National Technical University of Athens

Department of Transportation Planning and Engineering

May 2023

Presentation Outline

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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,
- to **promote science** and
- to **support development**

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 e**fficient, 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 **2**
- Post Doctoral Researchers **16**
- PhD Candidates **27**
- Technical and Administrative Staff **6**
- Research Assistants **12**

Department Faculty

Andreas Loizos
Professor

Athanasios Ballis
Professor

Eleni Vlahogianni
Professor

Stergios Mavromatis
Assistant Professor

George Yannis
Professor, Director

Christina Plati
Professor

Konstantinos Gkiotsalitis
Assistant Professor

Alumni Careers

Postgraduate/PhD students and PostDoc researchers of the Department demonstrate **excellent careers in Greece and globally**:

- Academia (TUMunich, TU Delft, ENPC Paris, EPFL, ULoughborough, UCyprus, UPatras, etc.)
- Ministries (Transport, Development, Economy)
- Transport Authorities (Motorways, Metro, Public Transport, Airports, Ports, Railways)
- Regional and City Authorities (Athens, other cities)
- Engineering Firms and Consultancies
- Industry (road, rail, air, sea, intermodal)
- International Organisations

Supporting Development

The scientists of the Department have served **Greek Government** at all levels (Ministers, Secretary Generals, Chairmen, BoD Members, Minister Advisors, etc.) at:

- Ministry of Infrastructure and Transport
- Ministry of Development and Investments
- Ministry of Finance
- City of Athens
- Hellenic Railways
- Athens Transport Authority
- Athens Metro
- Athens Airport
- Athens Master Plan Authority

ATTIKO METPO A.E.

ATHENS INTERNATIONAL AIRPORT ELEFTHERIOS VENIZELOS

ΟΡΓΑΝΙΣΜΟΣ ΡΥΘΜΙΣΤΙΚΟΥ ΣΧΕΔΙΟΥ & ΠΡΟΣΤΑΣΙΑΣ ΠΕΡΙΒΑΛΛΟΝΤΟΣ ΑΘΗΝΑΣ

Transportation Engineering

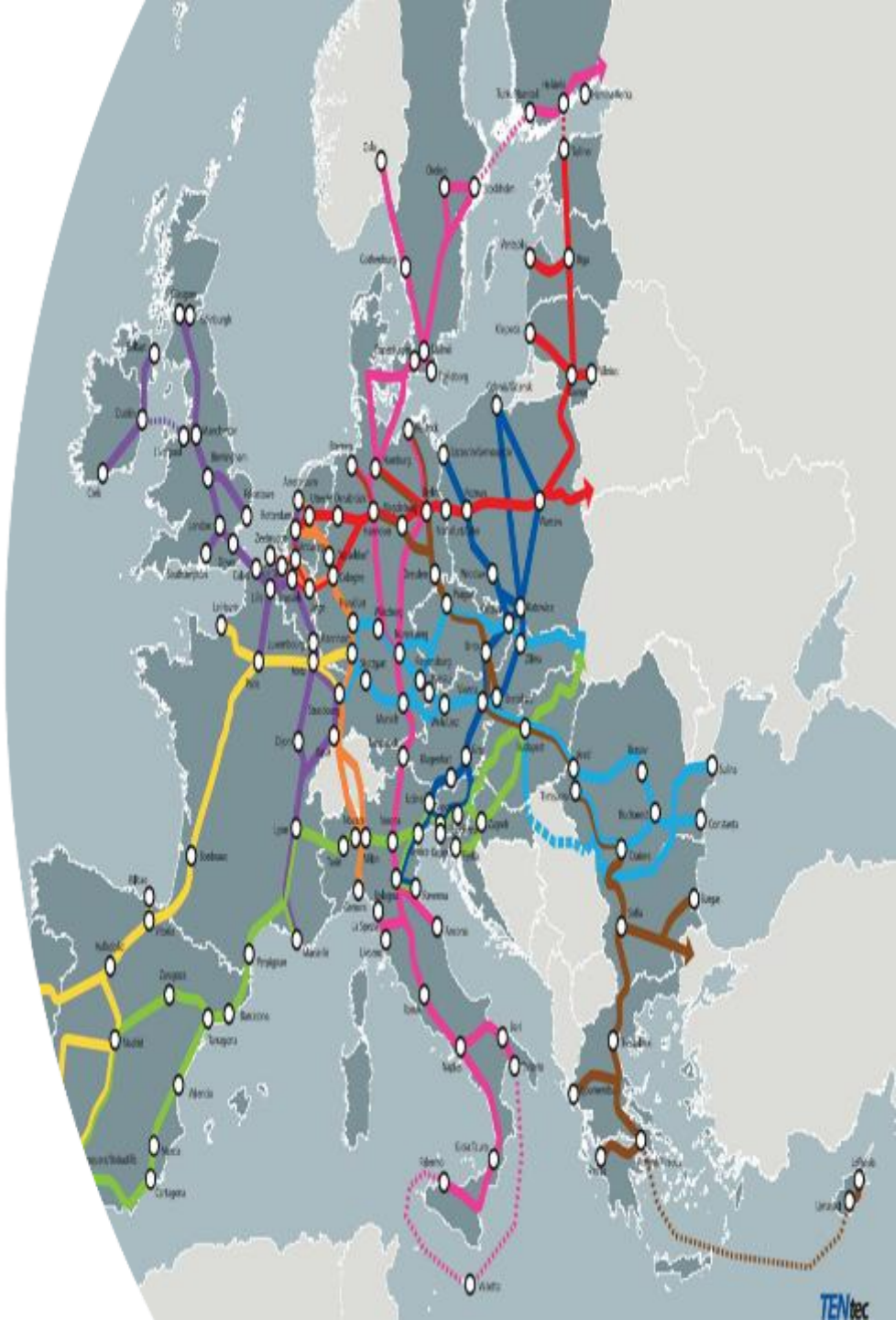
Transport Infrastructure in Greece

- **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 (1/2)

Transportation projects in all phases

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

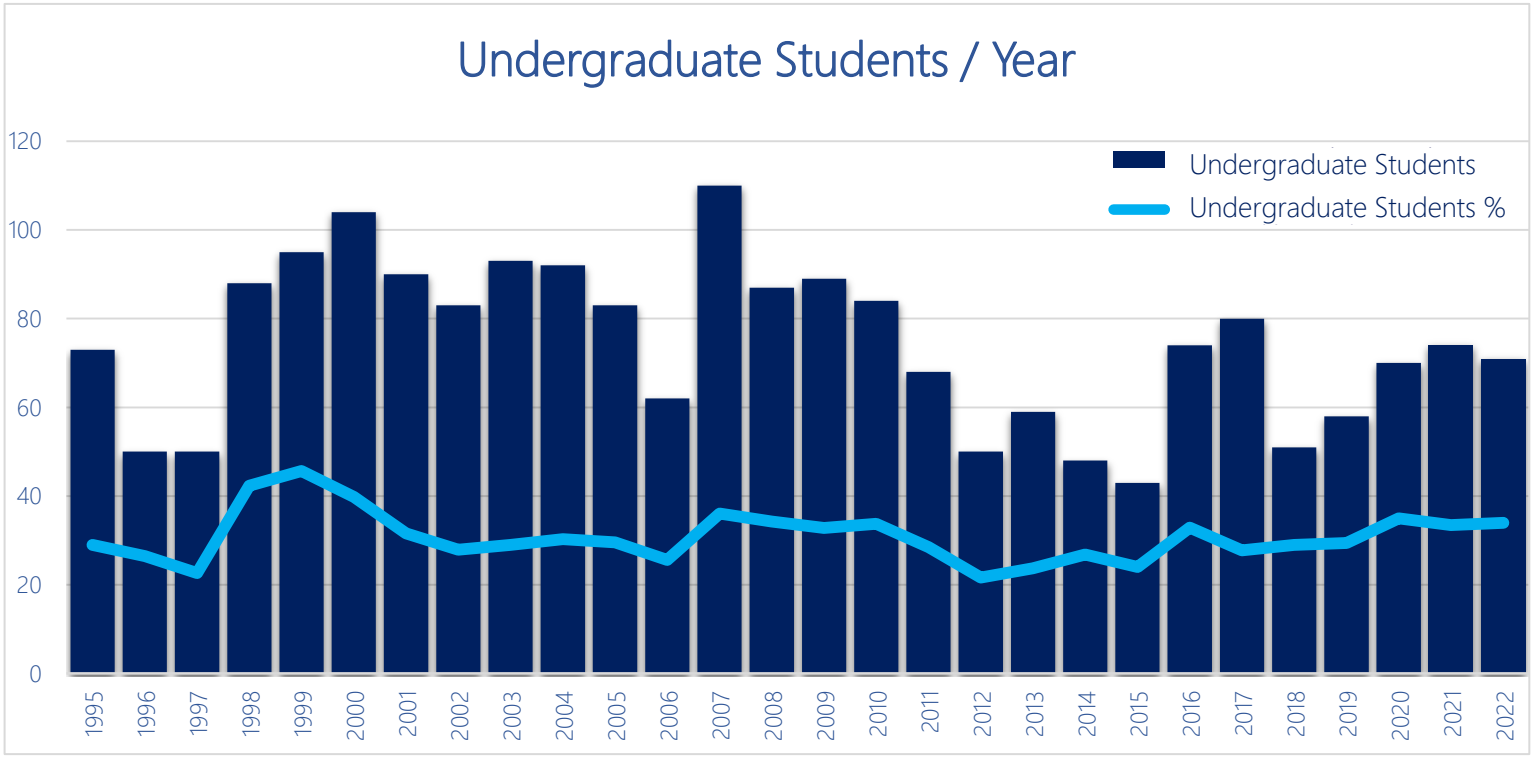
- Tendering
- Construction
- Delivery for operation

- Operation
- Management
- Maintenance

Education

Undergraduate Students

Civil Engineering - Transportation Cycle



Courses

The Department offers:

- 21 **undergraduate courses** at the School of Civil Engineering (compulsory and elective for all civil engineering students and all students of the transportation cycle)
- 4 **undergraduate courses** at NTUA Engineering Schools
- 5 **postgraduate courses** at NTUA Engineering Schools

Courses - Transportation Cycle

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

Courses - Other

Courses at the School of Civil Engineering and other Schools

- Laboratory on Materials
- Roads Geometric Design
- Roads Construction
- Transportation Systems Planning
- Environmental Impacts
- Practical Training
- Highway Engineering IV (Construction elements of road works), SRSGE
- Highway Engineering I (Geometric Design of Roads), SRSGE
- Planning - Design - Operation of Road Works, SRSGE
- 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 - modern vehicles, **Energy Production and Management**
- Urban Transport systems, **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**

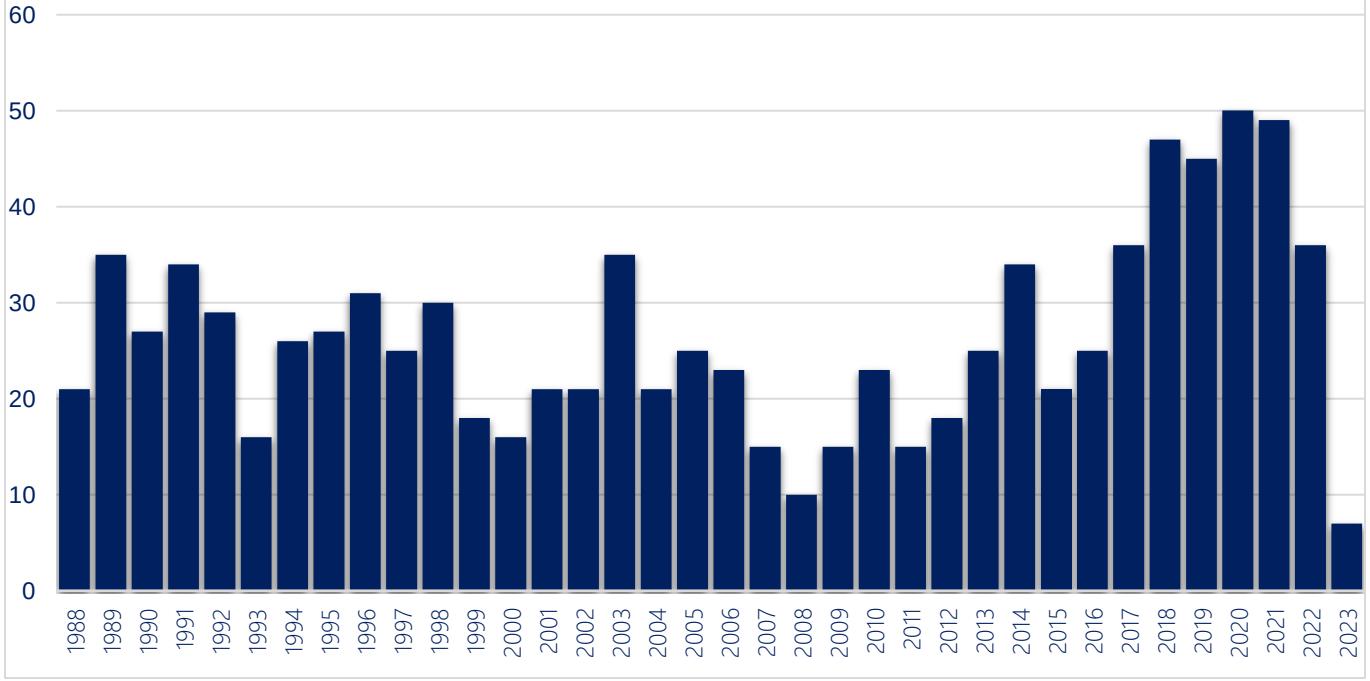
- Full **analysis** of current transportation situation
- **Transportation** (Internal and external transport analysis, Planning passenger / cargo ports and airports)
- **Traffic Engineering** (Traffic Analysis, Identification of high risk sites, Urban Mobility Plan)
- **Road construction** (Configuration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

Diploma Theses (10th semester)

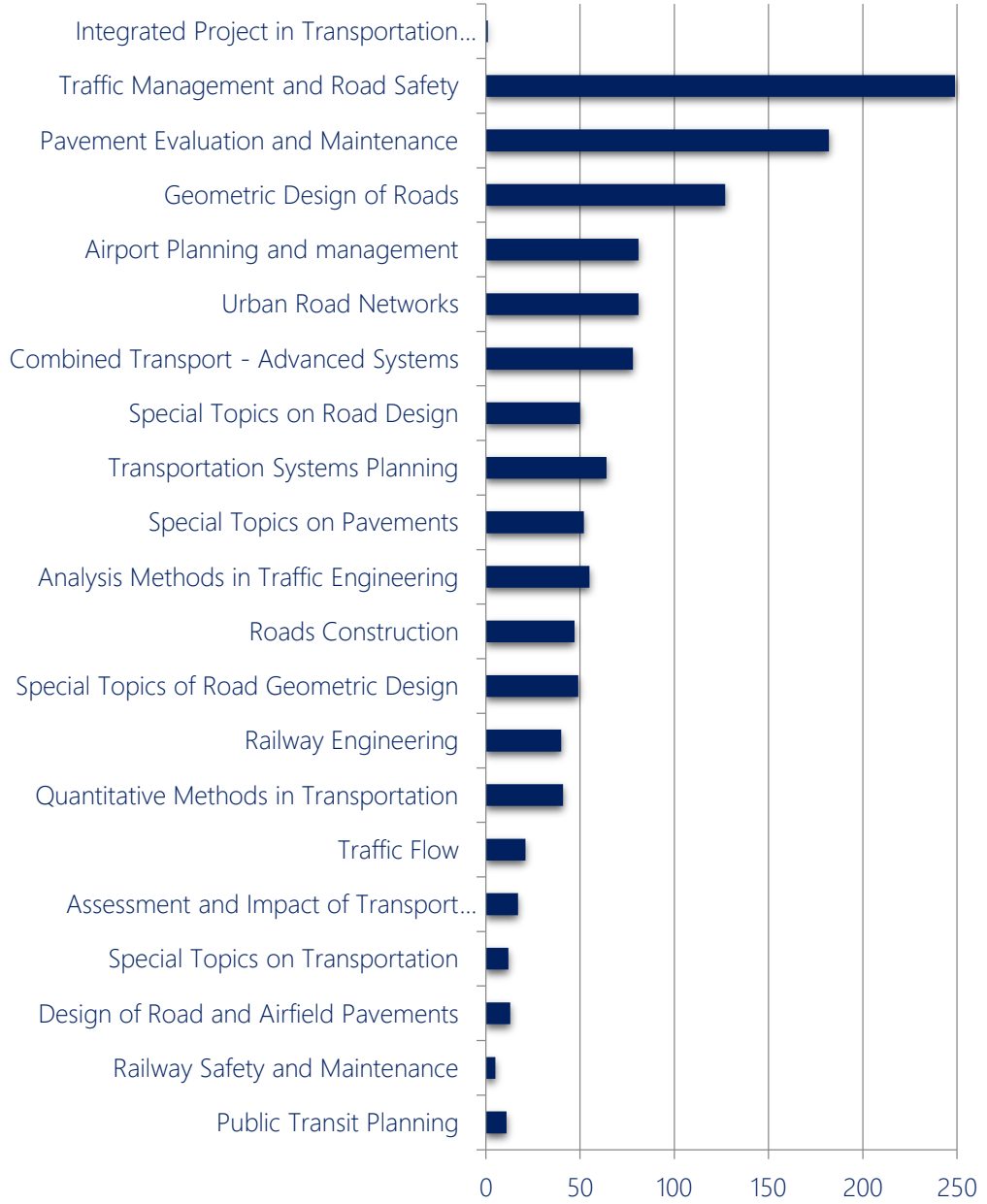
1276 Diploma Theses since 1975

26 Diploma Theses per year

Diploma Theses / Year



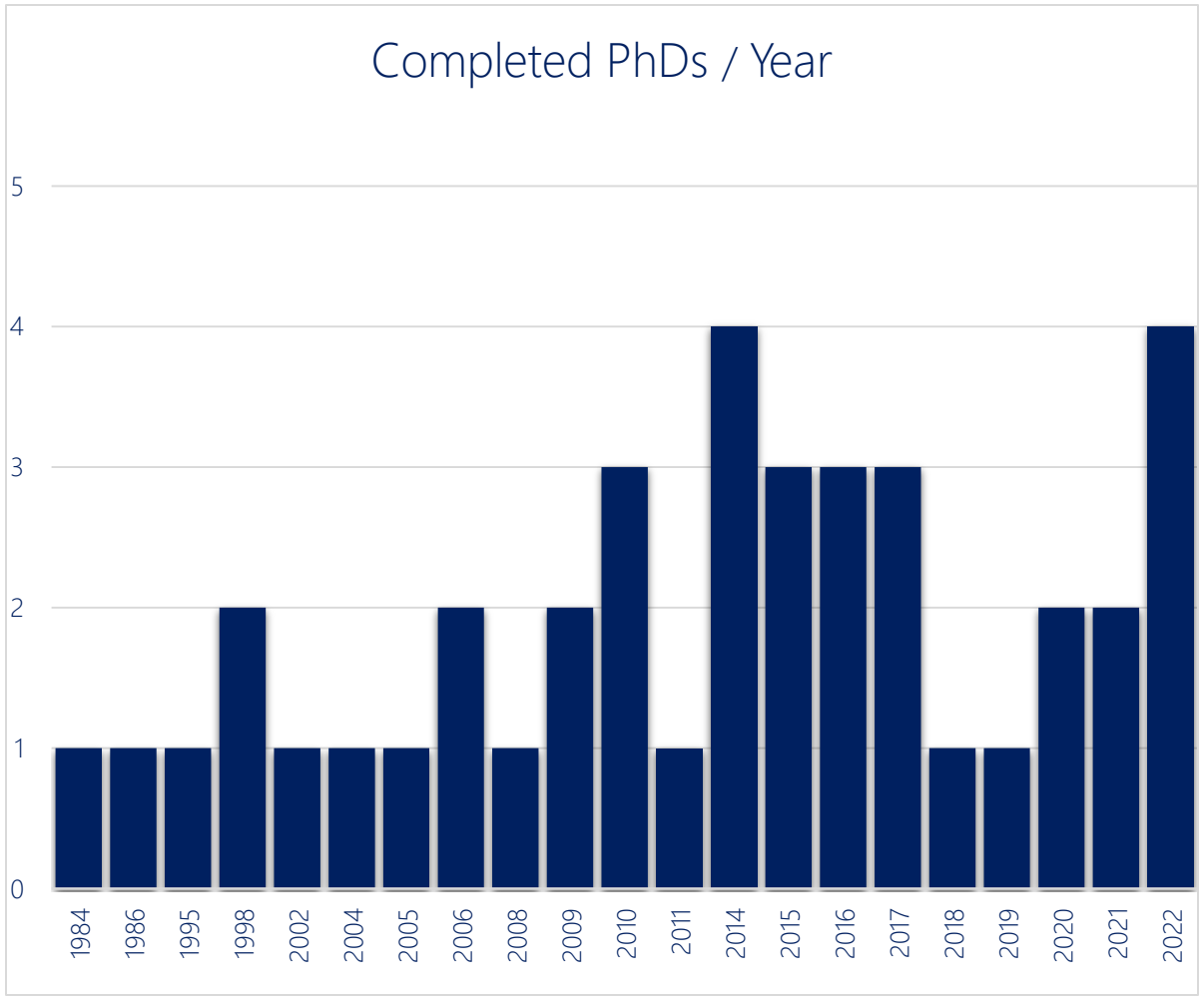
Diploma Theses / Course

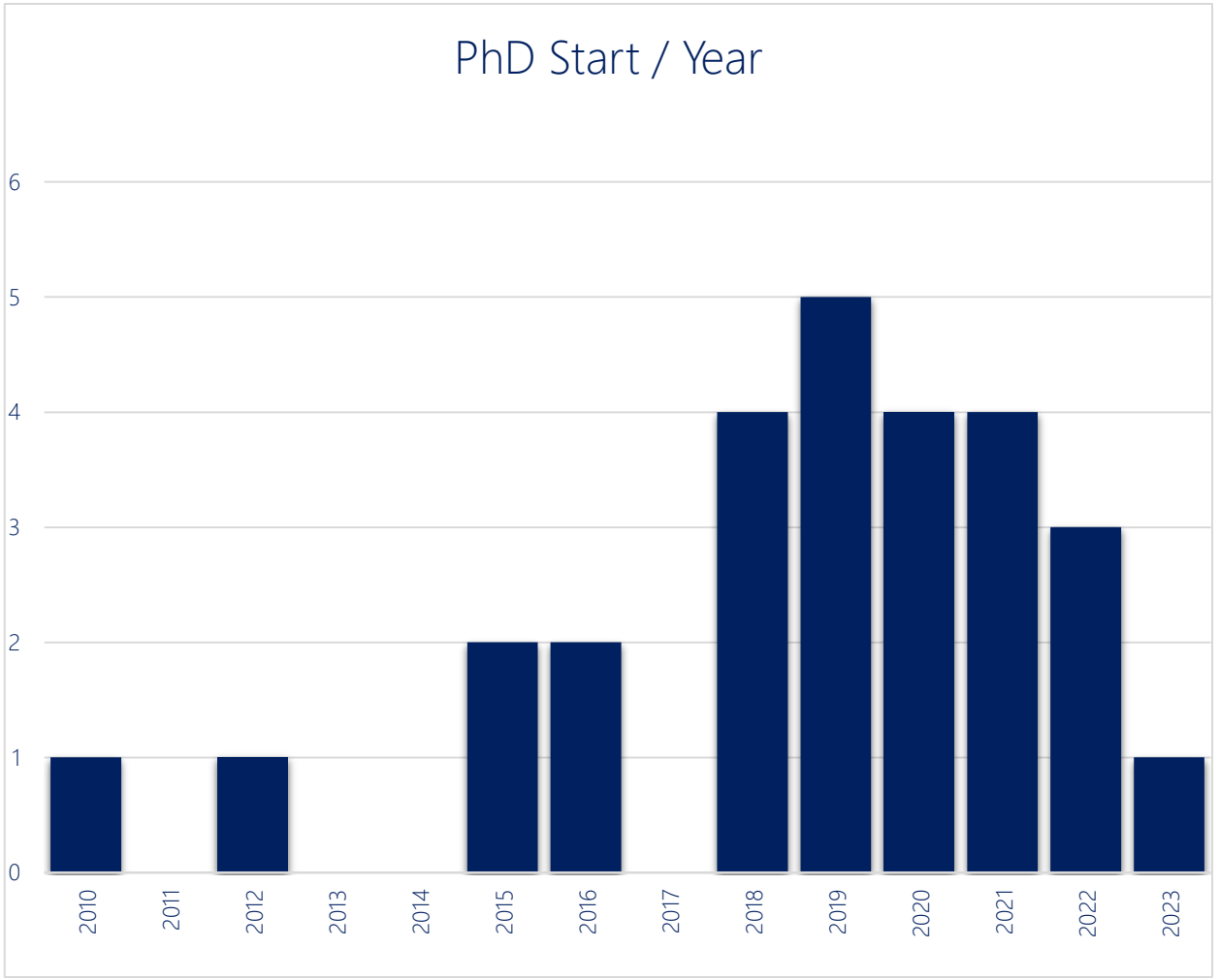


PhD Theses

40 PhD Theses Completed

27 PhD Theses Under Preparation





Conferences – Workshops

- **Road Safety Research Challenges,** NTUA - NRSO, 19/5/2023
- **Telematics and Driver Behaviour Workshop,** NTUA – NRSO, 4/4/2023
- **Road Safety & Simulation 2022**, NRSO - HITE, 8/6/2022
- **Innovation in Road Safety Research Workshop** online, NRSO, 20/5/2021
- **PIONEERing Solutions for the Smart City Challenge**, NTUA - Pioneer Alliance, 15/4/2021
- **NTUA - Innovation in Road Safety Research**, NRSO, 17/5/2019
- **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 - HITE, 12-13/3/2015
- **Road Infrastructure Safety Equipment** Technical Conference, NTUA - European Road Federation - HITE, 12-13/2/2015

Research

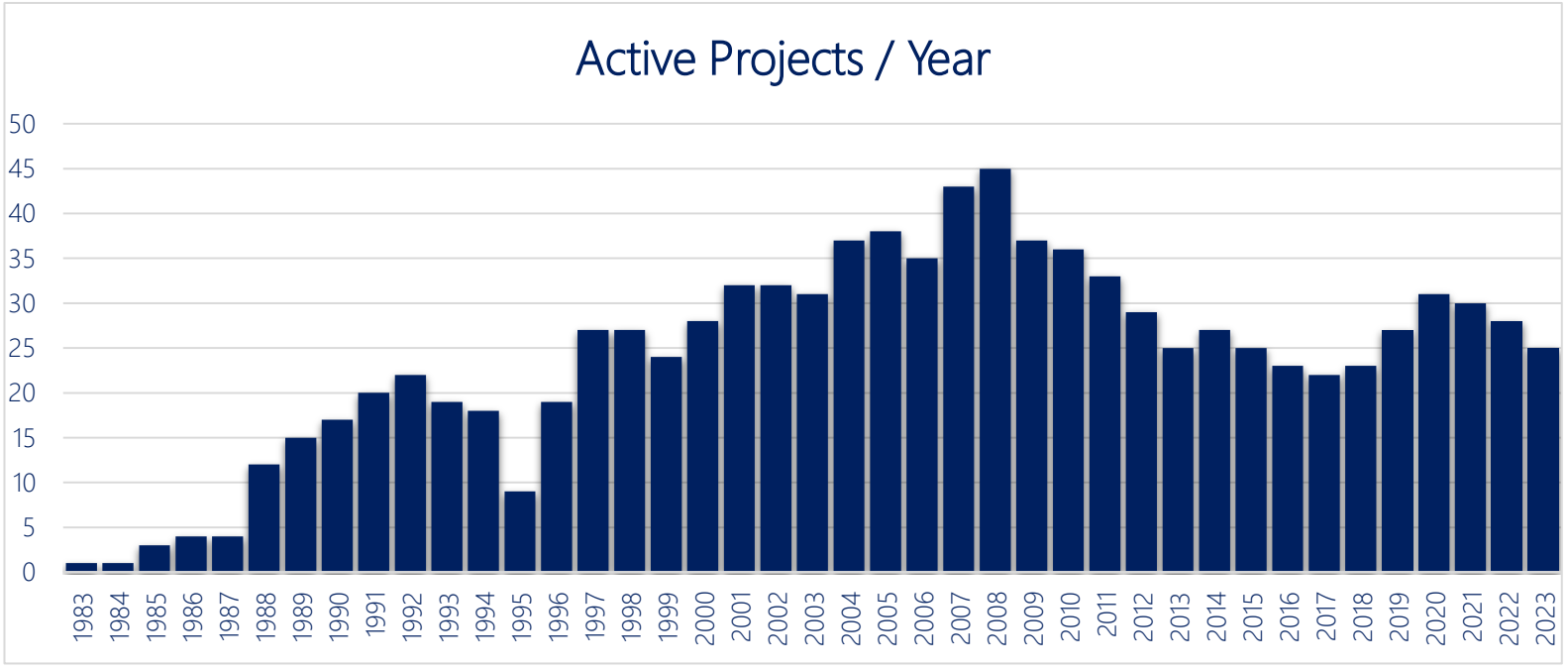
Research Projects

More than **370 Research Projects**

- **> 115** International
- **> 240** Greek

With more than **500 international partners**

More than **185** through highly **competitive** procedures



Scientific Publications

Publications in Journals	> 400
Publications in Conferences	>1.000
Presentations in Conferences	> 500
Citation Index – Scopus	> 6500
Citation Index - Google Scholar	> 11500

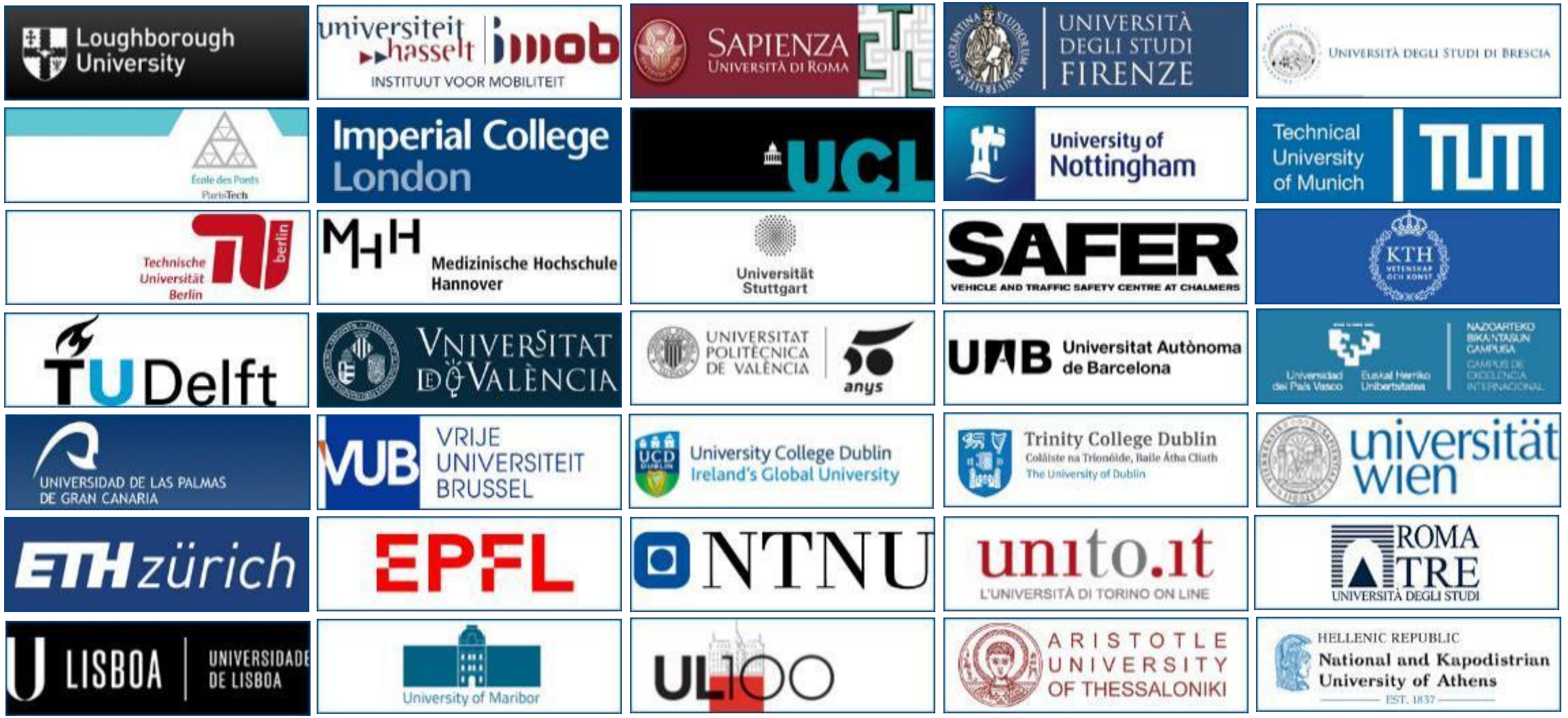
Cooperations and Partners

Our Cooperations Greece

Our Cooperations - Europe

Our Cooperations - Worldwide

Our Cooperations - European Universities



Our Cooperations - Universities Worldwide

Our Cooperations - 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 (1/3)

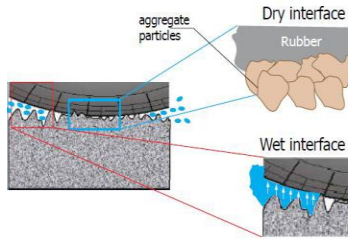
Section of Pavement Materials, Testing and Characterization

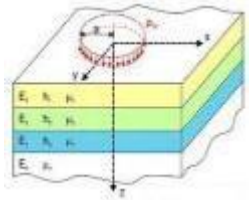
- Evaluation and proportioning of raw materials
- Materials (bound or unbound) testing and mechanical characterization
- Compaction
- Low-energy mixes testing and evaluation
- Assessment of alternative materials for pavement construction

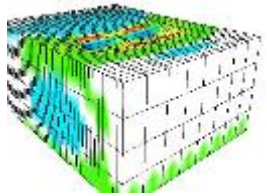
Laboratory of Pavement Engineering
Research Infrastructure and Priorities (2/3)

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





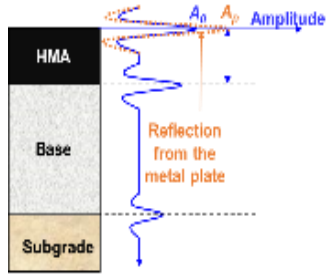


Laboratory of Pavement Engineering

Research Infrastructure and Priorities (3/3)

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
  - guidance
  - sight distance (stopping, passing, intersection)
  - 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):

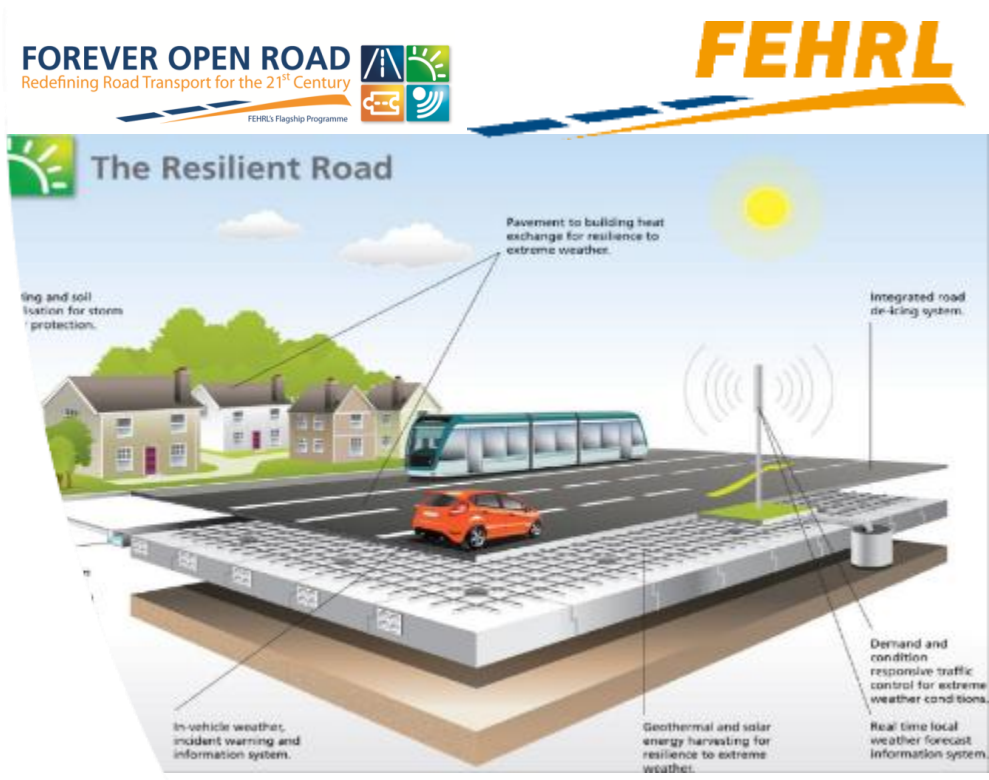
Ministry of Infrastructure and Transport
Central Public Works Department

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



Laboratory of Railways & Transport
Research Areas

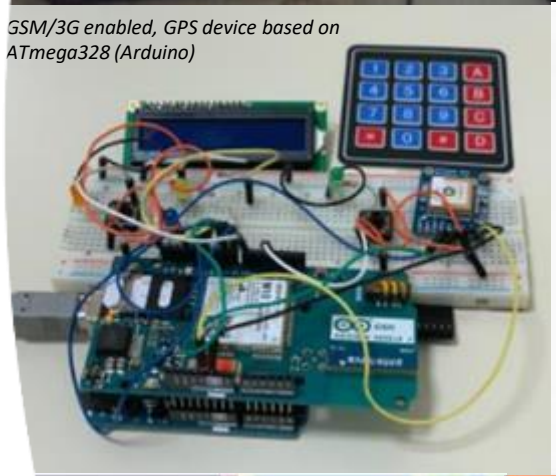
Established in: **1962**

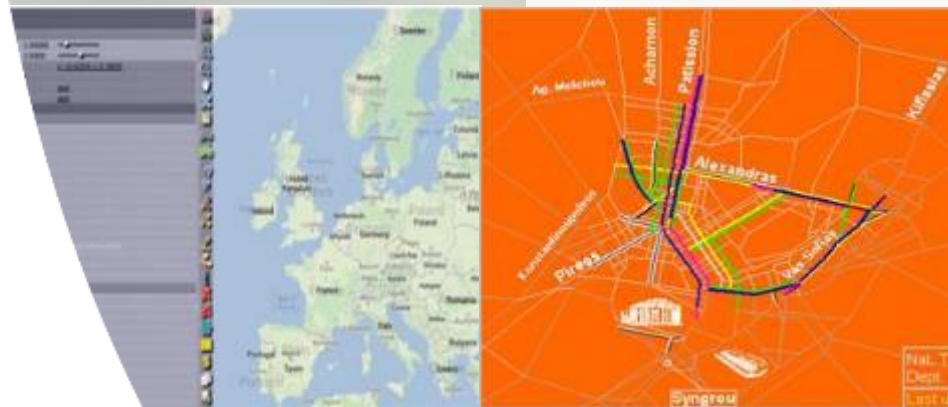
- **Public Transport** planning and control
- **Freight** Transport and Logistics
- **Airport** planning and operations
- **Railway** design an maintenance

Laboratory of Railways & Transport
Research Infrastructure

- Traffic load meters
- Traffic congestion map of Athens
- Rail stress measurement sensors
- Sound meters, video cameras and endoscopic cameras
- Oscilloscope, microcontroller application development tools
- Servers
- Geographic Information System (GIS)
- Specialised software (AIMSUN, ARENA, AnyLogic, Gurobi)

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 semitrailers

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
International Partnerships

TU Delft

TUM

UNIVERSITY OF TWENTE.

CHALMERS UNIVERSITY OF TECHNOLOGY

ectri

EPFL

TRB

UITP ADVANCING PUBLIC TRANSPORT

Laboratory of Railways & Transport
Key Research Priorities

- **Optimization** of **Passenger** and **Freight** Transport Systems
- **Optimization of Transport Systems Planning**
- Creation of **Intelligent Transport** decision making **Systems**
- Development of **research infrastructure** for transport & logistics
- **Wagon fleet management** (Balkan countries, development of smart OBD)
- Analysis of Greek **coastal** shipping and **air** services
- **Urban Freight** Truck routing
- **Freight villages** (legislation modernization)

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 Behavior & 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

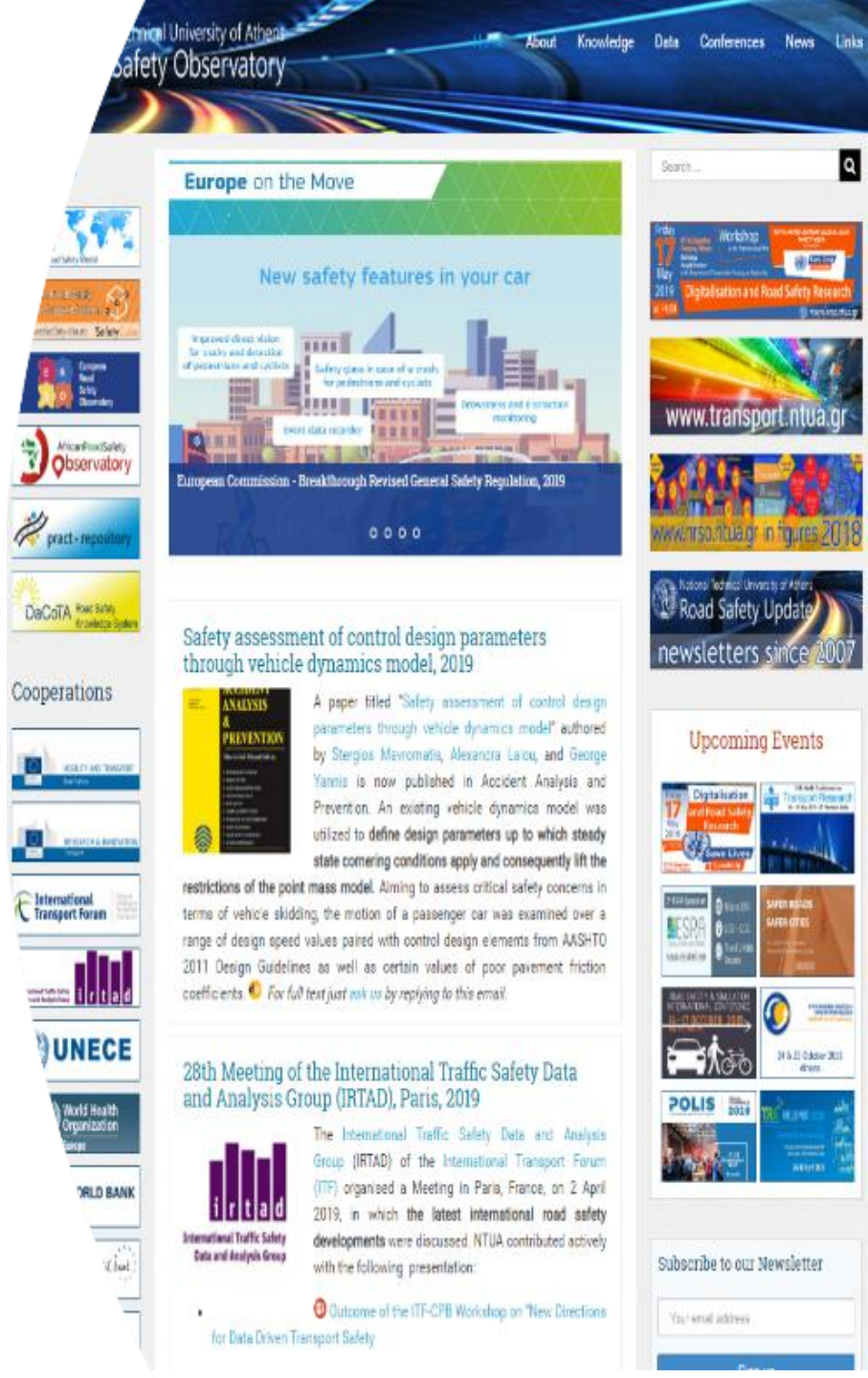
Laboratory of Traffic Engineering
Research Infrastructure

- **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

Information 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 Organizations (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 behavior
  - 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

May 2023