National Technical University of Athens

Department of Transportation Planning and Engineering

July 2019

Presentation outline

1. The NTUA Department of Transportation Planning and Engineering (5)
2. Transportation Engineering (4)
3. Education (8)
4. Research (2)
5. Cooperations and Partners (6)
6. Laboratories (17)

The NTUA Department of Transportation Planning and Engineering

The NTUA Department of Transportation Planning and Engineering

The Department of Transportation Planning and Engineering (www.transport.ntua.gr), established in 1982, is a **Center of Research and Innovation Excellence** in Transportation, with global recognition
[ranked: 9th in Europe and 39th worldwide (ShanghaiRanking's 2017), scientific citations: 3rd in Europe and 19th worldwide (Pulse 2017), road safety research: 2nd in Europe and 6th worldwide (AAP 2018)]

within the **School of Civil Engineering**
(one of the five Departments) [ranked: 3rd in Europe and 11th worldwide (ShanghaiRanking's 2019), 11th in Europe and 42nd worldwide (QS 2018)]

of the **National Technical University of Athens**
(the oldest of the eight engineering Schools)
[the oldest (since 1837) and most prestigious Greek Technical University]

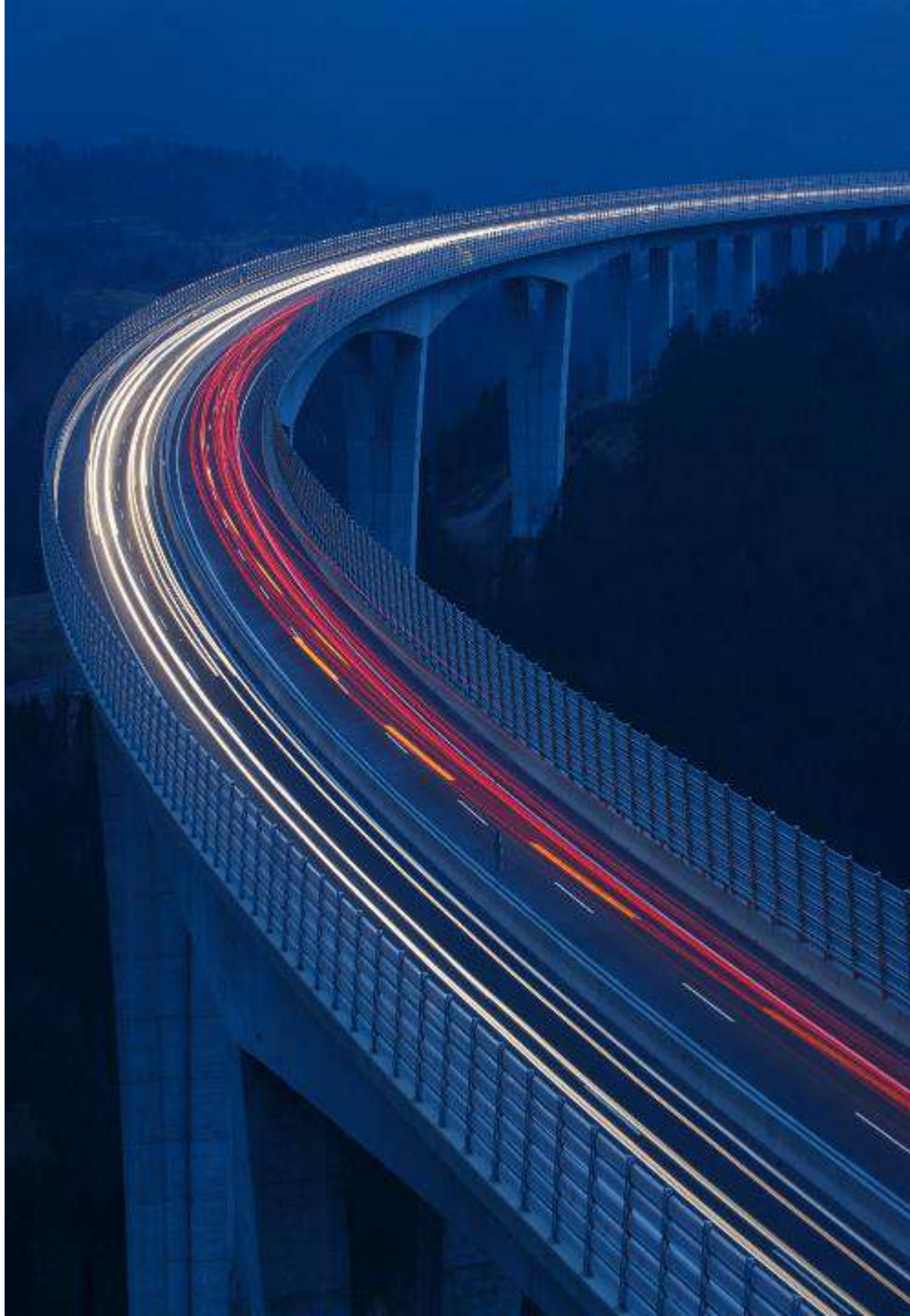
Mission

The **Mission** of the NTUA Department of Transportation Planning and Engineering is:

- to **educate scientists** engineers and
- to **promote science**

in the field of transportation planning and engineering

High scientific standards and performance are key objectives in all education and research activities of the Department



Vision

The Vision of the NTUA Department of Transportation Planning and Engineering is a future with highly **efficient, green and safe** transport systems in Greece, in Europe and globally,

through high level **scientific research** and technological development supporting evidence based decision making in all aspects of all transport modes and types

Department People

A dynamic team of more than 65 renowned scientists

- Faculty **7**
- Special Lab & Teaching Staff Member **4**
- Post Doctoral Researchers **10**
- PhD Candidates **30**
- Technical and Administrative Staff **7**
- Research Assistants **10**

Department Faculty

Ioannis Golias
Professor, NTUA Rector

Andreas Loizos
Professor

George Yannis
Professor, Director

Athanasios Ballis
Associate Professor

Eleni Vlahogianni
Associate Professor

Christina Plati
Assistant Professor

Stergios Mavromatis
Assistant Professor

Transportation Engineering

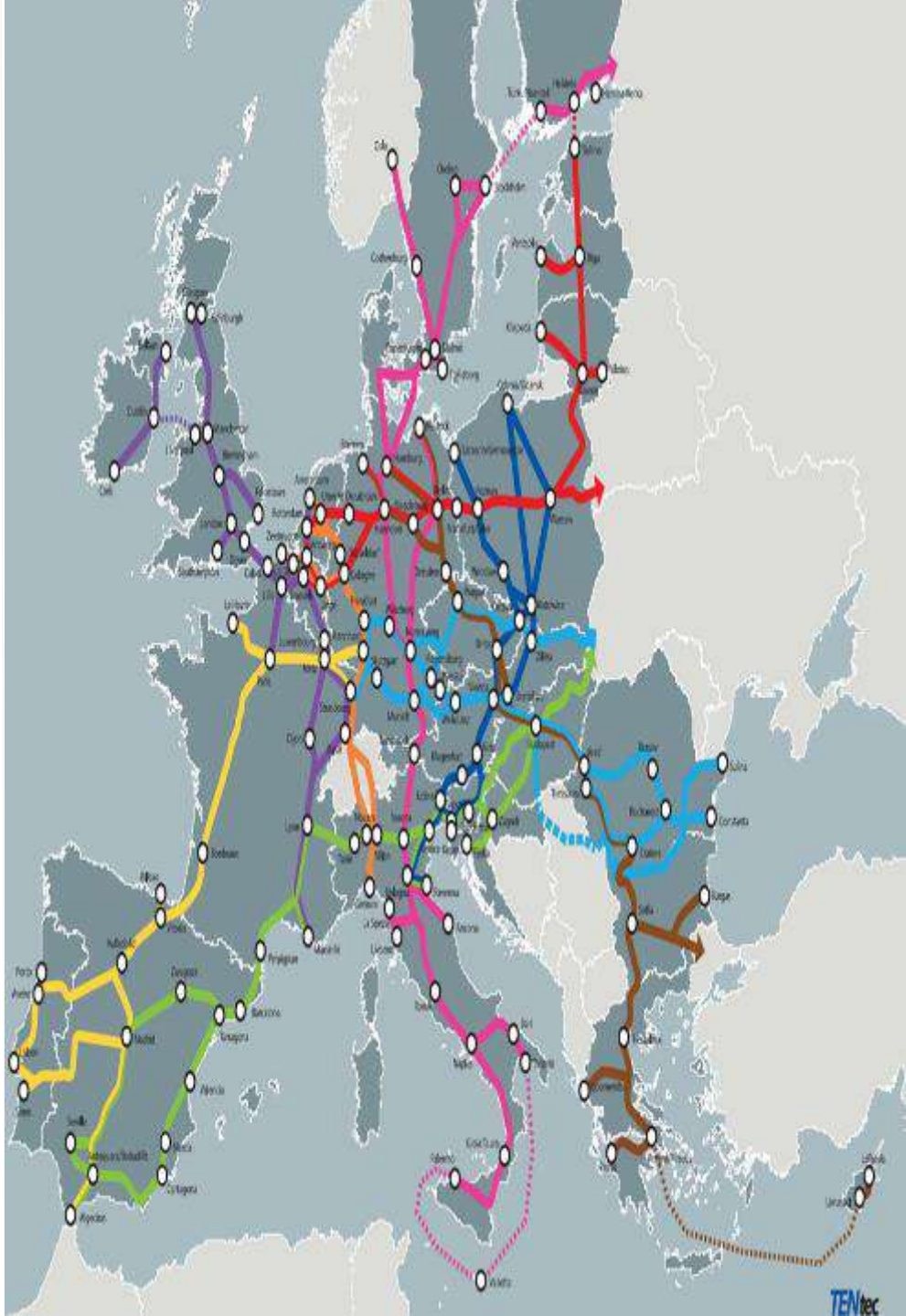
Transport Infrastructure in Greece

- **42.000 km** Interurban Road Network
- **2.500 km** Railway Network
- **40** Major Airports
- **60** Major Ports
- **>100.000 km** Urban Road Network

Transport Infrastructure in Europe

The Trans-European Transport Network (TEN-T) comprises:

- **> 7.200.000 km** Main Road Network
- **> 330.000 km** Main Railway Network
- **> 850** Major Airports
- **> 3.000** Major Ports



Transportation Engineering Scope (1/2)

Transport modes

- Road transport
- Rail transport
- Water transport
- Air transport
- Combined transport

Transport Types

- Transport of people and goods
- Urban and interurban transport
- National and international transport
- Terminals

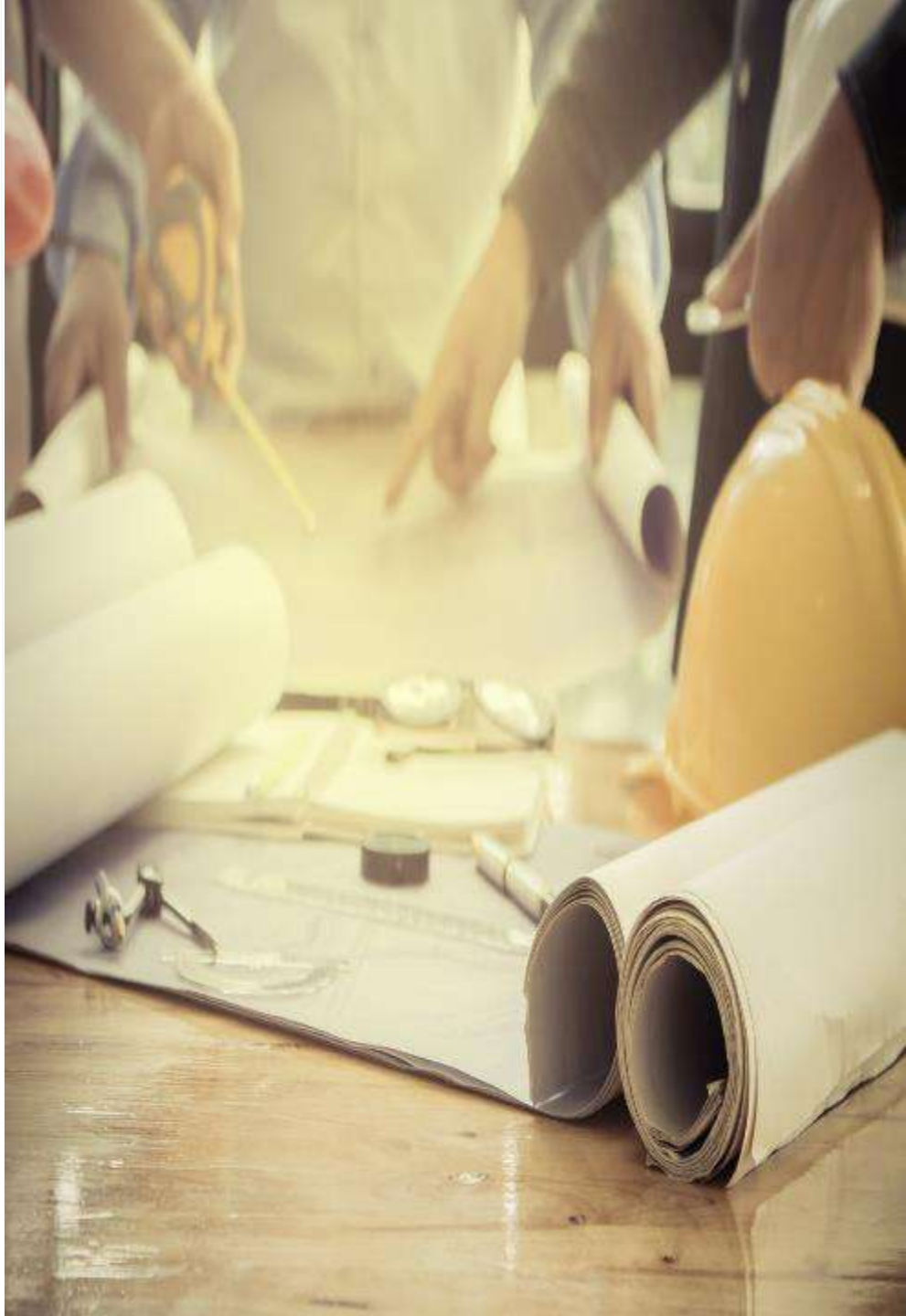
Transportation Engineering Scope (2/2)

Transportation projects in all phases

- Planning
- Design (Conceptual, Preliminary, Final General and Detailed)

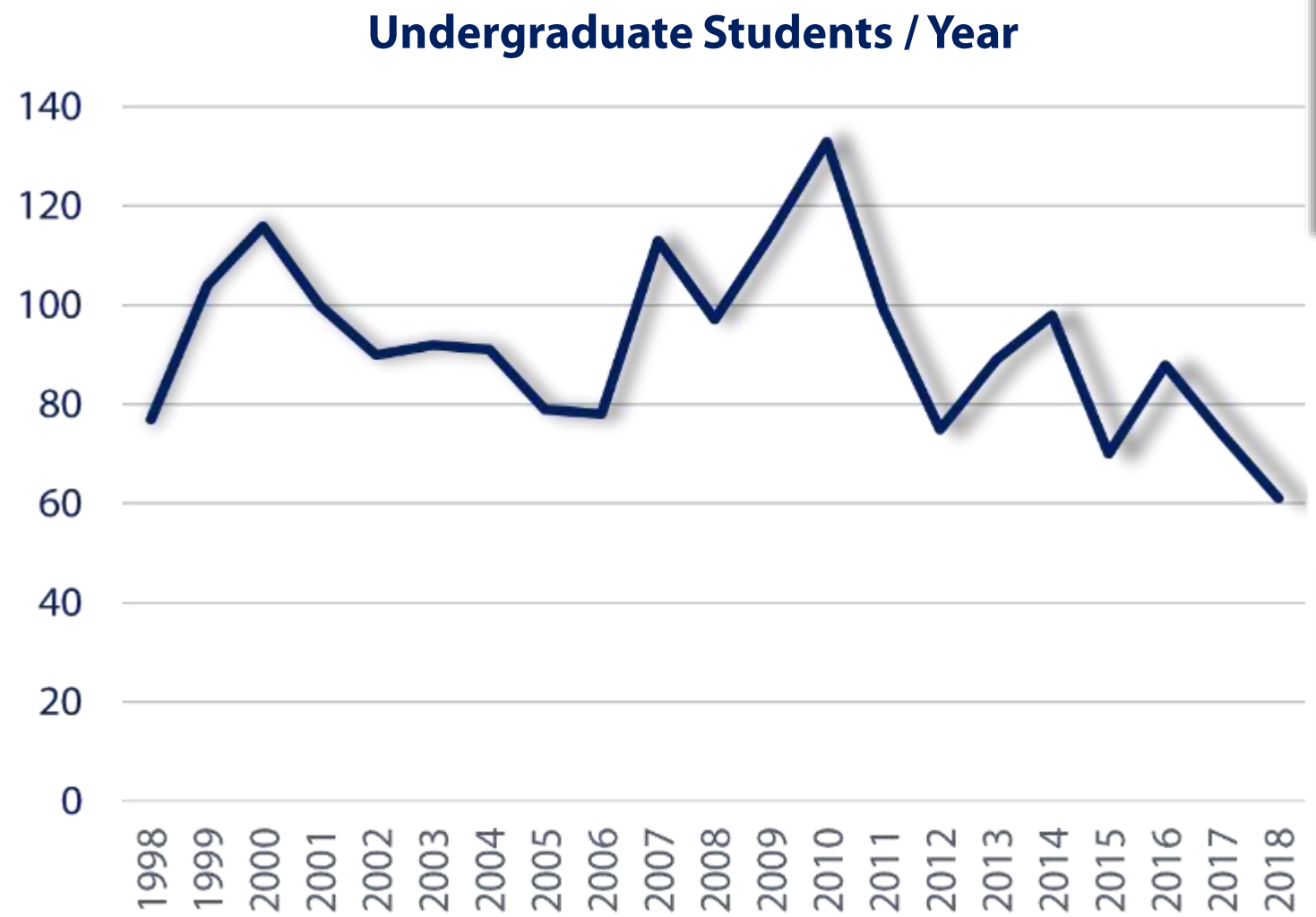
- Tendering
- Construction
- Delivery for operation

- Operation
- Management
- Maintenance



Education

Civil Engineering - Transportation Cycle Undergraduate Students



Courses offered

- The Department offers:
  - **16 undergraduate courses** at the School of Civil Engineering (compulsory and elective for all civil engineering students and all students of the transportation cycle)
  - **6 undergraduate courses** at NTUA Engineering Schools
  - **6 postgraduate courses** at NTUA Engineering Schools

Courses - Transportation Cycle

- Roads Geometric Design
- Roads Construction
- Transportation Systems Planning
- Traffic Flow
- Design of Road and Airfield Pavements
- Urban Road Networks
- Railway Engineering
- Advanced topics on Roads Geometric Design
- Public Transit Planning
- Pavement Evaluation and Maintenance
- Traffic Management and Road Safety
- Airport Planning and management
- Analysis Methods in Traffic Engineering
- Pavements - Special Topics
- Quantitative Methods in Transportation
- Integrated Project in Transportation Engineering
- Combined Transport - Advanced Systems

Courses - Other

Courses at the School of Civil Engineering and other Schools

- Laboratory on Materials
- Technology of Building Information Modeling (BIM)
- Environmental Impacts
- Practical Training
- Highway Engineering IV, SRSE
- Environment and Development, NTUA

Contribution to MSc Programs

- Shipping and Maritime Transport, **Water resources science & technology**
- Optimization of Infrastructure Networks, **Water resources science and technology**
- Transport and Traffic - non-conventional vehicles, **Energy Production and Management**
- Urban Transport systems, **Architecture - Spatial Design**
- New technologies in the design of complex infrastructure systems with focus on airports, **Architecture - Spatial Design**
- Data driven models in civil engineering problems, **Data science and machine learning**

Integrated Transport Planning Project

Greek Island Transport Plan Development

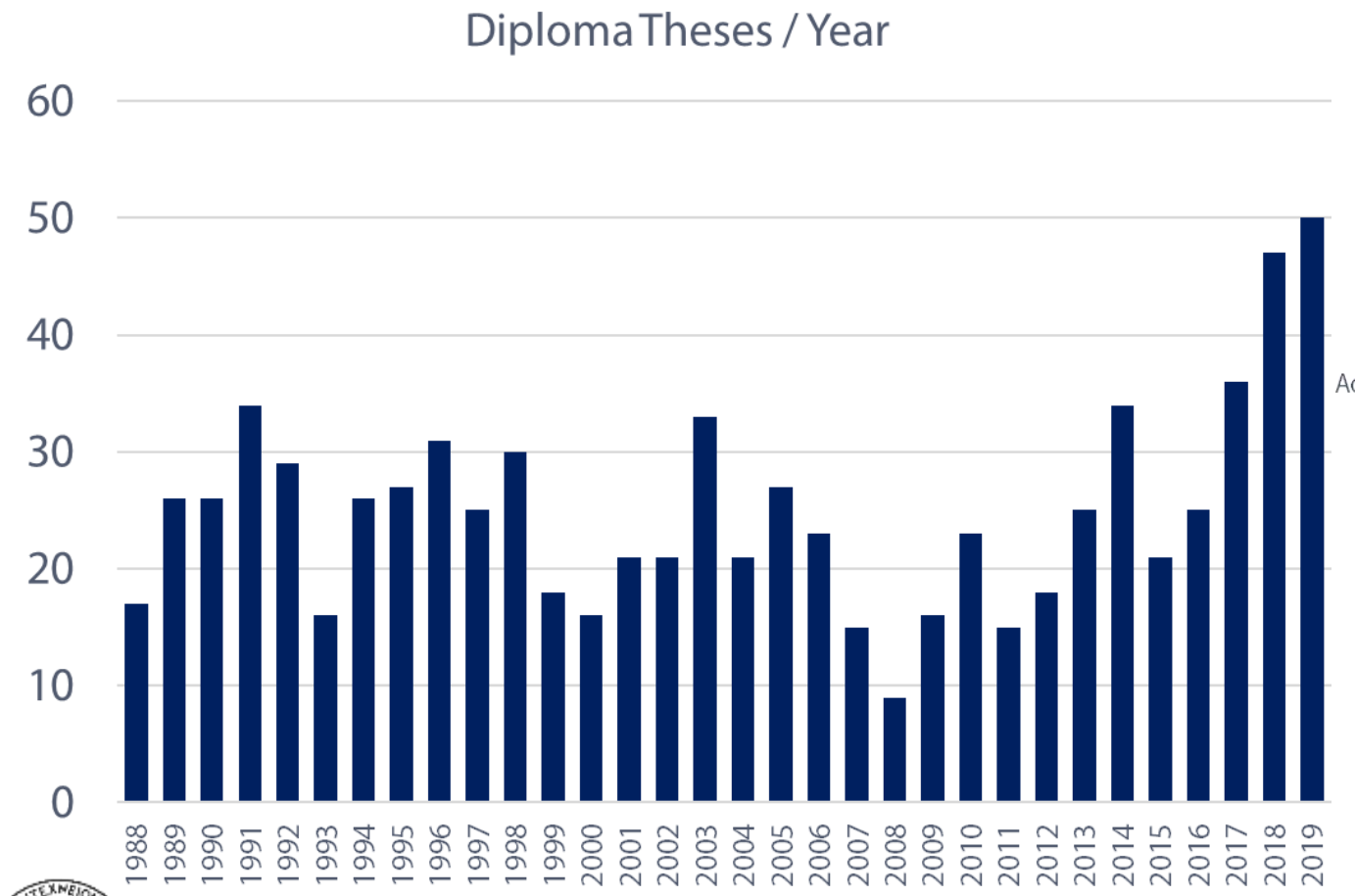
Exploitation of real data in a project that covers all transportation engineering disciplines, combining all different transport and development objectives in a **comprehensive and integrated approach**

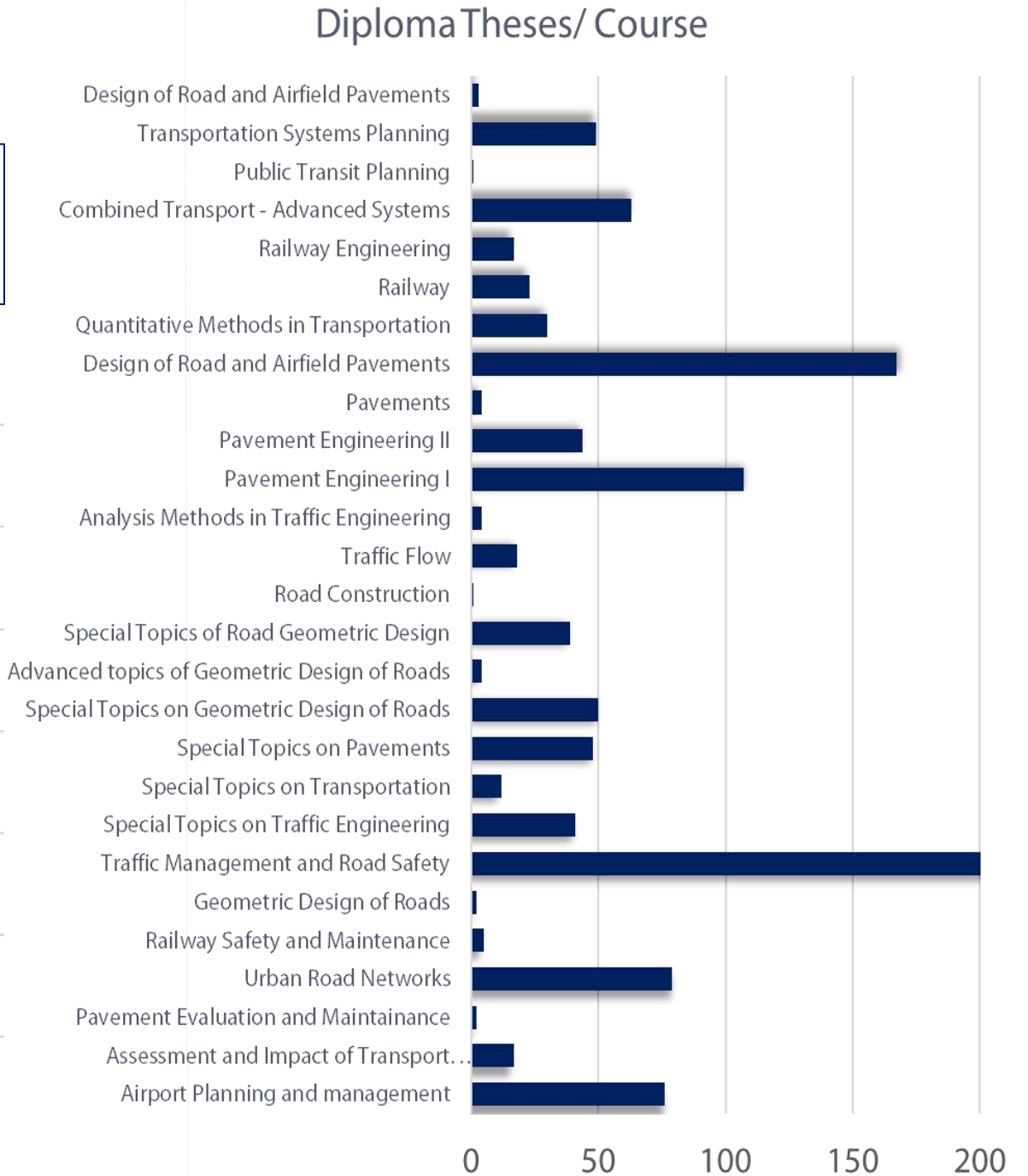
- Full **analysis** of current transportation situation
- **Transportation** (Internal and external transport analysis, Planning passenger / cargo ports and airports)
- **Traffic Engineering** (Traffic Analysis, Identification of high risk sites, Urban Mobility Plan)
- **Road construction** (Configuration of critical junctions, Pavement upgrade program)
- **Technical and economic** analysis of the overall plan of transportation development (cost-benefit)

Diploma Theses (10th semester)

1111 Diploma Theses **since 1977**

27 Diploma Theses **per year**

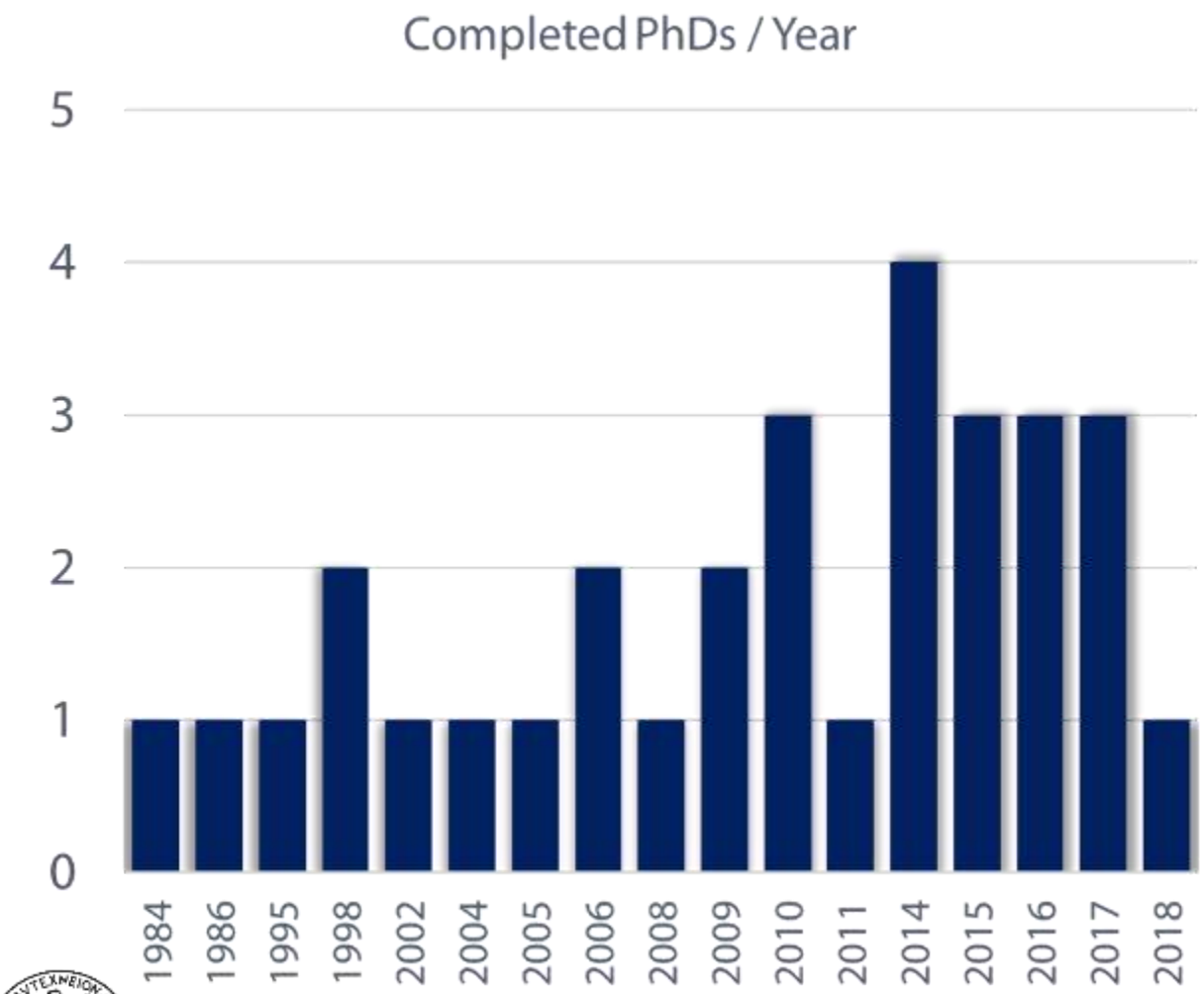


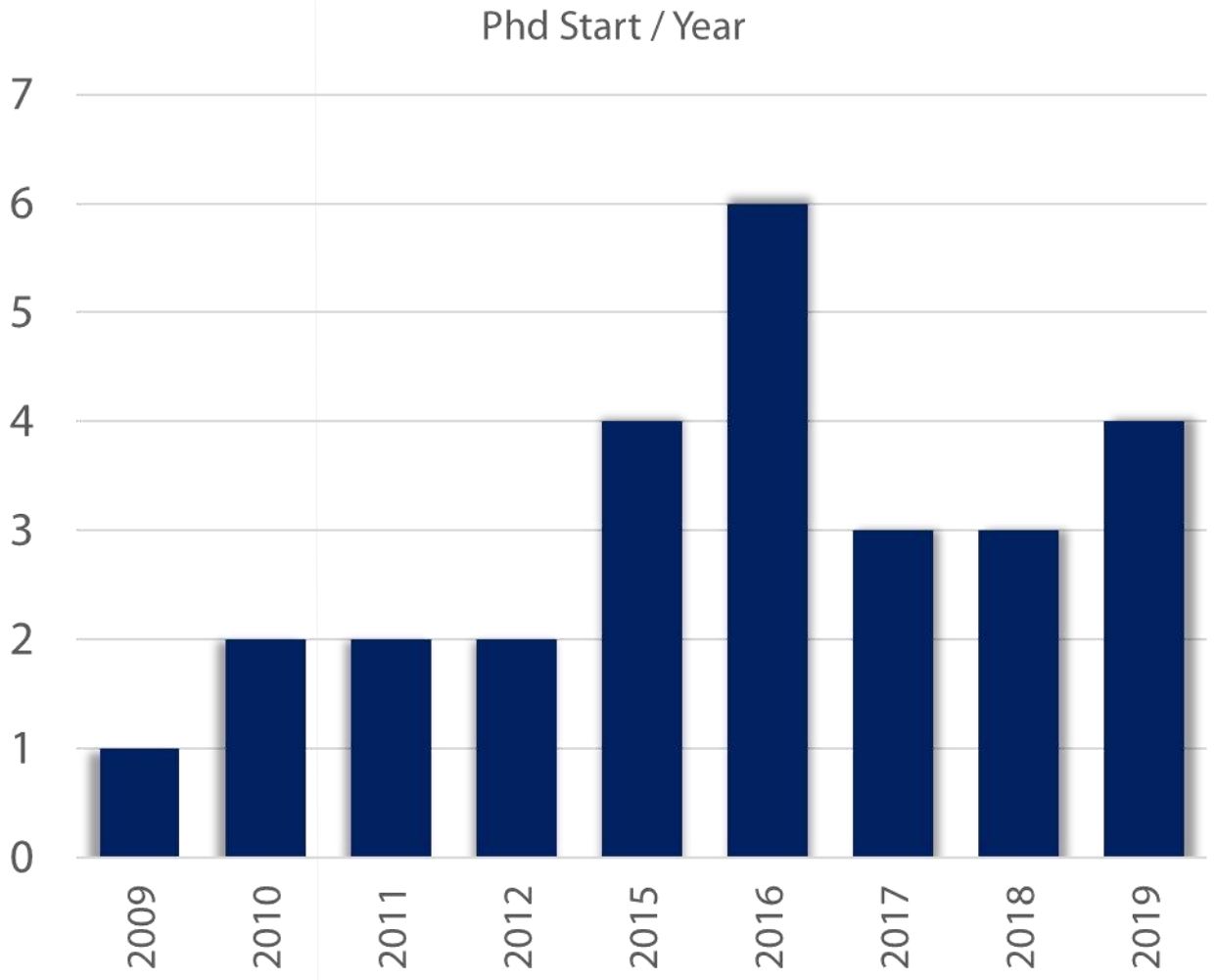


PhD Theses

32 PhD Theses Completed

30 PhD Theses Under Preparation





Conferences – Workshops (recent)

- **Digitalisation and Road Safety** Research Workshop, NTUA,17/5/2019
- Training course on the use of the **Aimsun Next Traffic Simulation** Program, AIMSUN / NTUA / TUMunich, 4/11/2018
- hEART2018 - 7th Symposium of the European Association for **Research in Transportation**, NTUA / TUMunich, 5-7/9/2018
- 10th International Conference on the **Bearing Capacity of Roads**, NTUA / TU Delft, 28-30/6/2017
- The **Future of Road Safety Research** Workshop, NTUA, 15/5/2017
- **Cognition, Behaviour and Driving** Inter-disciplinary Conference, NTUA / UOAthens, 26/6/2015
- 6th Pan-Hellenic Conference on **Road Safety**, NTUA / Hellenic Institute of Transportation Engineers, 12-13/3/2015
- **Road Infrastructure Safety Equipment** Technical Conference, NTUA / European Road Federation / HITE, 12-13/2/2015

Research

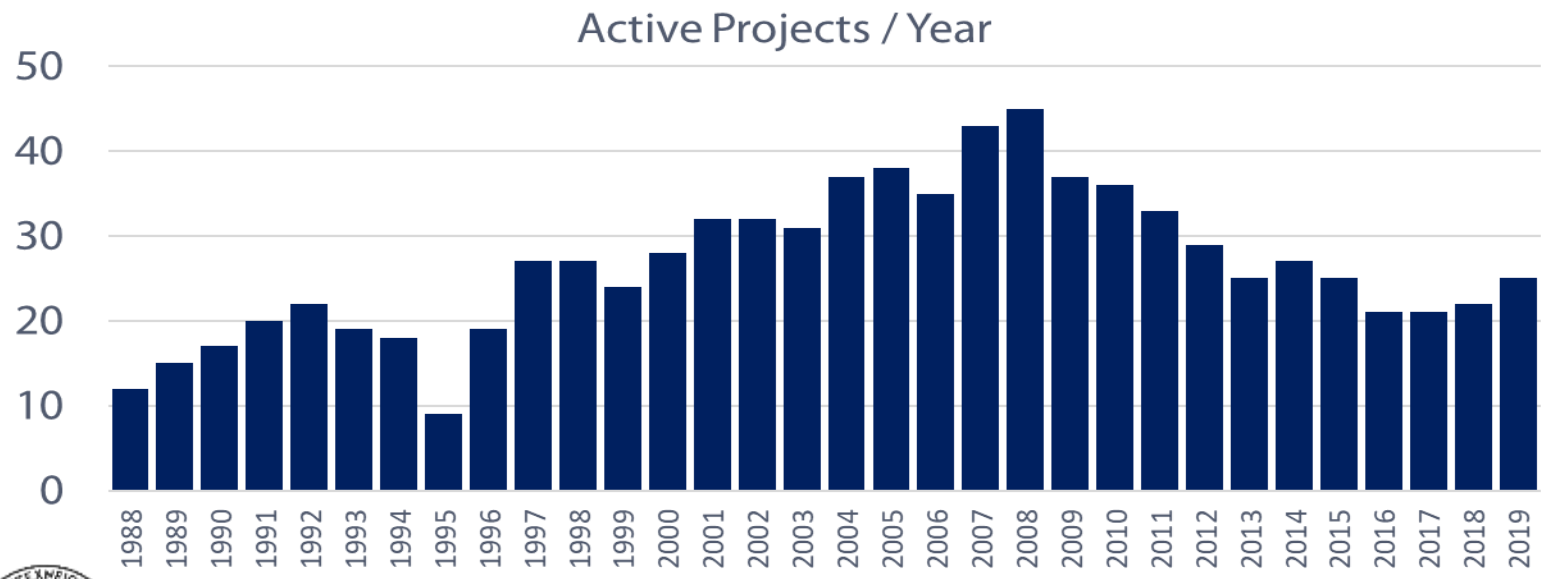
Research Projects

More than **325 Research Projects**

- **> 115** International
- **> 210** Greek

With more than **500 international partners**

More than **175** through highly **competitive** procedures



Scientific Publications

Publications in Journals	**> 400**
Publications in Conferences	**>1.000**
Presentations in Conferences	**> 500**
Citation Index Scopus	**> 20**
Citation Index Google Scholar	**> 30**

Cooperations and Partners

Our Cooperations - Greece

Our Cooperations - Europe

Our Cooperations - Worldwide

Our Partners - European Universities

Our Partners - Universities Worldwide

Our Partners - Research Institutes

Laboratories

Laboratories

Laboratory of Pavement Engineering
Scientific Disciplines

Established in early '60s

Section of Pavement Materials, Testing and Characterization

Section of in-situ pavement testing and evaluation

Education
Research
National and International collaborations

Laboratory of Pavement Engineering Research Infrastructure and Priorities

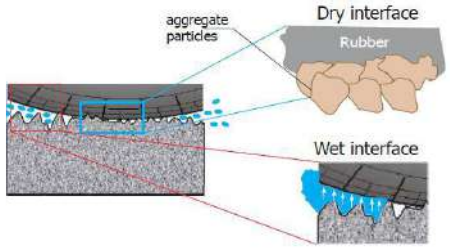
Section of Pavement Materials, Testing and Characterization

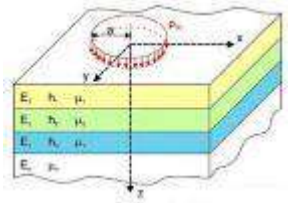
- Evaluation and proportioning of raw materials
- Materials (bound or unbound) testing and mechanical characterization
- Compaction
- Low-energy mixes testing and evaluation
- Assessment of alternative materials for pavement construction

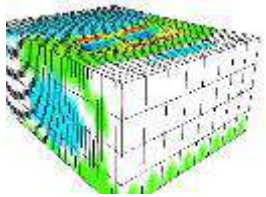
Laboratory of Pavement Engineering Research Infrastructure and Priorities

Section of in-situ pavement testing and evaluation

- Non Destructive Testing (NDT) in the field
- Pavement instrumentation (fiber optics)
- In-situ performance evaluation of pavement materials
- Pavement evaluation (structural and functional)
- Bearing capacity of roads and airfields



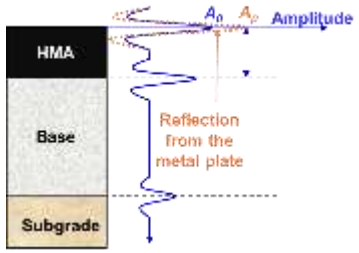




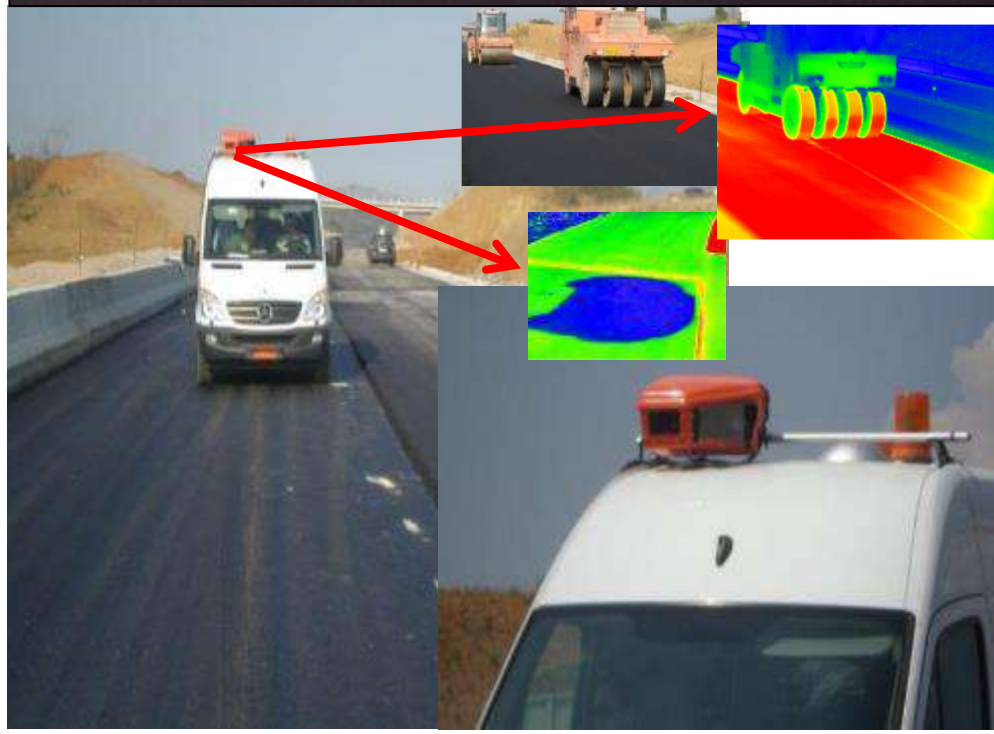
Laboratory of Pavement Engineering Research Infrastructure and Priorities

Section of in-situ pavement testing and evaluation

- Geophysics applications using Ground Penetrating Radar (GPR)
- Dielectric properties of pavement materials



- Pavement structure inspection (layers, cracks, moisture)
- Railway ballast assessment using GPR
- Post compaction assessment – Quality control
- Thermal camera use - Quality control



Laboratory of Pavement Engineering
Key Research Priorities

Section of Road Design

- Safety assessment of road design guidelines through **vehicle dynamics – 3D road** surface interaction
- Infrastructure design for **Autonomous and Connected Vehicles**
- **ADAS** deployment in vehicle automation environment
  - stopping sight distance
  - passing sight distance
  - speed adaptation
- Safety and operational assessment of **heavy vehicles**

Laboratory of Pavement Engineering
International Collaboration

FEHRL

Brussels

Decision making and excellence

Greek FEHRL Group (since 2004):

Ministry of Infrastructure and Transport
Central Public Works Department

Laboratory of Pavement Engineering
of the School of Civil Engineering of NTUA

Laboratory of Pavement Engineering
Key Research Goals

- Sustainable and innovative pavement materials – adaptation on **climate changes**
- **Remote and automated systems** for pavement rehabilitation
- Advances in **systems assessing** pavement condition
- Using **vehicle communication** systems for assessing pavement performance
- Pilot studies for assessing the performance of pre-fabricated pavements that contain **sensors**
- **Life Cycle Assessment** (LCA) of pavements

FOREVER OPEN ROAD
Redefining Road Transport for the 21st Century

FEHRL

Laboratory of Railways & Transport Research Areas

Simulation & Prototyping of Innovative Handling Systems

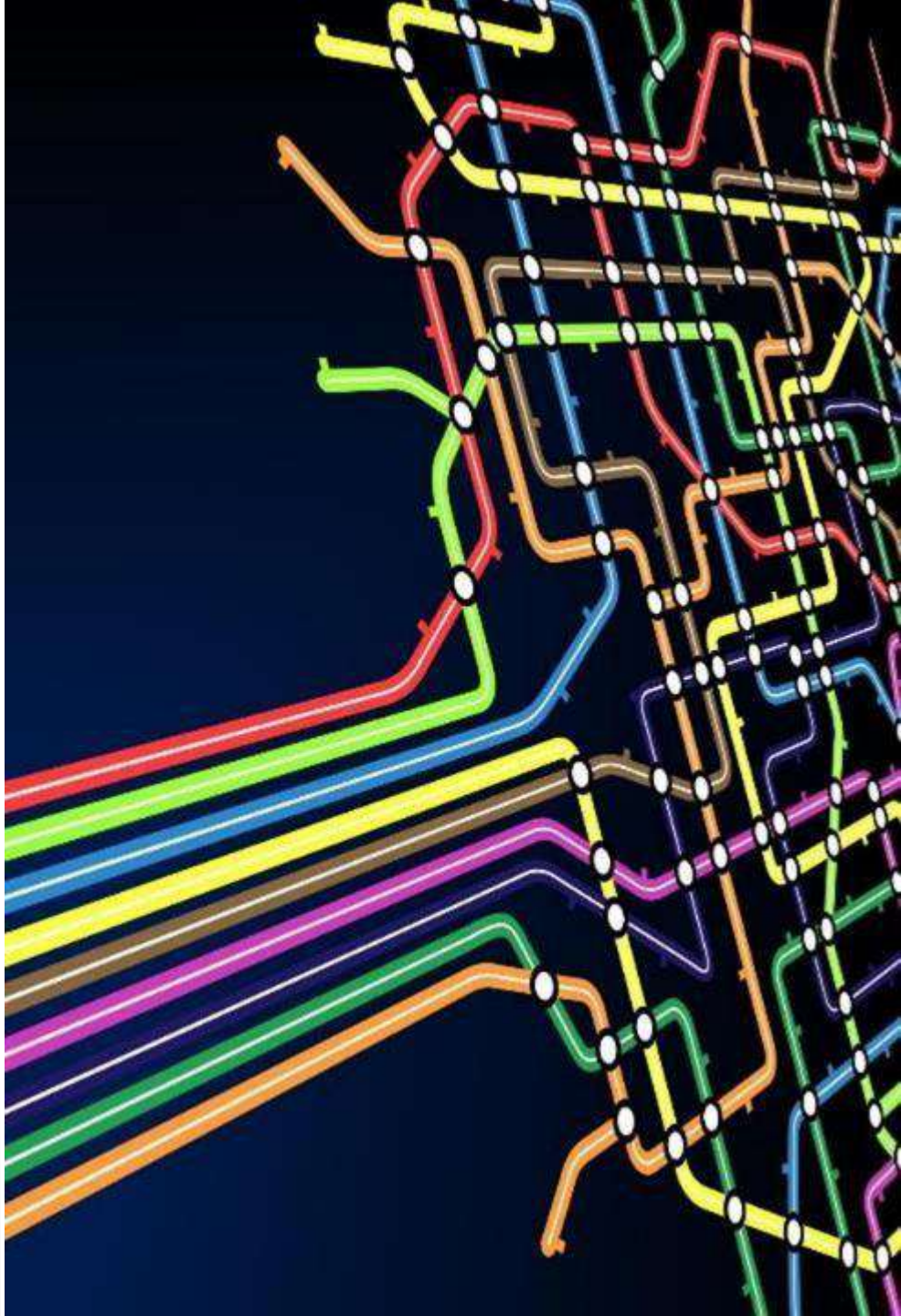
- AGV/ASC (Rotterdam port)
- Moving Train (Krupp)
- ISU handing system for conventional semitrailers

Information Systems for Transport Infrastructure

- ETIS (European Transport Information Systems)
- ENIRRIST (research infrastructure for transport & logistics)

Transport System Simulation & Optimization

- Intermodal container transport
- Wagon fleet management
- Urban Freight Truck routing
- Water airports & Seaplane Services
- Gas pipelines and LNG ports



Laboratory of Railways & Transport Research Infrastructure

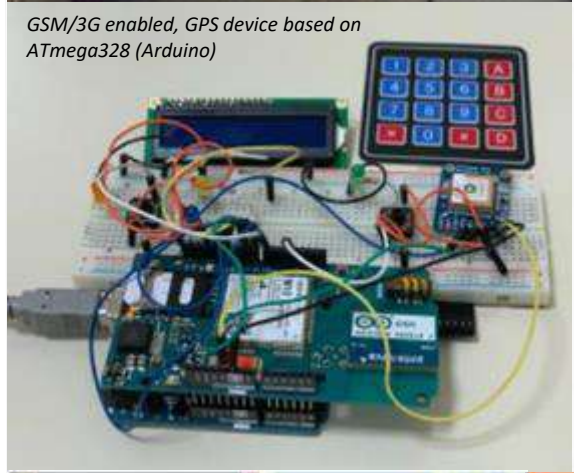
- Rail strain measuring sensor
- Endoscope Cameras
- Camcoder, Long duration videocamera

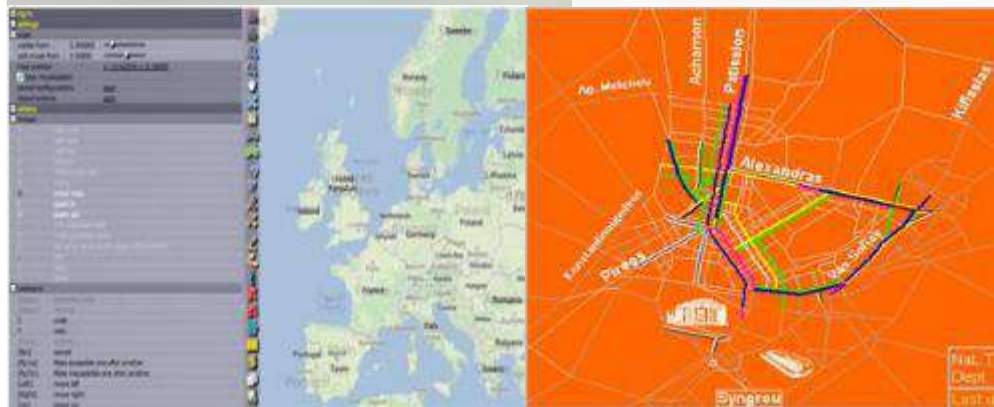
- Oscilloscope , digital multimeter, microcontroller development tools

- Sound meters and acoustical calibrator

- Traffic count recorder
- Server of Athens real-time traffic congestion map
- Server for GIS applications

GSM/3G enabled, GPS device based on ATmega328 (Arduino)





Laboratory of Railways & Transport – Example Key Projects

Impulse, ITIP, CREAM

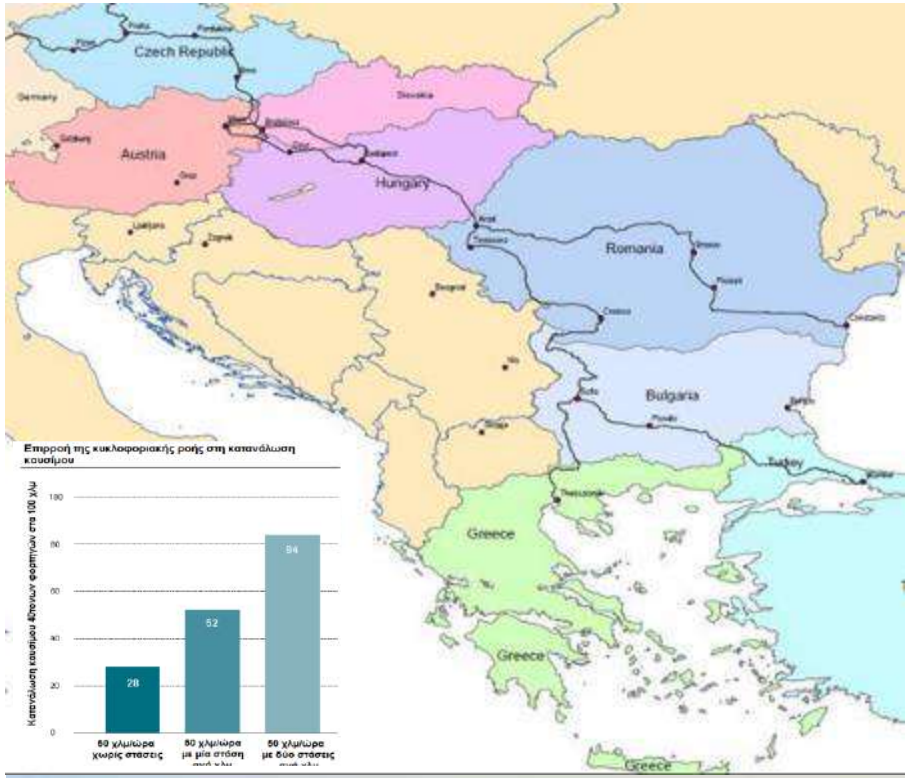
- **Simulation & Prototyping of Innovative Handling Systems**
  - AGV/ASC container handling equipment
  - Moving Train
  - ISU handing system for conventional

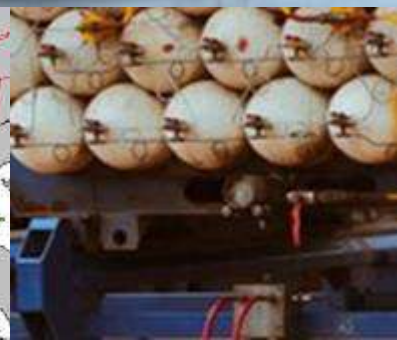
F-MAN, iCS

- **Wagon fleet management**
- **Intermodal transport**
  - Development of iCS service (Athens – Thessaloniki)
  - Wagon loading algorithm
  - Decision support for truck dispatching

Laboratory of Railways & Transport – Key Research Priorities

- Development of **research infrastructure** for transport & logistics *(8 Greek Universities & 3 Research Institutes)*
- **Wagon fleet management** (focus on Balkan countries, development of smart OBD)
- Analysis of Greek **coastal shipping** and air services
- **Urban Freight** Truck routing (Athens ring road)
- **Freight villages** (legislation modernization)
- **Water airport** and Seaplane Services (passengers, freight, synergies with cruise sector)
- **Gas energy** security (model development)
- **Virtual pipeline** for gas distribution in small Greek islands





Laboratory of Traffic Engineering Research Areas

Traffic Management

- Data driven traffic flow analysis and forecasting
- Mobility as a service, electromobility, connected/shared mobility
- Network level traffic prediction and management
- Design and operation of traffic management & parking systems

Traffic Safety

- Driver Safety Behaviour & Telematics
- Road Infrastructure Safety
- Road Safety Data, Knowledge & Management Systems

Intelligent Transportation Systems

- Smartphone sensing and analytics, driving telematics & analytics
- Traffic Automation
- Impact assessment of ITS, mobility, environment and safety

Laboratory of Traffic Engineering Research Infrastructure

- **Driving Simulator** (Foerst ¼ cab, moving base) for driver behavior experiments
- Unmanned Aerial Vehicles (**Drones**) for traffic monitoring
- On-Board Diagnostics Devices (**OBD**) for driver behavior monitoring
- **Cameras** for traffic monitoring
- **Other devices** for traffic counts, speed monitoring, position monitoring (GPS)

Laboratory of Traffic Engineering
Data and Knowledge Systems

Knowledge Systems

- NTUA Road Safety Observatory >1.300 items, > 3.000 visits/month
- Digital Road Safety Library > 5.000 key Reports
- International Bibliography databases (scopus, science direct)
- Analysis tools (traffic, simulation, statistics)

Databases

- SANTRA - Greek Road Accident Database with disaggregated data (1985 - 2017, 1,2 million recordings)
- CARE - European Road Accident Database with disaggregated data (1991 - 2017, 36 million recordings)
- IRTAD International Road Accident Database with aggregated data
- Databases of International Organisations (WHO, IRF, ERF, UITP)
- Databases with Aggregated Data (Vehicle fleet, veh-km, driver behavior, etc.

Laboratory of Traffic Engineering - Example Key Projects

i-Dreams (2019-2022)

➢ **Driving telematics from smartphones**
- Identification of safety-relevant behaviour
- Assessment and prediction of risk

➢ **600 operators Experiment**
- 4-stage 5-country experiment across 4 transport modes (car, bus, truck, train)
- Big data handling and processing

➢ **Intervention selection and testing**
- Real-time effectiveness (safety critical events, near misses etc.), driver state

➢ Definition, development, testing and validation of a context-aware **Safety Tolerance Zone**

Drive2theFuture (2019-2022)

➢ The **first Autonomous Vehicles behavioral model** (Multiple comfort zone, Risk Allostasis model, Risk Monitor Model)

➢ Data compilation from **20 European projects** (User behavior, acceptance, HMI, accident data)

➢ Data science techniques for **user acceptance prediction**

➢ **Pilots for testing automated driving** behavior (12 Pilots in 8 European Countries, Training schemes for AVs, HMI development)

Laboratory of Traffic Engineering
Key Research Priorities

- **Automation** and Connectivity
- Driving **Telematics** (smartphones & wearables)
- **Drone** based traffic monitoring and analysis
- Traffic and driving **simulation**

- **Smart Cities**
- **5G** traffic

- Traffic and Safety **Big Data**
- Traffic and Safety Information **Systems**

www.transport.ntua.gr

Welcome

The mission of the Department of Transportation Planning and Engineering is to educate scientists engineers and promote science in the field of transportation planning and engineering. High scientific standards and performance are key objectives in all education and research activities of the Department of Transportation Planning and Engineering.

The Department of Transportation Planning and Engineering is composed by three Laboratories: Pavement Engineering, Railways and Transport & Traffic Engineering, comprises more than 70 highly qualified personnel (7 Faculty members), offers 16 undergraduate courses at the School of Civil Engineering

Transport Tools

National Technical University of Athens

Department of Transportation Planning and Engineering

July 2019