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HORIZON 2020 RESEARCH & INNOVATION PROGRAMME

D2.2

Research educational and training program in Latvia and the region

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Author(s)	Eftihia Nathanail, Lambros Mitropoulos, Giannis Adamos		
Responsible Organisation	UTH		
WP Leader	UTH		
Internal Reviewer(s)	Irina Yatskiv (Jackiva), TTI Kay Matzner, Fraunhofer		
External Reviewer			
Project Officer	Agnes Hegyvarine Nagy		

ALLIANCE Beneficiaries	
TRANSPORT AND TELECOMMUNICATION INSTITUTE – TTI	Latvia
PANEPISTIMIO THESSALIAS – UTH	Greece
FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV – Fraunhofer	Germany

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	Description
EC	European Commission
ENAEE	European Network for Engineering Accreditation
EU	European Union
HEI	Higher European Institute's
LLE	Long-life-educational
MSc	Master of Science
STIP	Sustainable Transport Interchange Program
STSE's	Short-Term Staff Exchanges
SUMP	Sustainable Urban Mobility Plan
TTI	The Transport and Telecommunication Institute
UTH	University of Thessaly
WP	Work Package

Abstract

This deliverable is the core of WP2 since it links strategically the results of D2.1 “Good practices of research, educational and training programs on smart solutions for the interconnection of transportation networks” with D2.3 “Course material on smart solutions for the interconnection of transportation networks”. The present deliverable aims to present the process that was followed towards the formulation of curricula and subjects that will be used for the further development of the research educational and training program in Latvia and the region. The methodological approach that is followed results in the identification of 20 educational areas for passenger and freight interchanges, which with their turn are combined to result in the 12 courses that will compose the core of the Sustainable Transport Interchange Program. The 12 selected transport related courses are designed and the information collected from the process is presented tabulated. For presentation purposes, four important fields are used to reveal the transport courses’ aim, learning outcome, assigned hours, responsible institute, proposed syllabus, bibliography and teaching methods.

1 Introduction

1.1 Background

ALLIANCE aims at developing advanced research and higher education institution in the field of smart interconnecting sustainable transport networks in Latvia, by linking the Transport and Telecommunication Institute – TTI with two internationally recognized research entities – University of Thessaly – UTH, Greece and Fraunhofer Institute for Factory Operation and Automation – Fraunhofer, Germany. Close collaboration of TTI with UTH and Fraunhofer will enable the achievement of the goals through the following activities:

- Organization of young researchers' seminars.
- Organization of workshops.
- Organization of summer schools for trainers and young researchers.
- Development of educational programme for graduate and post-graduate students.
- Development of training programme for trainers and practitioners.
- Provision of grants for participation as authors of peer reviewed publications in conferences.
- Facilitation of Short-Term Staff Exchanges (STSE's) with the aim of international collaboration, mainly publications.
- Establishment of a guidance strategy for preparing scientific publications.
- Creation of an educational forum as on-line tool for distance learning and knowledge sharing.

The overall methodology of the project is built around the analysis of the needs of Latvia and the surrounding region of the Baltic sea (Lithuania, Estonia, Poland) on knowledge gain about intermodal transport networks and the development of the tools to attain this knowledge, providing at the same time excellence and innovation capacity. The analysis to be conducted during the first stages of the project relies on the overarching relations among policy makers, industry and education/research.

Structured around three main pillars: 1) Organizational/governance, 2) operational/services, and 3) Service quality/customer satisfaction, ALLIANCE will deliver a coherent educational/training program, addressed to enhancing the knowledge of current and future researchers and professionals offering their services in Latvia and the wider region. The expected impacts on the overall research and innovation potential of TTI and Latvian research community will be of high importance and TTI will benefit from ALLIANCE by:

- Improving its knowledge in methodologies for preparing, writing and publishing scientific papers.
- Strengthening its research capacity.
- Establishing international research teams in specific areas of interest.
- Generating new innovative ideas for future research work through the project's activities.
- Setting up the fundamentals for the young generation of researchers.
- Being integrated in a number of existing international transport research networks.
- Being incorporated in the European research system of transport and logistics.

In addition, the cooperation of TTI with UTH and Fraunhofer will induce benefits into several domains of everyday life at regional, national and international scope. New bases will be established concerning knowledge transfer procedures, education and interdepartmental collaboration amongst research institutes. The innovative organizational framework, which will

be structured for this purpose during the project, is expected to constitute a best practice application with tangible and well estimated progress results, which will be disseminated and communicated through social events to the research community and to the respective business sector as well. Lastly, an important benefit will be the configuration of an integrated framework pertaining to the knowledge transfer techniques and the generic upgrading of the educational system with use of networking, staff exchange, webinars and other knowledge transfer methods and techniques based on a well-structured and well-tried schedule.

1.2 Deliverable scope and structure

This document is the second deliverable of WP2 (Work Package 2) and its scope is the formulation of curricula and subjects that will be used for the development of the Research educational and training program in Latvia and the region. This deliverable is the core of WP2 since it links strategically the results of D2.1 “Good practices of research, educational and training programs on smart solutions for the interconnection of transportation networks” with D2.3 “Course material on smart solutions for the interconnection of transportation networks”.

The methodology that is followed in this deliverable focuses on addressing all requirements that have been identified in D2.1 (i.e., following the two level gap analysis) for the Latvia and the region. More specifically, educational areas are assigned to each identified requirement for passenger and freight transport infrastructure. The outcome of this work, which is presented in the remaining chapters, provides the basis for the detailed course material on smart solutions for the interconnection of transport that will be presented in subsequent deliverables.

Following the introductory chapter, the subsequent sections of this deliverable include: Chapter 2, which presents the methodology that was followed for the structure of the proposed curricula and final courses. Chapter 3 summarizes the program objectives, the organization and the guidelines that are followed towards the development of the curricula. Lastly, Chapter 4 outlines the content of each course which is based on collected information from EU educational institutes and partner organizations as well as the leaning outcomes, teaching hours and accreditation points for each course; the final courses will be used in the development of the educational program and will be detailed in Deliverable 2.3.

The designed curricula will be further developed based on target groups’ feedback and the courses’ final contents will be depicted in the subsequent deliverable D2.2.

2 Methodology and implementation

2.1 Methodological approach

As presented above, Deliverable 2.2 focuses on the development of a research, educational and training program in Latvia and the region. Towards this direction, the formulation of the curricula and subjects relies on three activities:

- Identification of good practices in research, education and training in the domain.
- Existing research, educational and training programs offered at research and educational institutes at EU level will be reviewed.
- An extensive survey will be designed and conducted with institutes, which are active in providing specialized knowledge on intermodal transportation, terminals and logistics, in regards to planning and operation (surveys, etc.)

Combining outcomes of the previous three activities and of D2.1, a first set of curricula will be drafted. These curricula will include:

1. Educational and training program to be implemented during the life cycle of the project. This program will be addressed to students attending Master's and PhD courses in programs offered at TTI, on "Transport Economics and Management", "Transport and Logistics" and "Telematics and Logistics".
2. Long-life-educational (LLE) program, addressed to University graduates who practice their profession in the transportation industry, thus work for an authority, SME, or other organization (Trans-logistics Educational forum).

Although, the core of the programs will be the same, the LLE program will be adjusted to meet the needs of transport.

The methodological approach adopted in the context of Deliverable 2.2 comprises of two parts, as follows:

1. Identification of educational areas. Based on the identified educational requirements for Latvia and the region that were the outcome of the two-level gap analysis in D2.1, 20 educational areas were created for passenger and freight transport interchanges given the available resources that were provided by the ALLIANCE partners and the EU experience. These educational areas will provide the foundation for subsequent tasks in ALLIANCE, namely the detailed presentation of course material in smart solutions for interconnecting transportation networks.

2. Conversion to courses. The 20 educational areas that are identified in Step 1 are combined based on their content (where applicable) to shape 12 courses for passenger and freight transport interchanges. These are the 12 courses that are going to be used for training and education in Latvia.

2.2 Implementation of the selected method

In D2.1 the second-level gap analysis converted practice related requirements for passenger and freight transport interchanges (i.e., level-one gap analysis) into educational gaps and requirements for passenger and freight transport interchanges (i.e., level-two gap analysis). Table 2.1 summarizes the educational requirements for Latvia and the region per thematic area

and topic for passenger and freight transport interchanges. Based on the findings in Table 2.1, the requirements per thematic area and topic are linked with an educational area. The educational areas are identified based on:

- Gap analysis II requirements
- Existing research, educational and training programs offered at research and educational institutes at EU level.

In total, 20 educational areas are identified for passenger and freight interchanges and are presented Table 2.1.

Table 2.1: Educational requirements for Latvia and the region (GAP analysis II)

Thematic Area	Topic	Gap I	Requirement	Educational areas
Governance	Stakeholders	-	Incorporation of organizational and business models in course material.	1. Building business models for passenger transport interchanges
	Policy	Legal framework does not focus on interchanges.	Improvement of course content on transport legal frameworks with reference to EU and partial coverage of interchanges and environmental legislation. Special attention on interchanges and environmental legislation in the courses oriented on EU transport policy issues.	2. Development and implementation of sustainability and transport policies in the EU region
		Not harmonized policy for interchanges.	**Improvement of course content on transport legal frameworks with reference to EU, freight transport and environmental legislation**	3. Development and implementation of freight transport policies in the EU region
	Ownership	Limited involvement of several authorities.	Incorporation of courses oriented on public private partnerships (PPP) models and mega infrastructure financing schemes in educational and training the programme.	4. Public Private Partnerships in transport: Theory and schemes
		Limited business models development.	**Incorporation of innovative business models in course material.**	**5.** Building business models for freight transport interchanges
	Sustainable development	Limited incorporation of interchanges in regional and national development plans.	Incorporation in the programme of topics with integrated development plans with reference to sustainable development and the environment.	6. Sustainable passenger transportation planning

Thematic Area	Topic	Gap I	Requirement	Educational areas
		Limited incorporation of interchanges in regional and national development plans.	**Incorporation in the programme topics with integrated development plans with reference to sustainable development and the environment.**	7. Sustainable freight transportation planning
	Management	Interchange Management Plan not including all aspects of interchange functionalities and interests.	Development of material on integrated coordination and operation of mega infrastructure facilities with special reference to interchanges and the utilization of technological advances.	8. Operation and management of urban public transport systems
		-	**Incorporation of innovative business and management models in course material.**	**9.** Operation and management of urban freight transport systems
	Operation	Limited coordination among modes and operators.	Incorporation of transport operations education and training materials that will focus on multimodal systems.	10. Multimodal transport optimization for passenger transport (General and case studies)
		-	**Development of education material on integrated coordination and operation of mega infrastructure facilities with special reference to interchanges and the utilization of technological advances.**	11. Multimodal transport optimization for freight transport (General and case studies)
Smart solutions	Information	Limited multimodal information.	Exploration and utilization of technologies to respond to transport information based needs.	12. Information systems for passenger intermodal terminals
	Services	Limited integrating ticketing. Existing services do not offer	Development of course that integrates public transport with	13. Integrated ticketing and time table coordination

Thematic Area	Topic	Gap I	Requirement	Educational areas
		travelers real-time information across all stages of a multimodal trip Possible conflicts between vehicles and pedestrians. Not sufficient security level.	smart solutions (technology and policy oriented) and potential sustainability impacts. Incorporation in the programme topics with interchange and terminal design and planning with reference to their special characteristics and safety issues.	14. Design and safety principles of transport terminal infrastructure
	Physical properties	Limited access for all. Insufficient cycling and walking facilities. Environmental concerns vary depending on facilities' age.	Development of education materials on transport planning and design of intermodal terminals for all users to satisfy user needs and fulfill sustainability principles.	15. Passenger terminal design
	New consolidation/distribution and logistics cooperative concepts	**Individually planned urban consolidation centers.** **Limited business and transport operational planning.**	**Development training materials for case studies of planning urban consolidation centers.**	**16.** Urban freight terminals design
	Information technologies	**Limited cooperation between publicly owned and operated Intelligent Transport Systems and enterprise-level software for supply-chain management, trip planning and fleet management.**	**Study of ITS characteristics and utilization in case studies for the effective supply chain management and trip planning.**	**17. Information technologies for intermodal freight transport**
	Smart transhipment	**Limited use of alternative, friendly to environment and energy technologies.**	**Review of policies related to alternative fuels and propulsion technologies, and estimation of environmental impacts for intermodal terminals.**	**18. Smart transhipment and alternative transport fuels**

Thematic Area	Topic	Gap I	Requirement	Educational areas
Decision-making	Interchange status assessment and users' feedback	Not obligatory. Insufficient information for decision making: only few surveys, data not reliable; no network assessment at the strategic level, etc. Limited data sharing.	Development of integrated course material that will focus on assessment practices with focus on interchanges and life cycle impacts (society, environment and economy) by including users' satisfaction.	19. Risk assessment analysis, behavioural modelling, social cost benefit analysis and multi-stakeholder multi-criteria assessment
	Decision-support methods	**Limited sharing of data.**	**Incorporation of novel data collection methods and exploitation of big data opportunities in decision making and analytics of freight transport.**	**20. Innovative data collection methods to support decision making**

Note: Grey hatched cells are freight based.

Following the identification of the 20 proposed educational areas, these are combined in 12 passenger and freight related courses on transport interchanges as shown in Figure 2.1. These are grouped in thematic areas as follows:

1. Governance

C1. The European policy on intermodal transport
C2. Building business models for intermodal transport interchanges
C3. Sustainable development and transportation planning
C4. Operation and management of intermodal transport systems
C5. Optimization of intermodal transport systems

2. Smart Solutions

C6. Smart solutions for passenger transport interchanges
C7. Smart solutions for freight transport interchanges
C8. Design of passenger transport interchanges
C9. Design of freight transport interchanges
C10. Smart equipment for freight transhipment

3. Decision making

C11. Decision making methodologies
C12. Data collection methods

These 12 courses compose the core curriculum of the Sustainable Transport Interchange Program (STIP). Following the requirements for the Latvia and the region two curricula are going to be further developed:

1. Educational and training program to be implemented during the life cycle of the project. This program will be addressed to students attending Master's and PhD courses in one of the two programs offered at TTI, on "Transport Economics and Management" and "Transport and Logistics".
2. Long-life-educational (LLE) program, addressed to University graduates who practice their profession in the transport industry, thus work for an authority, SME, or other organization (Trans-logistics Educational forum).

Lifelong learning may considered as a program that aims at attracting a more adult population, while the content may not differ from regular provision. However, higher education institutions may sometimes develop program to respond to the needs of non-traditional learners (EC 2015). The ALLIANCE project in order to respond to different requirements set by the two proposed curricula, changes in their content will be considered by providing more or less scientific background.

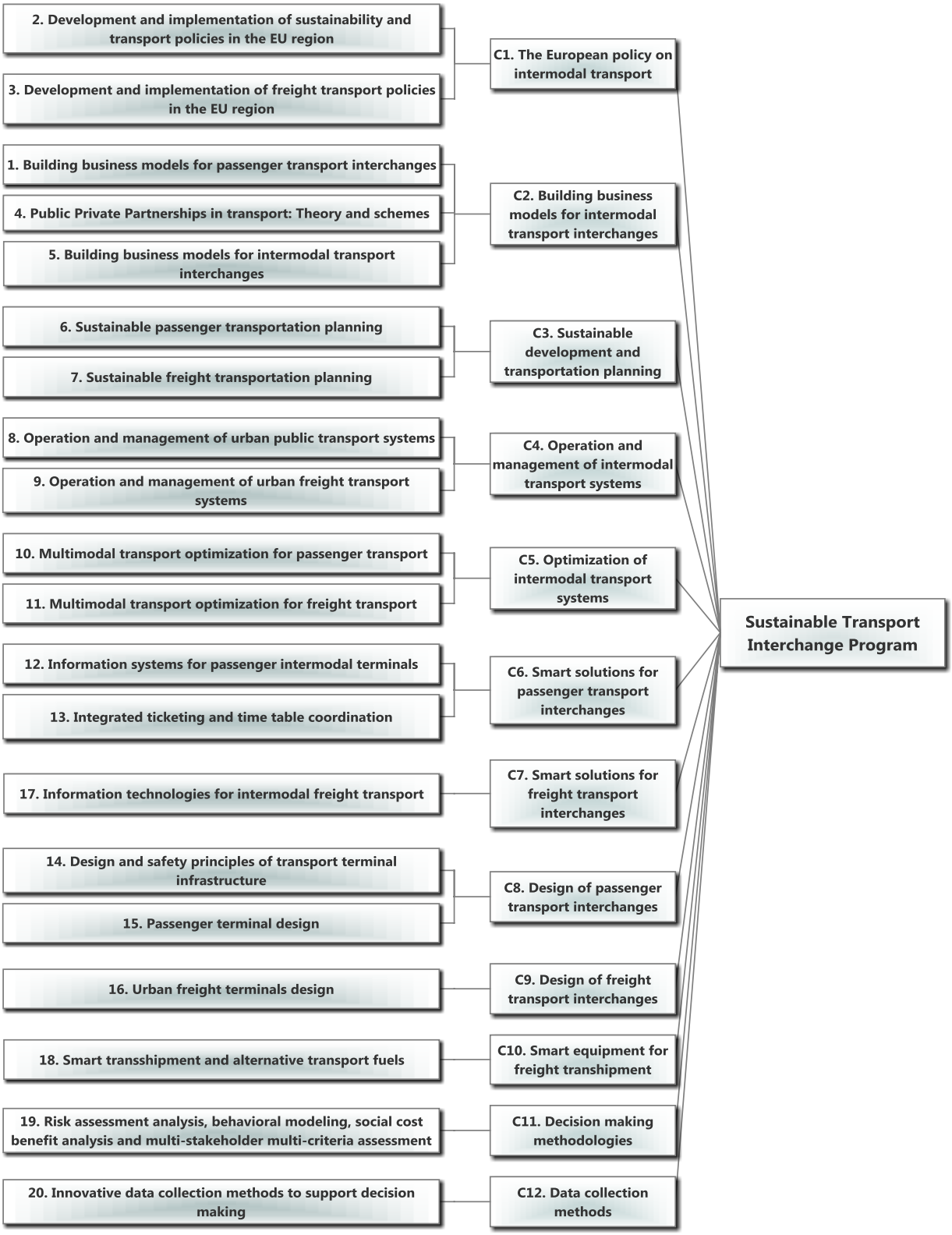

Figure 2.1 Combination of educational areas and resulting courses

3 CURRICULUM

3.1 Sustainable Transport Interchange Program

The Transport and Telecommunication Institute – TTI with two internationally recognized research entities – University of Thessaly – UTH, Greece and Fraunhofer Institute for Factory Operation and Automation – Fraunhofer, Germany develop an advanced research and higher education program in the field of smart interconnecting sustainable transport networks in Latvia capable of capturing the needs of interconnecting transportation networks and the research, educational and training requirements in Latvia and the region and complying with future infrastructural development in Latvia and the region. The developed program aims to strengthen the scientific and technological capacity of Latvia and build the grounds for a common understanding of the main components affecting sustainable intermodality and support the selection of the most optimal and applicable solutions for transport interchanges. It will facilitate stakeholder collaboration and the development of strong linkage among education, research and industry and it will also assist graduates to develop the skills that are required in the complex profession of transport intermodality. While this program is developed for graduates students who attend either program at TTI "Transport Economics and Management" and "Transport and Logistics" it may be attended by other PhD students who did not graduate from these master programs.

3.2 Program Objectives

The program research, training and education objectives relate to the short term goal (within five years period) that its graduates expect to gain after fulfilling the requirement of the program. The educational objectives of the program are:

1. For graduates to develop essential skills on transportation intermodality and establish the engineering profile that is needed to address issues in society, environment, and economy.
2. For graduates to advance their careers to a higher position of responsibility by acquiring professional judgement and critical thinking of every day transport related problems.
3. For PhD students to become familiar with methods and tools that are prerequisites to fulfil their program and have not covered in previous earned degrees or are required in the development of their thesis.

3.3 Program Outcomes

Learning outcomes or competences gained specify what students will learn and what skills they will develop and are strongly linked with the courses and consequently with the objectives of the transport program (ALLIANCE 2016). For these, the ALLIANCE has adopted the 8 outcomes specified by the European Network for Engineering Accreditation (ENAEE 2015). The Programme Outcomes specified by ENAEE are intended to be applicable to the full range of Master degree programs in engineering offered in European Higher European Institute's (HEI). They have to be considered as the 'minimum threshold' defined by the ENAEE community and to be fulfilled in order to assure the quality of engineering programs. These are:

1. *Knowledge and understanding*

The learning process should enable Master Degree graduates to demonstrate:

- in-depth knowledge and understanding of mathematics and sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes;
- in-depth knowledge and understanding of engineering disciplines underlying their specialisation, at a level necessary to achieve the other programme outcomes;
- critical awareness of the forefront of their specialisation;
- critical awareness of the wider multidisciplinary context of engineering and of knowledge issues at the interface between different fields.

2. *Engineering analysis*

The learning process should enable Master Degree graduates to demonstrate:

- ability to analyse new and complex engineering products, processes and systems within broader or multidisciplinary contexts; to select and apply the most appropriate and relevant methods from established analytical, computational and experimental methods or new and innovative methods; to critically interpret the outcomes of such analyses;
- ability to conceptualise engineering products, processes and systems;
- ability to identify, formulate and solve unfamiliar complex engineering problems that are incompletely defined, have competing specifications, may involve considerations from outside their field of study and non-technical – societal, health and safety, environmental, economic and industrial – constraints; to select and apply the most appropriate and relevant methods from established analytical, computational and experimental methods or new and innovative methods in problem solving;
- ability to identify, formulate and solve complex problems in new and emerging areas of their specialisation.

3. *Engineering design*

The learning process should enable Master Degree graduates to demonstrate:

- ability to develop, to design new and complex products (devices, artefacts, etc.), processes and systems, with specifications incompletely defined and/or competing, that require integration of knowledge from different fields and non-technical - societal, health and safety, environmental, economic and industrial commercial – constraints; to select and apply the most appropriate and relevant design methodologies or to use creativity to develop new and original design methodologies;
- ability to design using knowledge and understanding at the forefront of their engineering specialisation.

4. *Investigations*

The learning process should enable Master Degree graduates to demonstrate:

- ability to identify, locate and obtain required data;
- ability to conduct searches of literature, to consult and critically use databases and other sources of information, to carry out simulation in order to pursue detailed investigations and research of complex technical issues;
- ability to consult and apply codes of practice and safety regulations;
- advanced laboratory/workshop skills and ability to design and conduct experimental investigations, critically evaluate data and draw conclusions;

- ability to investigate the application of new and emerging technologies at the forefront of their engineering specialisation.

5. *Engineering practice*

The learning process should enable Master Degree graduates to demonstrate:

- comprehensive understanding of applicable techniques and methods of analysis, design and investigation and of their limitations;
- practical skills, including the use of computer tools, for solving complex problems, realising complex engineering design, designing and conducting complex investigations;
- comprehensive understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations;
- ability to apply norms of engineering practice;
- knowledge and understanding of the non-technical – societal, health and safety, environmental, economic and industrial - implications of engineering practice;
- critical awareness of economic, organisational and managerial issues (such as project management, risk and change management).

6. *Making judgements*

The learning process should enable Master Degree graduates to demonstrate:

- ability to integrate knowledge and handle complexity, to formulate judgements with incomplete or limited information, that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgement;
- ability to manage complex technical or professional activities or projects that can require new strategic approaches, taking responsibility for decision making.

7. *Communication and team-working*

The learning process should enable Master Degree graduates to demonstrate:

- ability to use diverse methods to communicate clearly and unambiguously their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences in national and international contexts;
- ability to function effectively in national and international contexts, as a member or leader of a team, that may be composed of different disciplines and levels, and that may use virtual communication tools.

8. *Lifelong Learning*

The learning process should enable Master Degree graduates to demonstrate:

- ability to engage in independent life-long learning;
- ability to undertake further study autonomously.

3.4 Organization of Sustainable Transport Interchange Program

The STIP is going to be elaborated and organized as a summer course, lasting one intensive week. Specific material will be also developed for the train-the-trainers session, which will transfer knowledge to TTI's staff on the topics, and involve them in the teaching activities during the summer schools. A preliminary course schedule presenting hours and the responsible institute per course is shown in Table 3.1. Courses are presented in detail in Chapter 4.

Table 3.1 Preliminary course schedule

<table>
<tr><th>Time</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th></tr>
<tr><td>9:00-10:00</td><td>C1 - UTH</td><td rowspan="3">C4 - UTH</td><td rowspan="3">C8 - UTH</td><td rowspan="3">C11 - UTH</td><td rowspan="2">C6 - Fraunhofer</td></tr>
<tr><td>10:00-11:00</td><td rowspan="2">C2 - Fraunhofer</td></tr>
<tr><td>11:00-12:00</td><td rowspan="2">C7 - Fraunhofer</td></tr>
<tr><td>12:00-13:00</td><td rowspan="3">C3 - UTH</td><td rowspan="3">C5 -UTH</td><td rowspan="3">C9 - UTH</td><td rowspan="3">C12 - Fraunhofer/UTH</td></tr>
<tr><td>13:00-14:00</td><td rowspan="2">C10 - Fraunhofer</td></tr>
<tr><td>14:00-15:00</td></tr>
<tr><td>15:00-16:00</td><td>C0</td><td rowspan="2">Project time</td><td rowspan="2">Project time</td><td rowspan="2">Project time</td><td rowspan="2">Project time</td></tr>
<tr><td>16:00-17:00</td><td rowspan="2">Project time</td></tr>
<tr><td>17:00-18:00</td><td></td><td></td><td></td><td></td></tr>
</table>

The teaching material will include PowerPoint theoretical presentations, educational videos from real world applications and on-site visits, as well as homework, gaming quiz or puzzle games in order to raise awareness of the audience. Also, digital training, e-learning and webinars via open access internet platforms. The organization of the programme and layout of the joint summer school type activities will be elaborated by TTI's personnel as it is going to take place at their premises, but always in collaboration with the other two institutes' staff who will be the main providers of the teaching material, knowledge and know-how.

As mentioned above, the educational program is addressed mostly to TTI's training staff, professors and students. However, this does not exclude any SMEs' personnel from participating in the educational and training course activities. On the contrary, the courses will be available and free of charge to all TTI's collaborative bodies and companies originated in the domain of passenger and freight transport, just like open post graduate university courses, in the form of life-long education and training. This will enable both amateurs and professionals to take the course while also bringing together theory and practice, bridging the gap amongst university and SMEs (Small and Medium-sized Enterprises), providing a more integrated approach and establishing new collaborative schemes. In addition, through the dissemination actions, there will be an attempt to get in contact with staff from SMEs originated in the field of passenger and freight transport, such as operators, drivers' associations, shipping companies, logistics service providers and local authorities. This may contribute both to the broadening of the staff's knowledge and expertise, while also setting the base for the establishment of new communication and collaboration channels between research and market towards more integrated business schemes.

3.5 Program Evaluation

The STIP will be followed by an analytic examination process at the end of the week that will take place at TTI's premises with the participation of all students in order to assess the degree of knowledge transfer and understanding.

Trainees are expected to actively participate in a project-teamwork throughout the duration of the project; the resulting technical report will be submitted and presented upon completion of STIP. For the project formulation, trainees will be guided by the advisor and they will deal with almost all topics included in the program. Each team will have a designated advisor to lead them.

Students will be evaluated by two trainers from the research intensive institutes' staff and one member of TTI in order to guarantee meritocracy. Passing the exams, the students will be granted 6 ECTS for the program.

3.6 Train the Trainers Seminar

The train-the-trainer seminar will take place prior to STIP and will be held only one time. During this seminar all twelve courses will be presented in summary by each responsible Institute within 20 minutes to disclose the syllabus that is going to be presented in detail during the duration of the STIP. A preliminary train-the-trainer seminar schedule is shown in Table 3.2.

Table 3.2 Preliminary train-the-trainer seminar schedule

Time	Topic	Responsible
10:00 -10:45	Good practices of research, educational and training programs on smart solutions for the interconnection of transportation networks in EU.	UTH
10:45 -11:15	Good practices of research, educational and training programs on smart solutions for the interconnection of transportation networks in BSR.	TTI
11:15 -11:45	Review of the gap and developed in frame of project study programme particularities and characteristics	UTH
Courses detailed presentation		
12:00 – 12:20	C1. The European policy on intermodal transport	UTH
12:20 – 12:40	C2. Building business models for intermodal transport interchanges	Fraunhofer
12:40 – 13:00	C3. Sustainable development and transportation planning	UTH
14:00 – 14:20	C4. Operation and management of intermodal transport systems	UTH
14:20 – 14:40	C5. Optimization of intermodal transport systems	UTH
14:40 – 15:00	C6. Smart solutions for passenger transport interchanges	Fraunhofer
15:00 – 15:20	C7. Smart solutions for freight transport interchanges	Fraunhofer
15:20 – 15:40	C8. Design of passenger transport interchanges	UTH
15:40 – 16:00	C9. Design of freight transport interchanges	UTH
16:30 – 16:50	C10. Smart equipment for freight transhipment	Fraunhofer
16:50 – 17:10	C11. Decision making methodologies	UTH
17:10 – 17:30	C12. Data collection methods	Fraunhofer/ UTH

In forthcoming years there will be a trainers' conference, where potential issues that might have occurred from the implementation of the STIP will be addressed, as well as advancements in the

domain of intermodal terminals will be presented and discussed to be included in the curriculum. The outcome will be the dissemination of knowledge, the networking of the involved partners' personnel and the development of a clear ground for joint research activities and collaboration in the near future. A workshop will be also adapted and offered by Fraunhofer to ALLIANCE trainees, on international logistics, during the first year, within the context of the yearly offered seminars by the Institute.

4 Sustainable Transport Interchange Program Courses

This section presents the courses that will compose the core of the STIP in the form of tables. The 12 selected transport related courses have been designed and the information collected from the process has been inserted in the following tables. For presentation reasons, four important fields are presented to reveal the transport courses' aim, learning outcome, assigned hours, responsible institute, proposed syllabus, bibliography and teaching methods.

Course # C0	
Title	**Workshop: Research methodology and teamwork setup**
Thematic area	**NA**
Aim	• Present techniques of conducting literature review • Guide how to use databases, search engines and electronic libraries • Explain how to write a scientific report • Explain how to prepare and present research work • Organize teams for conducting the summer school project
Learning outcomes	
• Look into databases, search engines and electronic libraries to retrieve information about a topic • Organize a scientific report • Conduct state-of-the-art • Document methodology and results • Work as a team member	
Prerequisites (if any)	
Language	English
Hours	1
Responsible personnel/institute	TTI

<table>
<tr><td>Syllabus</td><td colspan="2">Box 1: Course topics
1. Research process
2. Literature review
3. Quantitative research
4. Research dissemination
• Dissertation
• Research publication
• Poster
• Presentation
• Scientific report
• Oral
5. Citations and references
6. Ethics and Plagiarism
7. Comfort and ergonomy</td></tr>
<tr><td>Bibliography</td><td colspan="2">• The Writing Lab & The OWL at Purdue and Purdue University (1995-2011)
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<tr><td rowspan="6">Teaching methods</td><td>Lectures</td><td>☒</td></tr>
<tr><td>Demonstrations</td><td>☐</td></tr>
<tr><td>Hands on/gaming</td><td>☐</td></tr>
<tr><td>Exercises</td><td>☐</td></tr>
<tr><td>Visits at facilities</td><td>☐</td></tr>
<tr><td>Other (please describe):</td><td>☐</td></tr>
</table>

Course # C1

Title	**The European policy on intermodal transport**
Thematic area	**Governance**
Aim	• Present and analyse the basic concepts on intermodality. • Identify stakeholders that play an important role in intermodal transport, pinpoint their competences and distribute the tasks that each one realizes in the domain, by revealing overlaps or complementarities. • Review the European legislation and policies in terms of transport modes (road, rail, waterborne, air), transport system environment, intermodality and financing. • Review, analyse and assess the planning and financing schemes developed in the European Union addressing intermodal transport. • Identify collaborative practices that can formulate a coherent decision-making framework in the domain of sustainable passenger and freight transport interchanges.
Learning outcomes	
• Provide an understanding of the basic concepts on intermodal transport, including: intermodality, passenger and freight urban interchanges, long-short distance interconnection, urban/interurban interconnection • Possess an understanding of the complexity of decision making processes, mainly addressed by the involvement of several entities and the conflict of interests of the involved stakeholders • Acquire theoretical knowledge of the European Union's policies and legislation on intermodality • Ensure that students are capable of investigating and identifying key drivers that provide coherence in the regulatory framework and the planning and financing schemes affecting intermodality within decision-making.	
Prerequisites (if any)	
-	
Language	English
Hours	1
Responsible personnel/institute	University of Thessaly
Syllabus	This course introduces the basic concepts that are met in intermodal transport, such as intermodality, urban passenger and freight transport interchanges, long-short distance interconnection and urban/interurban interconnection. The main focus of the course is to present the European policies and legislation on intermodality, to identify the degree of flexibility provided by EU legal instruments, to illustrate how this flexibility is adopted by representative European countries, e.g. Spain, France, Norway, Finland, Czech Republic and Greece, and to investigate the role that other regulatory actors may have. Also, it analyses the complexity of the decision-making processes followed in intermodal transport, mainly affected by the involvement of different entities in all stages and the absence of a strict hierarchical flow chart of responsibilities, resulting to complicated procedures.

	Box 1: Course topics • Basic concepts on intermodality • Defining obstacles and problems on intermodal transport • Stakeholders and distribution of competences in the decision-making framework • European institutional framework and legislation • European Union policies • National institutional frameworks and legislation • Planning and financing schemes affecting intermodality within decision-making.	
Bibliography	• Adamos, G., Tsami, M. & Nathanail, E., 2015. "Urban interchanges: Moving towards a seamless transportation solution". 5th International Conference on Environmental Management, Engineering, Planning and Economics (CEMEPE) and SECOTOX Conference. Mykonos Island, Greece, June 14-18, 2015. • Adamos, G. & Nathanail, E., 2013. "Recommendations on the development and implementation of a coherent decision making process in the short-long transport interconnection". 13th World Conference on Transport Research, Rio de Janeiro, Brazil, July 15-18, 2013. • Adamos, G., Nathanail, E. & Zacharaki, E., 2012. "Developing a Decision-Making Framework for collaborative practices in long-short distance transport interconnection". Procedia – Social and Behavioral Sciences, Volume 48, 2012, Pages 2849-2859. • CLOSER, 2011. CLOSER Deliverable D4.1. Analysis of the decision-making framework. CLOSER Project. • CLOSER, 2012. CLOSER Deliverable D4.2. Policy Advisory Group recommendations. CLOSER Project. • European Commission (2001). White Paper " European transport policy for 2010: Time to decide (CEC, 2001). • European Commission (2004): Towards passenger intermodality in the European Union. Brussels. • European Commission (2006). Keep Europe Moving. Sustainable mobility for our continent. Mid-term review of the European Commission's 2001 transport White Paper. ISBN 92-79-02312-8. Luxemburg: Office for Official Publications of the European Communities, 2006. • European Commission, 2007. "GREEN PAPER - Towards a new culture for urban mobility", Brussels, 25.9.2007 COM (2007) 551 final. • European Commission (2011). Roadmap to a Single European Transport Arena –Towards a competitive and resource efficient transport system. White Paper of the European Commission. COM (2011) 144 final. • Nathanail E. & Adamos, G. 2013. "Planning and financing schemes linked to the decision-making for the interconnection of long-short distance transport". Transport and Telecommunication. Volume 14, Issue 1, Pages 20–28, ISSN (Online) 1407-6179, ISSN (Print) 1407-6160, DOI: 10.2478/ttj-2013-000, February 2013.	
Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☐

	Exercises	☐
	Visits at facilities	☐
	Other (please describe):	☐

<table>
<tr><th colspan="2">Course # C2</th></tr>
<tr><td>Title</td><td>Building business models for intermodal transport interchanges</td></tr>
<tr><td>Thematic area</td><td>Governance</td></tr>
<tr><td>Aim</td><td>• Present the main collaborative schemes of intermodal transport interchanges
• Identify stakeholders, roles and interactions
• Build the frame for quantitative and qualitative analysis
• Guide investigation of viability of schemes
• Assist in developing conditions for successful implementation</td></tr>
<tr><td colspan="2">Learning outcomes</td></tr>
<tr><td colspan="2">• Draw the necessary bodies for the successful operation of intermodal transport interchanges and identify their roles and interactions
• Analyse the operational impacts of the interchanges
• Assess collaborative schemes viability
• Develop guidance for successful implementation of collaborative schemes</td></tr>
<tr><td colspan="2">Prerequisites (if any)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Hours</td><td>2</td></tr>
<tr><td>Responsible personnel/institute</td><td>Fraunhofer / University of Magdeburg</td></tr>
<tr><td>Syllabus</td><td>The interchanges will be analysed in terms of passenger and freight transportation nodes. The typology will be specified as formulated by the geospatial location of the node, the modes that it accommodates, the area that it covers and the services that it offers. The development stages will be described, in the sense of planning, design, construction, operation, maintenance, management, exploitation. For each of the stages, the respective models will be explained, describing the stakeholders involved, the roles and interactions. The organizational schemes will be specified and the governance models will be drawn. The financing schemes for establishing and operating the interchanges will be highlighted and the possibilities for using alternative sources. Viability analysis techniques will incorporate quantitative and qualitative analyses. The drafting of designated guidance to be formulated based on the viability results will be explained.

Box 1: Course topics
• Transportation Interchanges typology
• Stakeholder categorization
• Organizational models
• Management models
• Operational models
• Financial schemes
• Viability analysis
• Consensus building</td></tr>
</table>

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Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☒
	Exercises	☐
	Visits at facilities	☐
	Other (please describe):	☐

Course # C3	
Title	**Sustainable development and transportation planning**
Thematic area	**Governance**
Aim	The course aims to provide an understanding of transportation planning at a National, regional and local context through outlining transport strategies, policies and smarter choices for increasing sustainability. Methods and approaches for analysing intermodal transport and sustainable transport interchanges are presented, such as scenarios, forecasting, environmental impact and safety analysis and strategic environmental assessment. The course will provide knowledge on planning and operations of intermodal transport systems and their analysis and evaluation through various measures of performance.
Learning outcomes	
• Implement the basic concepts of transportation modelling, scenario development and forecasting • Identify the challenges and elements for creating sustainable transport systems • Develop relevant policy measures, strategies and select smart solutions to address transport oriented problems • Account for sustainability indicators, implement indicators to different transport systems and compare scenarios with present transport systems • Identify different stakeholder groups and factors influencing transport development • Embed environmental impact and safety assessment approach of transport interchanges	
Prerequisites (if any)	
Language	English
Hours	3
Responsible personnel/institute	University of Thessaly
Syllabus	This course will focus on integrated development plans with reference to sustainable development and the environment. During the entire course attention is paid to a sustainable development of the transport interchanges both passenger and freight in the European Union. First the course will present essential transportation forecasting methodologies that are used at EU level and the importance of forecasting towards estimating transport impacts and successfully delivering transport plans. The components which affect traveling and transportation system performance will be identified. The sustainability principles will be covered. Sustainability Urban Mobility Plans and Sustainability Urban Logistics Plans will be analysed. Indicators being estimated by impact assessment of transportation interchanges will be discussed and explained. Students will get exposed to software packages dealing with transportation planning and impact assessment.

	Box 1: Course topics • Transportation planning principles and forecasting methodologies • Elements of Travel planning and influencing travel decisions • Delivering transport plans (incentives for smarter travel) • Integration of smart solutions in sustainable transport planning • Transport impacts • Sustainability concepts, visions of sustainable transport systems and assessment of the present situation (performance indicators) • The potential for technological development in transport and infrastructure systems in relation to various energy futures. • Sustainable urban development and mobility plans. • Environmental impacts assessment (EIA).
Bibliography	• Cascetta (2009). *Transportation System Analysis: models and applications.* 2nd edition. Springer. • Trip generation, Institute of Transportation Engineers ITE, 2000. • R. Stopher, and A. H. Meyburg, Urban Transportation Modeling and Planning, Lexington Books, 1975. • B. G. Hutchinson, Principles of Urban Transport Systems Planning, McGraw Hill, 1974. • J. de D. Ortuzar, and L. G. Willumsen, Modelling Transport, J. Wiley & Sons, 2002 • N. Oppenheim, Urban Travel Demand Modeling, J. Wiley & Sons, 1995. • Travel Behaviour Research, The International Association for Travel Behaviour, 1987. • Richardson, E. Ampt, and A. Meyburg, Survey Methods for Transport Planning, Eucalyptus Press, 1995. • Stopher P. and M.Lee-Gosselin, Understanding travel behaviour in an era of change, Pergamon, 1997. • Denos C. Gazis, Traffic Theory, Kluwer Academic Publishers, 2002. • Hensher D.A., Button K.J., Handbook of Transport Modelling, Pergamon, 2000. • Moshe E. Ben-Akiva, Steven R. Lerman - 1985 Discrete Choice Analysis: Theory and Application to Travel Demand, The MIT Press.
Teaching methods	Lectures ☒ Demonstrations ☐ Hands on/gaming ☐ Exercises ☐ Visits at facilities ☐ Other (please describe): ☐

<table>
<tr><th colspan="2">Course # C4</th></tr>
<tr><td>Title</td><td>Operation and management of intermodal transport systems</td></tr>
<tr><td>Thematic area</td><td>Governance</td></tr>
<tr><td>Aim</td><td>• This course is oriented to the operation and management of passenger and freight interchanges.
• It analyses the organization of interchanges regarding operational functionality, ownership and financing schemes, management and efficiency of services.
• The impacts of the interchanges operation on local economy and land use planning are also addressed.</td></tr>
<tr><td colspan="2">Learning outcomes</td></tr>
<tr><td colspan="2">• Provide an understanding of how stakeholder engagement and management works
• Conduct an operational and ownership analysis, with the use of integrated management, ownership and operation models, which are based on practice from several European countries and case studies
• Recognize and assess implications revealing from different regulatory and industrial ownership structures
• Analyse the impacts of interchanges on local economy and the role they have in land use planning, in terms of revenues for local enterprises, new start-up businesses, new jobs, etc.
• Learn how to draft an interchange management plan.</td></tr>
<tr><td colspan="2">Prerequisites (if any)</td></tr>
<tr><td colspan="2">Courses C1, C3</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Hours</td><td>3</td></tr>
<tr><td>Responsible personnel/institute</td><td>University of Thessaly</td></tr>
<tr><td>Syllabus</td><td>The course analyses the involvement of stakeholders and stakes, and respective questions are answered, such as: “Why, when and which stakeholders to involve?”, “What is public involvement, and what kind of public should be involved within the interchange decision-making process”, etc.
In addition, the course analyses the organization of interchanges in terms of operational functionality, management, practicalities, services and efficiency, while the impacts on local economy and land use planning are also introduced.
Box 1: Course topics
• Stakeholder engagement and management
• Regulatory and ownership structures
• Operational structures
• Management structures
• The role of urban interchanges in urban planning
• Urban economic impacts
• Interaction between interchanges and cities
• Integrated management plan</td></tr>
</table>

Bibliography	• Ballis, A. (2004). Introducing Level Of Service Standards for Intermodal Freight Terminals. Transportation Research Record: Journal of the Transportation Research Board, Vol 1873, Washington DC, pp. 79-88. • Banister, D. & Berechman, Y., 2001. Transport investement and the promotion of economic growth. Journal of Transport Geography, 9(2001) 209-218. • Bask, A. 1999. Third Party Relationships in Logistics Services, Helsinki School of Economics and Business Administration, Licentiate Thesis, Helsinki. 140 p. • City-HUB, 2013. City-HUB Deliverable D4.1. Integrated management of efficient urban interchanges. • City-HUB, 2015. City-HUB Deliverable D5.2. City-HUB Handbook. • European Commission, 2001. White Paper " European transport policy for 2010: Time to decide (CEC, 2001). • European Commission, 2006. Keep Europe Moving. Sustainable mobility for our continent. Mid-term review of the European Commission's 2001 transport White Paper. ISBN 92-79-02312-8. Luxemburg: Office for Official Publications of the European Communities, 2006. • European Communities, 2009. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Action Plan of Urban Mobility. COM (2009) 490 final. Brussels, Belgium. • European Commission, 2011. Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. White Paper. COM (2011) 144 final. European Commission. Brussels, Belgium. • GUIDE (2000) Terzis, G., Last, An. GUIDE – Urban Interchanges – A Good Practice Guide – Final Report prepared for EC DG VII. April, 2000. • Grotenhuis, J.W., W.W. Bart and P. Rietveld (2007). "The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort saving". Transport Policy, Vol. 14, pp. 27-38. • IMONODE (2005). WP3: Supply side – Intermodal network analysis. IMONODE – Efficient Integration of Cargo Transport Modes & Nodes in CADSES area. • PIRATE project, 2001. Final report. Accessed by http://www.transport-research.info/web/projects/project_details.cfm?ID=593 on 11/03/2013.	
Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☐
	Exercises	☐
	Visits at facilities	☐
	Other (please describe): Case study	☒

Course # C5	
Title	**Optimization of intermodal transport systems**
Thematic area	**Governance**
Aim	The aim of this course is to introduce students with the principle of optimization, and the mathematical models that are built to facilitate decisions, in the context of reaching the optimum taking into account applying restrictions.
Learning outcomes	
• Identifying variables and relationships that govern in an optimization problem. • Develop mathematical formulations that take into account the optimization of the objective function, safeguarding the satisfaction of constraints and limitations. • Use computer programs that solve optimization problems.	
Prerequisites (if any)	
Language	English
Hours	3
Responsible personnel/institute	University of Thessaly
Syllabus	The course identifies the components that formulate a problem and the decision variables that need to be estimated for its solution. Firstly, it introduces the student to the network structure of the problem, and the conversion in mathematical terms of the decision variables and the constraints that apply. It presents the concept of linear programming, and the alternative ways to formulate an optimization problem (e.g. p-median, p-center, uncapacitated, etc.), depending on the variables to be defined by the analyst. The linear programming technique is explained in depth and presented through the solution of examples. A more specific category of linear programming, integer linear programming is also studied. In this case, the variables may only obtain integer values, which restricts the number of possible solutions. Finally, the transportation problem is described and solved, as well as other specific applications that deal with vehicle routing, resource allocation and facility location. **Box 1: Course topics** • Introduction to operational research • Network formulation • Linear programming • Integer linear programming • Transportation problems
Bibliography	• Bertsimas DJ, Jaillet P, Odoni AR, “A priori optimization”, Operations research 38/1, 1019 – 1033, 1990 • Bodin LD, Golden BL, Assad AA, Ball MO, “Routing & scheduling of vehicles and crews: The state of the art”, Computers and Operations Research, 10/2, 63-211, 1983 • Christofides N, Mingozzi A, Toth P, “The vehicle routing problem”, in

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Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☐
	Exercises	☐
	Visits at facilities	☐
	Other (please describe):	☐

Course # C6	
Title	**Smart solutions for passenger transport interchanges**
Thematic area	**Smart Solutions**
Aim	• Give a technology and trend overview adressing intelligent services for passenger transport • Define the role of ITS, applications and services that could be delivered and the underlying technologies utilised by these • Assess how intelligent solutions can be used to address passenger transport problems
Learning outcomes	
• Understand the basic building blocks and techniques used in the delivery of ITS systems and services • Understand the applications and services that could be delivered and the underlying technologies utilised by these • Evaluate technologies, applications and services • Understand the effects of implementing such applications and demonstrate the application of techniques	
Prerequisites (if any)	
Language	English
Hours	2
Responsible personnel/institute	Fraunhofer IFF/ University of Magdeburg
Syllabus	The course includes an introduction to ITS, analyses the various architectures (European, American, Japanese) and compares their similarities and particularities. It explains the main components of intelligent passenger transportation, and it focuses on systems related to facilitate users of intermodal transportation terminals. It puts ITS into the European policy context, based on white papers, directives, and others that shape the development/ deployment of Intelligent Systems and Services. It focuses on explaining the fundamental principles of the integrating ticketing system, passenger information services and timetable coordination among transport operators. It explains the technologies deployed and demonstrates their impacts through case studies.

	Box 1: Course topics • ITS Architecture for transportation (Traffic Management and Mobility Services: Real time data, data management, signalling enforcement, sensors managed Motorways/congestion charge/SCOOT+dynamic UTC) • Location based services: route guidance, navigation, positioning, mapping, etc. • Public Transport and demand responsive systems • Trip sharing concept and systems • Multimodal information • Smart Ticketing • Time table coordination • Passenger terminal information systems and smart services • Open Data and Big Data – Big Challenges for Application in Transport
Bibliography	• UITP, Information Technology and Innovation Commission. Accessed from www.uitp.org/Public-Transport/technology (2014) • Potential Needs for Standardisation of Urban ITS - Europa.eu (2016) http://ec.europa.eu/transport/themes/its/road/action_plan/doc/2013-urban-its-expert_group-report-on-standardisation-needs.pdf • Ambrosino, G., Boero, M., Nelson, J., Romanazzo, M. (2010) *Infomobility systems and sustainable transport services*. Italian National Agency for New Technologies, Energy and Sustainable Economic Development: ENEA. 336 p. • Kotsakis, E., Caignault, A., Woehler, W., Ketselidis, M.: Integrating Differential GPS data into an Embedded GIS and its Application to Infomobility and Navigation. In: 7th EC-GI & GIS Workshop, Managing the Mosaic, Potsdam, Germany (2001) • Paganelli F., Giuli D.: An Evaluation of Context Aware Infomobility Systems, Context-Aware Mobile and Ubiquitous Computing for Enhanced Usability, Cap. 15 (2009) • Giuli, D., Paganelli, F., Cuomo, S., Cianchi, P.: A systemic and cooperative approach towards an integrated infomobility system at regional scale. In ITS Telecommunications 11th International Conference, pp.547 -553. IEEE (2011) • Arena, M., Azzone, G., Franchi, F., Malpezzi, S.: An Integrated Framework for Infomobility. In: Third International Engineering Systems Symposium, CESUN 2012, Delft University of Technology (2012) • Sterle, C.: Location-Routing models and methods for Freight Distribution and Infomobility in City Logistics, PhD Thesis, Università degli Studi di Napoli 'Federico II' (2009) • Canali, C., Lancellotti, R.: A distributed architecture to support infomobility services, ACM Digital library (2006) • POLITE Project, http://www.polite-project.eu/polite-project • eMOTION project, http://www.emotion-project.eu • Rits-Net project http://www.rits-net.eu/ • Yatskiv I., Kopytov E., Casellato D., Giuseppe L. and R. McDonald (2013). Benchmarking and Assessment of Good Practices in Public Transport Information Systems. Transport and Telecommunication, Vol.14 (4) – Riga, TTI, pp. 325–336. DOI: 10.2478/ttj-2013-0028 • Yatskiv, I., Kopytov, E., Gorky, R. (2014) Application of Multi-Criteria

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<tr><td rowspan="6">Teaching methods</td><td>Lectures</td><td>☒</td></tr>
<tr><td>Demonstrations</td><td>☒</td></tr>
<tr><td>Hands on/gaming</td><td>☐</td></tr>
<tr><td>Exercises</td><td>☐</td></tr>
<tr><td>Visits at facilities</td><td>☐</td></tr>
<tr><td>Other (please describe):</td><td>☐</td></tr>
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<table>
<tr><th colspan="2">Course # C7</th></tr>
<tr><td>Title</td><td>Smart solutions for freight transport interchanges</td></tr>
<tr><td>Thematic area</td><td>Smart Solutions</td></tr>
<tr><td>Aim</td><td>The aim of this course is to introduce students with the smart solutions which are used in intermodal transportation, in regards to freight.</td></tr>
<tr><td colspan="2">Learning outcomes</td></tr>
<tr><td colspan="2">• Requirements for seamless intermodal freight transportation
• Smart solutions in regards to governance and collaborative schemes for city logistics operations, employing leading-edge technologies like tracking systems data and information sharing
• Correlation of smart solutions with specificities of the area and the expected impacts</td></tr>
<tr><td colspan="2">Prerequisites (if any)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Hours</td><td>2</td></tr>
<tr><td>Responsible personnel/institute</td><td>Fraunhofer IFF/ University of Magdeburg</td></tr>
<tr><td>Syllabus</td><td>The course focuses on how emerging technologies may support and enable seamless interconnectivity among transportation modes at intermodal terminals, make more effective cargo transfer from one mode to the other, and between the long and short distance traveling, achieve high quality service for the last mile delivery, and provide a basis for improved collaboration between the actors in the logistics network, making intermodal transport more reliable from the shipper to the end receiver.

Box 1: Course topics
• Categorization of smart solutions in freight transportation and logistics.
• Administrative schemes and incentives
• Collaborative schemes
• Urban consolidation centers
• Emerging technologies and achievements in the domain of freight transport and logistics (Intelligent cargo, information sharing)
• Cooperative logistics</td></tr>
<tr><td>Bibliography</td><td>• European Commission White paper (2011): Roadmap to a single European Transport area. Towards a competitive and resource efficient transport system. Brussels COM 144 final.
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Teaching methods	Lectures	☒
	Demonstrations	☒
	Hands on/gaming	☐
	Exercises	☐
	Visits at facilities	☐
	Other (please describe):	☐

Course # C8	
Title	**Design of passenger transport interchanges**
Thematic area	**Smart Solutions**
Aim	• Gain skills to design medium and large scale infrastructure and increase the perception of creating effective and efficient solutions than rely on safety principles. • Understand the design requirements and special characteristics of passenger interchanges for designing accessible infrastructure. • The course aims at achieving a synergy between substantive technical knowledge and safety consideration knowledge.
Learning outcomes	
• Acquire practical knowledge of design aspects for passenger transport interchanges • Possess a good understanding of passenger transport interchanges, know design principles of accessibility and acquire basic engineering skills in interchange planning. • Provide an understanding of the fundamental relationships involved in the design of passenger transport interchanges by integrating facilities, retailing, passenger transfer and considering interactions with other sectors and future challenges • Ensure that students have a sound understanding of the key issues affecting the planning, safety and comfort of passenger terminals.	
Prerequisites (if any)	
Language	English
Hours	3
Responsible personnel/institute	University of Thessaly
Syllabus	This integrated course is composed of two education areas: 1) Design and safety principles of transport terminal infrastructure, and 2) Passenger terminal design. The course covers the access/egress aspects of passenger interchanges at local area, the transport and transfer of passengers for intermodal transport, the development and integration of facilities and retailing within the premises of the infrastructure. During the entire course, attention is paid to safety and security as well to the physical accessibility aspects of designing transport interchanges. The course is supplemented by a series of case studies to demonstrate the design of the main transport infrastructure in the European Union. Especially medium to large-scale infrastructure is included, for which all the above aspects are covered with up to date and very extensive projects, such as the Moncloa Interchange in Spain, Ilford railway station in UK, and Kamppi Interchange in Finland.

	Box 1: Course topics
	• Access/egress
	• Transport and transfer
	• Facilities and retailing
	• Understanding the interchange
	  ○ Way finding
	  ○ Legibility
	  ○ Permeability
	• Safety and security
	• Comfort and convenience
	• Accessibility

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Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☐
	Exercises	☐
	Visits at facilities	☒
	Other (please describe): Case study	☒

<table>
<tr><th colspan="2">Course # C9</th></tr>
<tr><td>Title</td><td>Design of freight transport interchanges</td></tr>
<tr><td>Thematic area</td><td>Smart Solutions</td></tr>
<tr><td>Aim</td><td>Gain skills to design intermodal freight infrastructures and increase seamless transhipment and secure interconnections.</td></tr>
<tr><td colspan="2">Learning outcomes</td></tr>
<tr><td colspan="2">• Knowledge of design aspects for intermodal freight terminals
• Good understanding of requirements of freight transport terminals and the complexity introduced by the multi-stakeholder and multi-disciplinarity of the associated activities
• Integrating freight servicing facilities, with special services, such as 3rd and 4th party logistics, and other facilitations</td></tr>
<tr><td colspan="2">Prerequisites (if any)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Hours</td><td>3</td></tr>
<tr><td>Responsible personnel/institute</td><td>University of Thessaly</td></tr>
<tr><td>Syllabus</td><td>This course will focus on the components of an intermodal freight terminal and will analyse the parameters that have to be estimated and assessed, in order to provide the input data for designing the terminal.
It will present the European and national legal frameworks for industrial building design, and reveal the relativeness of transportation planning with regional and urban development procedures.
The main modules which comprise these terminals will be presented, and their functionalities and interactions will be explained.
The layout of areas and services associated will be presented from selected case studies.
Box 1: Course topics
• Legislational framework for industrial building design
• Parameters affecting design of intermodal freight terminals
• Layout components
• Interactions among terminal modules, and between terminal and incoming/outgoing cargo
• Case studies of special freight and logistics terminals</td></tr>
<tr><td>Bibliography</td><td>• CEC, Transport Infrastructure Needs Assessment in Central and Eastern Europe - TINA project.
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Teaching methods	Lectures	☒
	Demonstrations	☒
	Hands on/gaming	☐
	Exercises	☐
	Visits at facilities	☐
	Other (please describe):	☐

Course # C10	
Title	**Smart equipment for freight transhipment**
Thematic area	**Smart Solutions**
Aim	The aim of this course is to: • Give a technology and trend overview addressing smart solutions for freight transport • Provide a clear understanding of smart solutions for freight transport applications and services that could be delivered • Explore alternative fuels and propulsion technologies with application to intermodal terminals
Learning outcomes	
• Acquire practical knowledge of smart solutions for freight transport . • Possess a good understanding of smart solutions for freight transport, know design principles of accessibility and acquire basic engineering skills in the transport planning. • Provide an understanding of the fundamental relationships involved in the design of freight transport by integrating facilities, retailing, freight transfer and considering interactions with other sectors and future challenges. • Ensure that students have a sound understanding of the key issues affecting the transport planning. • Use of smart technologies and policies that have the potential to improve environmental impacts for intermodal terminals.	
Prerequisites (if any)	
Language	English
Hours	2
Responsible personnel/institute	Fraunhofer IFF/ University of Magdeburg
Syllabus	This course focuses on the introduction of technologies considered as smart solutions for freight transport. It will explore how smart transport solutions support and enable seamless interconnectivity between the actors and activities in the transport systems, providing a basis for improved collaboration between the actors in the logistics network and make intermodal transport more reliable. It will review policies related to alternative fuels and propulsion technologies based on international and EU practice and it will provide an estimation of environmental impacts for intermodal terminals.

	Box 1: Course topics • Policies and alternative fuels • Environmental impact of alternative fuels • Propulsion technologies and equipment • Application in intermodal terminals • Economic benefits of smart solutions for freight transport	
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Teaching methods	Lectures	☒
	Demonstrations	☒
	Hands on/gaming	☐
	Exercises	☒
	Visits at facilities	☐
	Other (please describe):	☐

<table>
<tr><th colspan="2">Course # C11</th></tr>
<tr><td>Title</td><td>Decision making methodologies</td></tr>
<tr><td>Thematic area</td><td>Decision making</td></tr>
<tr><td>Aim</td><td>The course aims to help students to understand the basic decision making methodologies by exploring different characteristics and features of each one and demonstrate how these can be applied in real life problems.</td></tr>
<tr><td colspan="2">Learning outcomes</td></tr>
<tr><td colspan="2">• Apply basic steps of decision making
• Understand key methods for supporting logistics decision making
• Set goals, objectives and organize alternatives
• Understand most important decision making methods and problem building given alternatives and different stakeholders
• Evaluate alternatives with different units by considering normalization techniques
• Perform analysis, synthesis, and address problem issues and develop critical thinking skills to treat tradeoffs between alternatives
• Manage data and build decision support models in spreadsheets
• Use available tools for performing decision making</td></tr>
<tr><td colspan="2">Prerequisites (if any)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Hours</td><td>3</td></tr>
<tr><td>Responsible personnel/institute</td><td>University of Thessaly</td></tr>
<tr><td>Syllabus</td><td>The students are exposed to (a) social cost benefit analysis and (b) multicriteria assessment methodologies.
Social costs and benefits are analysed, through various techniques, such as monetarization, normalization etc. and will guide to the estimation of financial indicators, Net Present Value, Internal Rate of Return, Benefit to Cost ratio.
Multicriteria analysis introduces a hierarchical process for analysing complicated systems through the identification of stakeholders, their objectives and criteria, selection of alternative solutions, quantification of the criteria through quantitative and qualitative indicators, identification of weights, estimation of the performance index of the solution.
Risk assessment, transferability and adaptability analysis are also described and respective indicators and estimation methodologies are explained.
Box 1: Course topics
• Social cost benefit analysis
• Multi-stakeholder Multi-criteria analysis
• Transferability and adaptability analysis
• Risk analysis</td></tr>
<tr><td>Bibliography</td><td>• Cascetta (2009). Transportation System Analysis: models and applications. 2nd edition. Springer.
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Teaching methods	Lectures	☒
	Demonstrations	☐
	Hands on/gaming	☐
	Exercises	☒
	Visits at facilities	☐
	Other (please describe): Case study	☐

Course # C12	
Title	**Data collection methods**
Thematic area	**Decision making**
Aim	The aim of this course is to: • Provide an understanding of quantitative and qualitative methods in data collection • Present most used methods in transport for data collection and explore their characteristics • Provide an overview of transport survey methods, the practical problems of sample design, the collection and application of transport-related data • Review the state of the art in urban freight surveys with an emphasis on new methods and data sources.
Learning outcomes	
• Identify appropriate methods for transport, traffic and spatial data collection. • Understand transport data needs • Understand the role of sampling in data collection • Use descriptive statistics for the analysis and preparation of data • Understand how relevant data is obtained from transport management systems • Introduce students to Big Data analytics	
Prerequisites (if any)	
Language	English
Hours	3
Responsible personnel/institute	Fraunhofer and University of Thessaly
Syllabus	This intercollegiate course will be organized and offered by two institutes: Fraunhofer (2 hours) and University of Thessaly (1 hour). The main part will focus on describing how to set up a survey related to the performance of an interchange and will distinguish between passenger and freight terminals. It will cover aspects of sample estimation and experimental design and will introduce some basic statistical methods for data base preparation and analysis. Both quantitative and qualitative methods will be presented in summary and the most well used methods in transport will be further introduced. The importance of working with sample data will also be presented. Finally the basic principles for designing questionnaires for transport users will be presented. Briefly, this course will introduce the main aspects of big data and applications in transport.

	Box 1: Course topics • Quantitative data collection methods • Qualitative data collection methods • Data collection and sampling • Data collection methods • Open data sources (bluetooth, GPS, RFID, onboard sensors, social networks etc.) • The organization of passenger transport surveys: case studies. • The organization of freight transport surveys: case studies. • Sampling, response, experimental and quasi-experimental design, survey design, and ethical issues • Data analysis and visualization • Data fusion techniques • Big data in transport
Bibliography	• Transport Survey Methods: Best Practice for Decision Making Editor(s): Johanna Zmud, Martin Lee-Gosselin, Marcela Munizaga, Juan Antonio Carrasco, ISBN: 978-1-78-190287-5 eISBN: 978-1-78-190288-2 • Amekudzi, A., Meyer, M., & Ross, C. (2011). Transportation planning for sustainability guidebook. Washington, D.C.: U.S. Federal Highway Administration. • Travel survey methods, freight data systems, and asset management 2011. (2011). Washington, D.C. • Bonnel, P. (2009). Transport survey methods. Bingley, UK: Emerald. • Bayart, C., Bonnel, P., & Morency, C. Survey mode integration and data fusion. • Travel Survey Methods. Quality and Future Directions. Edited By Peter Stopher, Cheryl Stecher. Elsevier, 2006.706 p. • Peter Stopher. Collecting, Managing, and Assessing Data Using Sample Surveys. Cambridge University Press, 2012. 246p. • Yatskiv, A. Grakovski and E. Yurshevich. An overview of different methods available to observe traffic flows using new technologies. In: Proceedings of the international conference NTTS, 5-7 March 2013, Brussels, Belgium, 2013. • Survey Sampling. Theory and Methods, 2nd edition. Arijit Chaudhuri, Horst Stenger. Charman&Hall, 2005.- 380 p. • Nathanail E., 2007, "Developing an integrated logistics terminal network in the CADSES area", Transition Studies Review, May 2007, Volume 14, Issue 1, pp 125-146. • Andrés Monzón, Floridea Di Ciommo, Sara Hernández, Eftihia Nathanail, Giannis Adamos, Maria Tsami, Ricardo Poppeliers, Odile Heddebaout, Tuuli Jarvi, Marko Nokkala, Juno Kostiainen, Derek Palmer, Clare Harmer, Katie Millard, Jardar Andersen, Petter Christiansen, Albert Gabor, Adam Pusztai, Almos Virag, Jan Spousta, 2015. CITY-HUBs: Sustainable and Efficient Interchange Stations. Taylor and Francis Group, 2015. • NOVELOG project (2016). Framework for Data, Information and Knowledge Collection for Urban Freight and Service Demand Understanding. Deliverable 2.1.
Teaching methods	Lectures ☒

	Demonstrations	☐
	Hands on/gaming	☐
	Exercises	☒
	Visits at facilities	☐
	Other (please describe): Case study	☒

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