risk
- Individual risk
- Serious accidents density
- Accident costs density
- Serious accidents ratio
- Accident costs ratio

The student is required to complete three tasks as part of this type of activity:

- Task 1 - Based on the presentation and provided data, calculate social risk (serious accident density, accident costs density) for road sections presented in Excel.
- Task 2 - Based on the same data from Task 1, calculate individual risk (serious accidents ratio, accident costs ratio) for road sections from Excel.
- Task 3 - Based on the results of Task 1 and Task 2, present the calculated risks on maps and summarise the results. Prepare a report summarising your work.

The teacher must prepare Excel files with the calculation data as in Table 2.

Table 2 Data table for theoretical, practical scenario

Road section	Voivodeship	Road	Length [km]	VKT [mln veh-km/3 years]	AADT [Veh/24h]	Accidents [number]	Injuries [number]	Serious injured [number]	Fatalities [number]	Costs [mln PLN.]
2003	Dolnośląskie	R292	14,500	45,310	2854	10	18	10	0	24,668
2290	Dolnośląskie	R292	1,300	5,632	3957	0	0	0	0	0,000
2291	Dolnośląskie	R292	3,100	30,036	8848	4	7	4	0	9,712
2292	Dolnośląskie	R292	3,600	38,703	9818	4	6	6	0	14,375
2007	Dolnośląskie	R292	14,500	53,556	3373	6	9	3	1	9,668
2008	Dolnośląskie	R292	4,600	3,160	627	0	0	0	0	0,000
2309	Dolnośląskie	R292	3,000	2,185	665	0	0	0	0	0,000
2319	Dolnośląskie	R292	17,000	72,037	3870	2	2	2	0	4,731
2311	Dolnośląskie	R292	17,000	34,242	1840	4	4	4	0	9,835
2012	Dolnośląskie	R296	6,621	13,854	1911	0	0	0	0	0,000
2013	Dolnośląskie	R296	5,200	12,551	2204	1	1	0	0	0,053
2294	Dolnośląskie	R296	16,600	54,151	2979	8	11	1	2	7,167
2295	Dolnośląskie	R296	1,200	0,000	0	0	0	0	0	0,000

4.3.3 Practical based on field activities (scenario B)

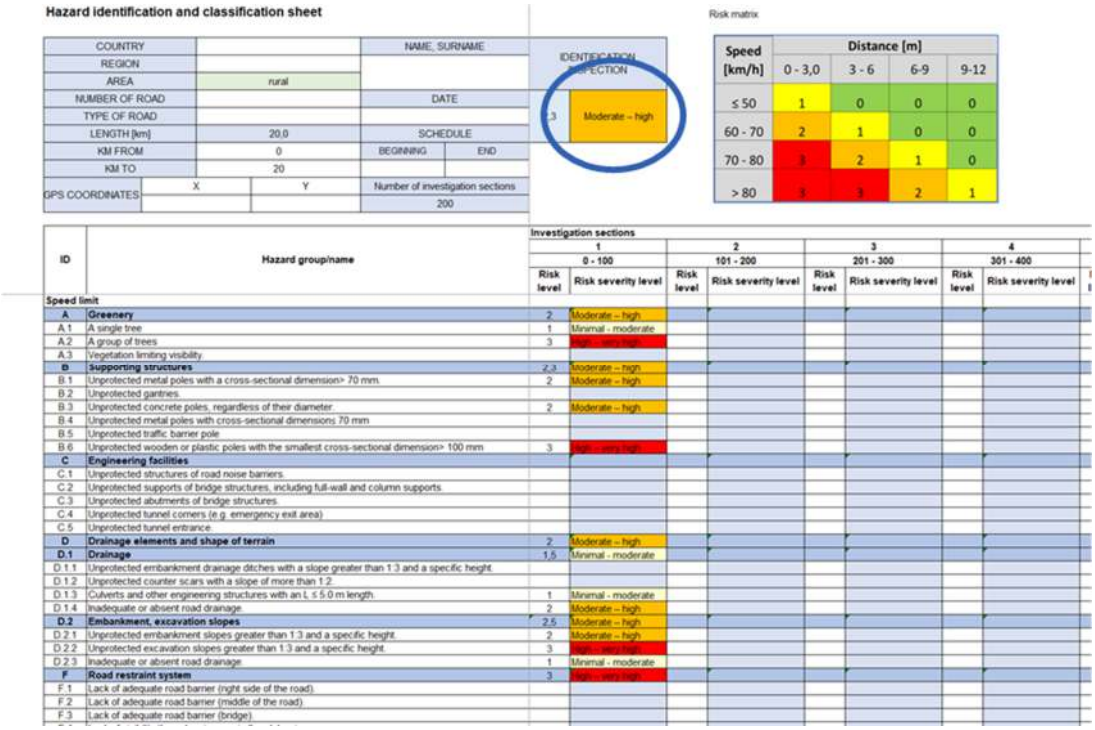
In this exercise, the student must create a report summarising the analyses conducted during the fieldwork and assess the safety aspects of the section under development. The tasks within this report can be categorised into the following sections:

Part A – general information about the road, detailed characterisation of the road section.

The student should provide a detailed characterisation of the road section or intersection under audit in this section. It's essential to specify the location of the subject of the audit (including the option of adding a map for reference). Additionally, it clarifies the framework within which the proposed solution is planned and the environmental context regarding development type. Student should include descriptions of the design characteristics of the elements to be assessed, such as road class, design speed, anticipated traffic volume, cross-section type, and other geometric parameters like curve radii and gradients. Depending on the availability and detail of materials, provide a description of the audited facility that aids in comprehending the context for errors, defects, and risks outlined in the subsequent sections.

Part B - an overall assessment of the road section

In this part, student should make an overall assessment of road safety hazards on the whole analysed section, resulting from a detailed analysis of every 100m section of the road.



Hazard identification and classification sheet

COUNTRY		NAME, SURNAME	
REGION			
AREA	rural		
NUMBER OF ROAD		DATE	
TYPE OF ROAD			
LENGTH [km]	20,0	SCHEDULE	
KM FROM	0	BEGINNING	END
KM TO	20		
GPS COORDINATES	X	Y	Number of investigation sections
			200

IDENTIFICATION SECTION: 2,3 Moderate – high

Risk matrix

Speed [km/h]	Distance [m] 0 - 3,0	3 - 6	6-9	9-12
≤ 50	1	0	0	0
60 - 70	2	1	0	0
70 - 80	3	2	1	0
> 80	3	3	2	1

ID	Hazard group/name	Investigation sections 1: 0 - 100 Risk level	1: 0 - 100 Risk severity level	2: 101 - 200 Risk level	2: 101 - 200 Risk severity level	3: 201 - 300 Risk level	3: 201 - 300 Risk severity level	4: 301 - 400 Risk level	4: 301 - 400 Risk severity level
Speed limit									
A	**Greenery**	2	Moderate – high						
A.1	A single tree	1	Minimal - moderate						
A.2	A group of trees	3	High – very high						
A.3	Vegetation limiting visibility								
B	**Supporting structures**	2,3	Moderate – high						
B.1	Unprotected metal poles with a cross-sectional dimension> 70 mm	2	Moderate – high						
B.2	Unprotected gantries								
B.3	Unprotected concrete poles, regardless of their diameter	2	Moderate – high						
B.4	Unprotected metal poles with cross-sectional dimensions 70 mm								
B.5	Unprotected traffic barrier pole								
B.6	Unprotected wooden or plastic poles with the smallest cross-sectional dimension> 100 mm	3	High – very high						
C	**Engineering facilities**								
C.1	Unprotected structures of road noise barriers								
C.2	Unprotected supports of bridge structures, including full-wall and column supports								
C.3	Unprotected abutments of bridge structures								
C.4	Unprotected tunnel corners (e.g. emergency exit area)								
C.5	Unprotected tunnel entrance								
D	**Drainage elements and shape of terrain**	2	Moderate – high						
D.1	**Drainage**	1,5	Minimal - moderate						
D.1.1	Unprotected embankment drainage ditches with a slope greater than 1:3 and a specific height								
D.1.2	Unprotected counter scars with a slope of more than 1:2								
D.1.3	Culverts and other engineering structures with an L ≤ 5.0 m length	1	Minimal - moderate						
D.1.4	Inadequate or absent road drainage	2	Moderate – high						
D.2	**Embankment, excavation slopes**	2,5	Moderate – high						
D.2.1	Unprotected embankment slopes greater than 1:3 and a specific height	2	Moderate – high						
D.2.2	Unprotected excavation slopes greater than 1:3 and a specific height	3	High – very high						
D.2.3	Inadequate or absent road drainage	1	Minimal - moderate						
F	**Road restraint system**	3	High – very high						
F.1	Lack of adequate road barrier (right side of the road)								
F.2	Lack of adequate road barrier (middle of the road)								
F.3	Lack of adequate road barrier (bridge)								

Figure 5 Example of the overall assessment of road segment

Then, the student should describe in general terms the nature of the risks perceived while watching the film, the problems most frequently encountered and/or most critical.
In Part C, The student should conduct a thorough assessment of the road section, including (Figure 6):

- Evaluating the risk severity level for each hazard group and providing the percentage of the affected section length.
- Including sample images of selected hazards.
- Identifying and describing the most hazardous segments.

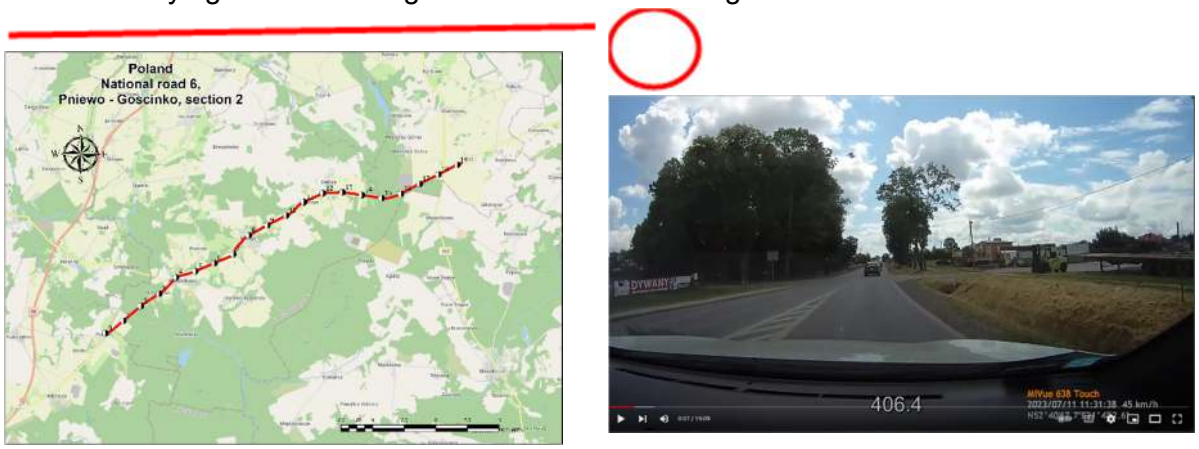


Figure 6 Example of a sample hazard

In part D, the student should perform an analysis of specific critical sections where a detailed road safety analysis is required (Figure 7). In part E, student should propose solutions for the most critical sections.

ID	Hazard group/name	Investigation sections													
		1		2		3		4		5		6		7	
		0 - 100		101 - 200		201 - 300		301 - 400		401 - 500		501 - 600		601 - 700	
		Risk level	Risk severity level	Risk level	Risk severity level	Risk level	Risk severity level	Risk level	Risk severity level	Risk level	Risk severity level	Risk level	Risk severity level	Risk level	Risk severity level
G	Other elements	3	High – very high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	2	Moderate – high
G.1	Unprotected rocks and walls	3	High – very high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	2	Moderate – high
G.2	Unprotected surface water deeper than 1.0 m														
G.3	Unprotected permanent obstacles protruding at least 0.15 m above the ground level														
Average		2.5	Moderate – high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	3	High – very high	2	Moderate – high

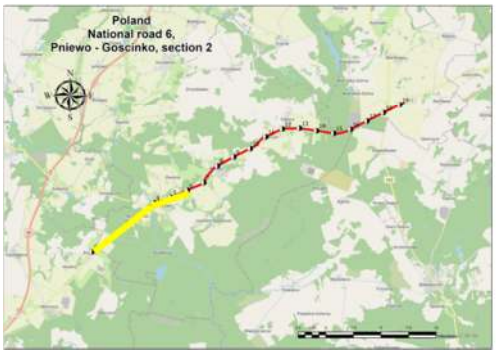


Figure 7 Example of critical section pointing

In the last section, F, a summary of the analyses performed in the following report sections should be made. For the result discussion, it is essential to prepare PowerPoint presentation.

4.4 Safety management of vulnerable road users

The objective of this practical class is to familiarize students with the process of selecting solutions for Vulnerable Road Users (VRUs) in different countries (Poland, Belgium, Germany, New Zealand, and Austria) based on specific traffic and pedestrian data. Students will use data related to traffic flow, pedestrian flow, vehicle speed, sight distance, and cross-section to analyze and compare the rules and regulations in each country to select the appropriate type of solution for VRUs.

Materials:

- Data on traffic flow, pedestrian flow, vehicle speed, sight distance, and cross-section for the given location (Table 3).
- Access to relevant traffic regulations and guidelines for Poland, Belgium, Germany, New Zealand, and Austria.
- Writing materials, calculators, and laptops for data analysis.

Table 3 Traffic volume, speed limit and cross-section for planning facilities for VRU

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

Methodology The methodology includes the following (

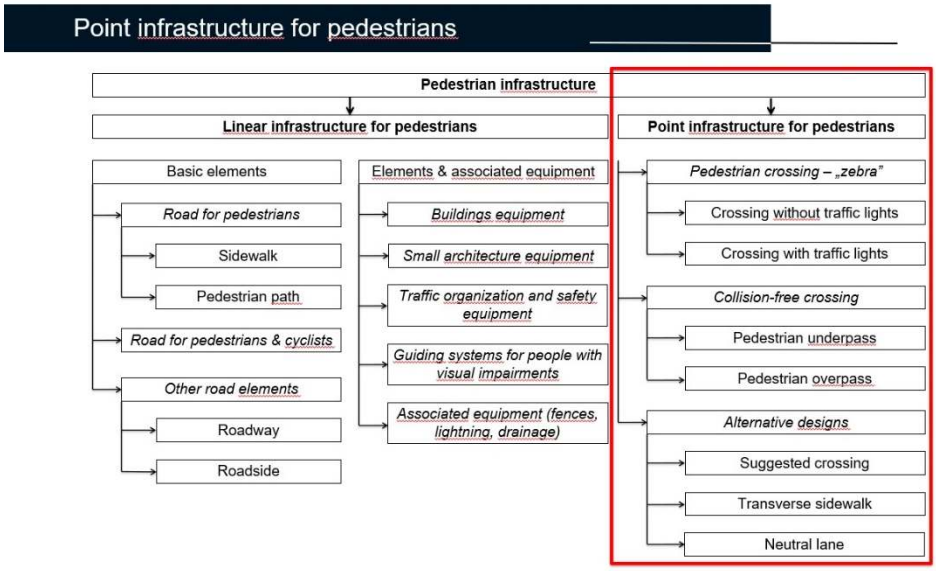


Figure 8 - Figure 10):

1) Introduction:
   - Briefly introduce the purpose of the practical class, which is to select solutions for VRUs in different countries.
   - Explain the importance of considering local traffic and pedestrian data when designing VRU solutions.
   - Explain the method in each country.
2) Data Collection and Analysis:
   - Distribute data on traffic flow, pedestrian flow, vehicle speed, sight distance, and cross-section to each student.
   - Individually, students should analyse the data and calculate relevant parameters (e.g., pedestrian volume, vehicle speed, sight distance).
   - Identify the specific challenges and characteristics of the location based on the data.

3) Research and Regulation Review:
   - students research and review the traffic regulations and guidelines related to VRUs in countries. This includes rules regarding pedestrian crossings, traffic control devices, and road design.
4) Solution Selection:
   - Based on the analysis of the data and the regulations, students should propose appropriate solutions for VRUs in the given location.
   - Solutions could include pedestrian crossings, traffic signals, speed limits, or road modifications.
   - Encourage students to justify their choices by referring to the data and regulations.
5) Comparison:
   - Students should present their chosen VRU solutions to the class.
   - Discuss the similarities and differences in the selected solutions for each country.
   - Highlight the impact of local regulations and data on solution selection.
6) Group Discussion and Feedback:
   - Open the floor for group discussions and questions.
   - Encourage students to provide constructive feedback on the solutions proposed by their peers.
7) Summary and Conclusion:
   - Summarize the key takeaways from the practical class.
   - Emphasize the importance of considering local context and regulations when addressing VRU safety.
8) Assignment:
   - Provide students with a follow-up assignment that may include a written report or presentation on the selected VRU solutions and a comparison of the five countries' approaches.

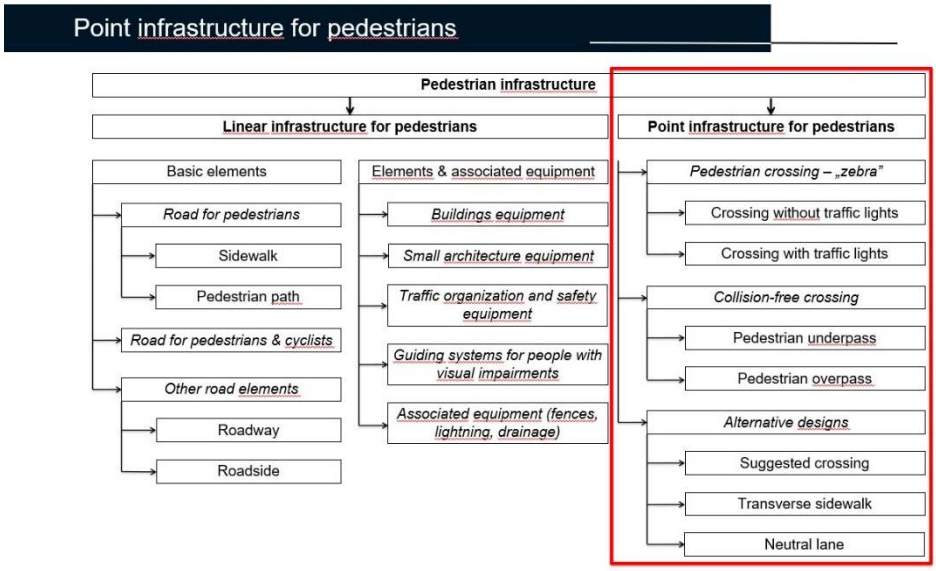


Figure 8 Point infrastructure for pedestrians

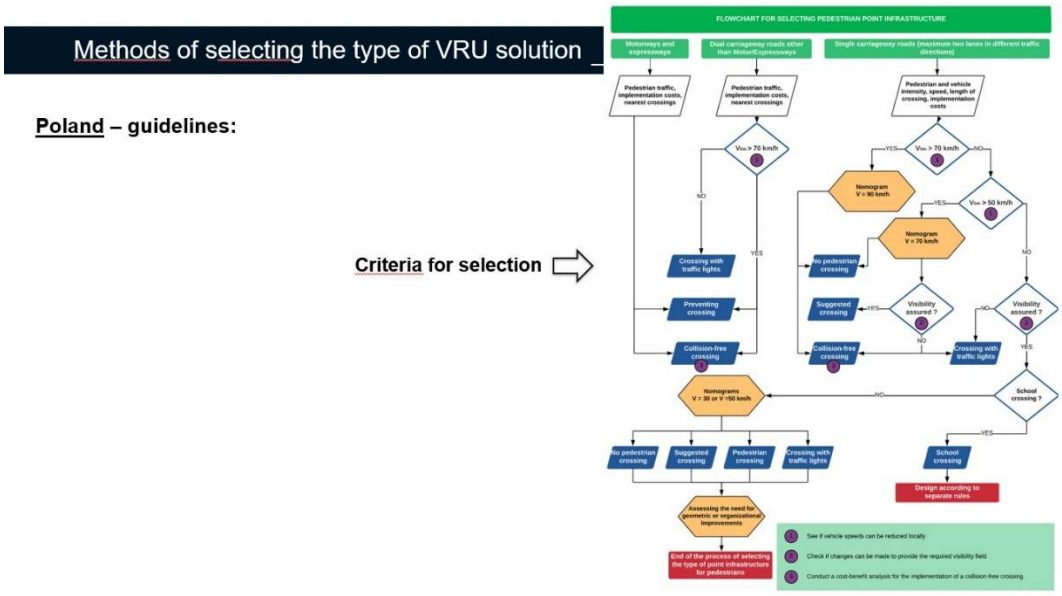


Figure 9 Methods of selecting the type of VRU solution – Polish guidelines

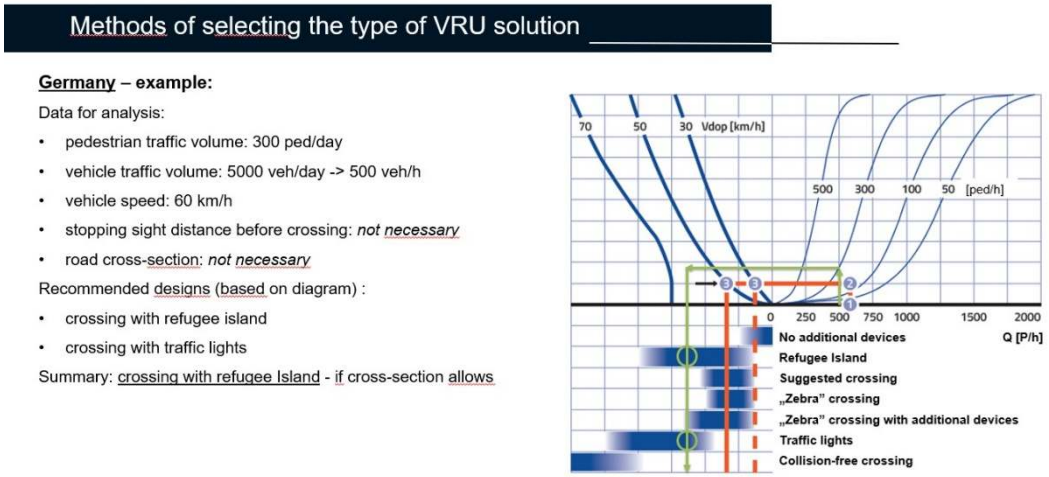


Figure 10 Methods of selecting the type of VRU solution - German guidelines

This methodology allows students to gain practical experience in selecting VRU solutions while considering the influence of local regulations and data. It also promotes critical thinking and cross-country comparisons in road safety planning.

4.5 Road pavement management

The practical part in the field of road surface management consists primarily of selecting road sections, identifying damage, and assessing and classifying the road surface condition. It is necessary to comprehensively assess the road condition damage, considering various factors such as frequency, size, and severity. Assessment is key to gaining insight into the condition of road infrastructure.

The practical part of the work can be divided into the following key stages:
1) Selection of road sections for evaluation.
2) Collecting road input data to the pavement management system (necessary and additional data)
3) Identification of road pavement damages.

By following these steps, road authorities and maintenance teams can make informed decisions regarding necessary repairs, maintenance priorities, and overall infrastructure management.

The practical part in the field of road surface management is planned as the student's own work. The teacher's task is:
- Checking the work done by students and making any corrections.
- Preparation of an exercise involving damage recognition.

4.5.1 Teacher preparation

The teacher's preparation for the practical classes is an important element in the teaching process. The teacher prepares the materials, the following are recommended:
- pavement management guidelines/standards,
- diagnostic guidelines/standards, e.g.
  - https://www.archiwum.gddkia.gov.pl/pl/2982/Diagnostyka-Stanu-Nawierzchni
  - https://www.archiwum.gddkia.gov.pl/userfiles/articles/s/system-oceny-stanu-nawierzchni_6165//documents/aktualizacja-wytycznych-sosn-o-pomugiec.pdf
  - https://www.archiwum.gddkia.gov.pl/userfiles/articles/z/zarzadzenia-generalnego-dyrektor_17474/zarzadzenie%2034%20zalacznik%20wytyczne%20stosowania.pdf
- spare road sections (see methodology for field classes).
- photo examples of various damages of road pavements.

4.5.2 Selection or road section for evaluation

In the case of this part of practical classes, the teacher should check the student's own work in terms of:
- correct selection of the section for further work (length, location, type, number of damages, size of damages, etc.) (Figure 11)
- assign students independently prepared (spare) road sections for further work - in case the students perform this part of the task incorrectly or have problems accepting the section independently (Figure 12).

How to choice the road section?

- ❑ Choose a road for further works.
- ❑ Road should be located in an urbanized, built-up area.
- ❑ Choose a 1 km section of this road.
- ❑ The section should be located in one specific traffic lane.
- ❑ The section should be damaged (with min. 5 different types of damages).
- ❑ When choosing, use your knowledge of the condition of roads in the vicinity.
- ❑ When choosing, use GoogleMaps© and StreetView option.
- ❑ When choosing, make sure the damages are clearly visible in Google Street View.
- ❑ Decide on the section of the road together in each student group.

Figure 11 Example of assumptions regarding road section selection and data collection

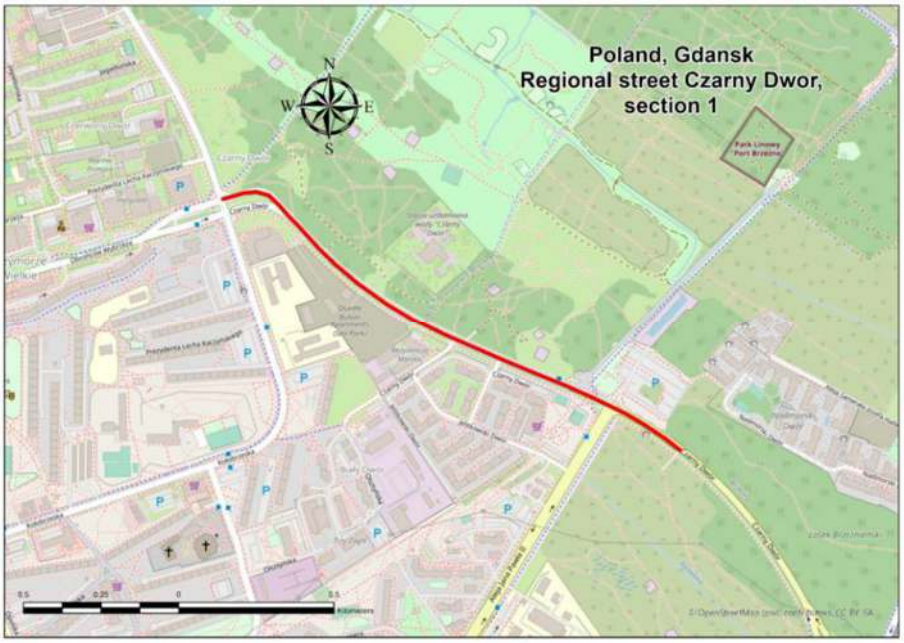


Figure 12 Example of prepared spare road section for students' works

4.5.3 Collecting road input data to the pavement management system

In the case of this part of practical classes, the teacher should:

- indicate to students what data they should collect (Figure 13).
- indicate to students where they can obtain data (Figure 14).
- check the quality of the data collected by students.

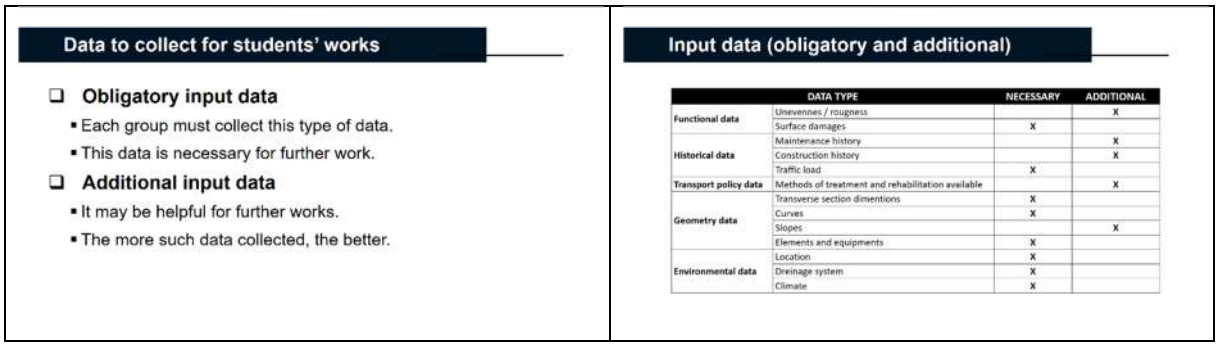


Figure 13 Example of types of data collected by the students

Figure 14 Example of tips on where to find information about road sections

4.5.4 Identification of road pavement damages

In the case of this part of practical classes, the teacher should prepare exercises on various pavement damage recognition. During the exercise, each student, in turn (one by one), names damage, which is visible on the displayed photo.

The number of collected photos of sample damage should depend on the number of students but should be less than three times their number. This means that each student should be able to recognise at least three different damages prepared graphically by the teacher. An example is shown in Figure 15.

Figure 15 Example of the damage from recognition exercise

4.5.5 Assessment and classification of the pavement condition

In the case of this part of practical classes, the teacher should provide students with tips on:

- assessment and classification of the pavement condition (Figure 16),
- how to assess and classify pavement condition (Figure 16),
- how to present students' results (Figure 17).

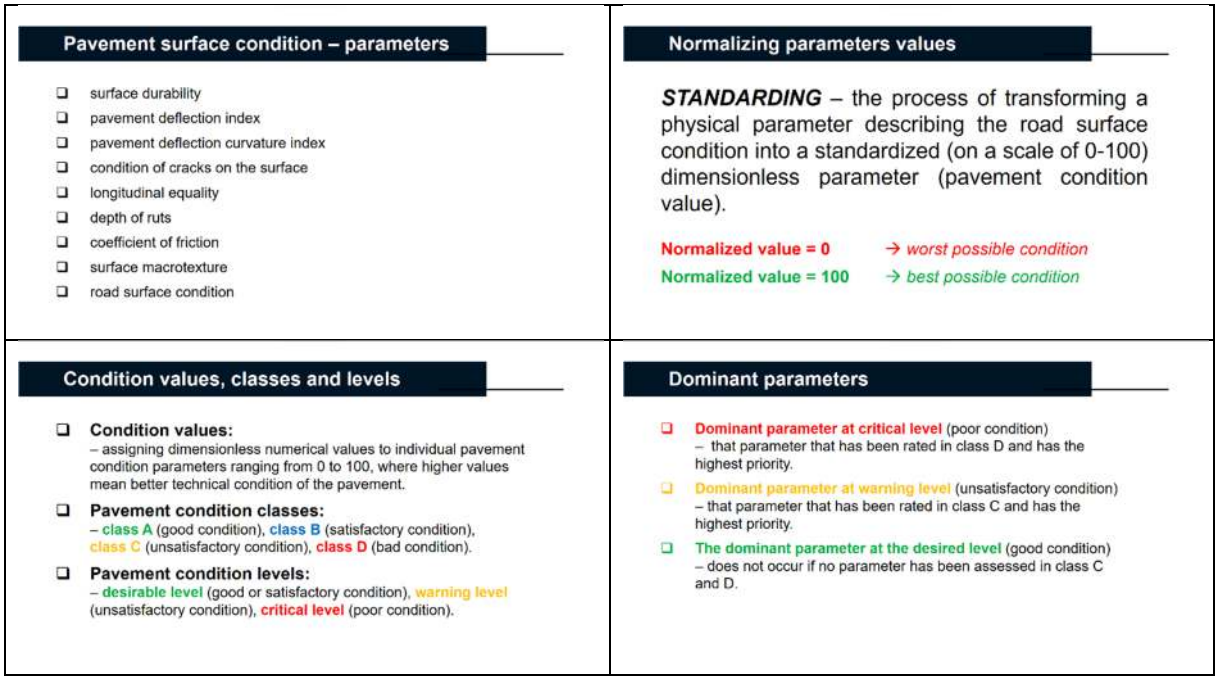
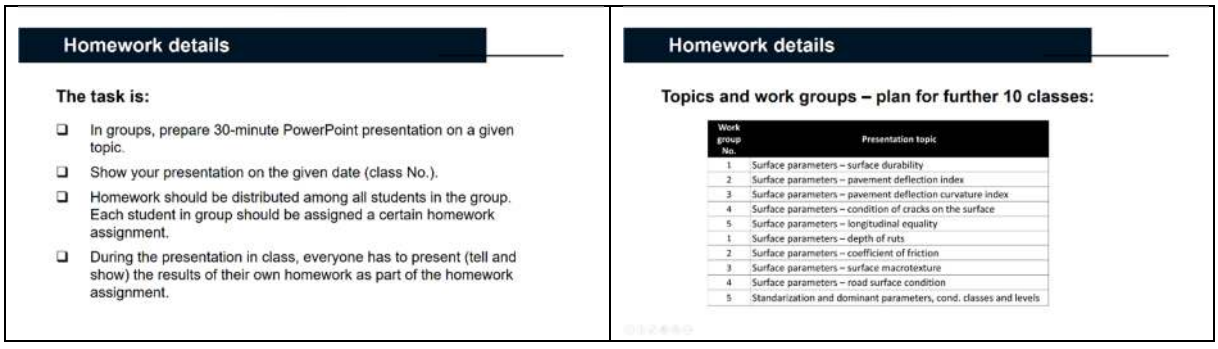


Figure 16 Example of information about parameters, classes and levels of pavement condition



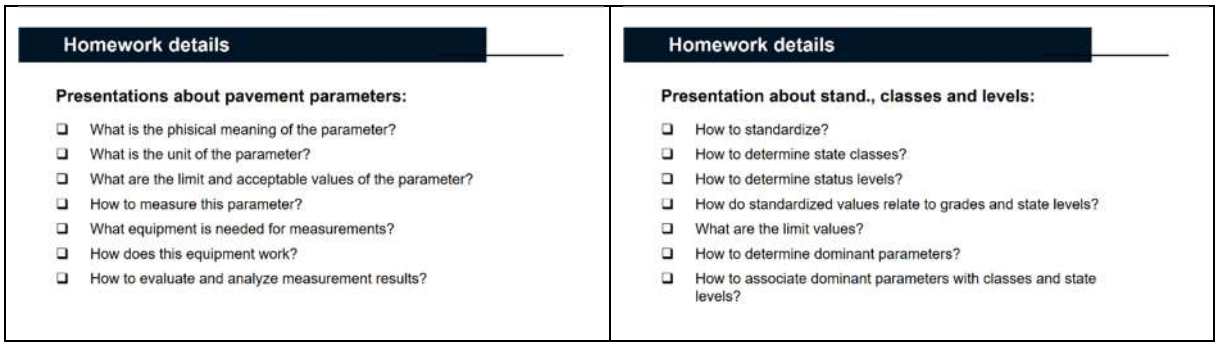


Figure 17 Information about the method of results presentation

5 SUMMARY

This document described the methodology for practical class preparation in an online environment. Document details steps of the process of practical class preparation, students' organisation into working groups and teaching materials that can be employed for practical class conduction. It was developed within the project InfoRo@d and was focused on preparing teaching and training materials within four modules for the Road infrastructure management course (Road safety audit, Roadside safety management, Safety management of vulnerable road users and Road pavement management). The provided methodology is based on the results and experience from the project didactical workshops that were placed in four partners´ universities: Zilina (Slovakia), Gyor (Hungary), Gdansk (Poland) and Klagenfurt (Austria). Necessary details were also developed on additional bilateral transnational meetings.

A detailed methodology for conducting online classes, including remote practical classes in the RIM area, can be found in the e-book "A Guidebook for Road Infrastructure Management Teachers and Trainers".