FACULTY OF TRANSPORTATION SCIENCES CTU IN PRAGUE

Introduction of the Faculty of Transportation Sciences CTU in Prague

Faculty of Transportation Sciences (Established 1993)

Our Role in CTU Ecosystem: System Integrators

At CTU, each faculty plays a unique role:

- → FS (Mechanical Engineering): designs vehicles and mechanical systems
- → FEL (Electrical Engineering): develops control units, sensors, automation
- → FIT (Informatics): focuses on AI, data, algorithms
- → FA (Architecture): designs urban space and infrastructure
- → FJFI (Nuclear Sciences): explores modeling, safety, advanced mathematics

FTS integrates their outputs into functional, intelligent transportation systems.
We link the physical, digital, and societal layers of mobility.

Our Mission

Educating top engineers and systems thinkers to tackle real-world transportation challenges with **a holistic, future-oriented approach**.

Our Vision

To be a leader in smart, sustainable mobility — linking people, technology, and systems through interdisciplinary research, education, and real-world impact.

Faculty of Transportation Sciences

We are unique…

We focus on the whole picture:
system dynamics, user behavior, technology, policy
We connect:
infrastructure with AI, vehicles with cities, research with impact
We lead: in sustainable and cooperative mobility, traffic management and control, logistics, smart cities and others
We innovate:
through interdisciplinary labs and real-world deployments

IN THE CZECH REPUBLIC

- → **in having adopted a specific form of project-oriented education**
- → **in having set up several unique scientific research facilities since 1993**
  - → project education closely linked with practice and collaborating on solving current problems in the field of transportation

IN THE WORLD

- → **in offering a coherent education dual-degree programme in Intelligent Transportation Systems (IS) and Smart Cities (SC)**
  - → closely linked with practical applications
  - → aimed not only at Czech students but also at foreign students at famous universities abroad (University of Texas at El Paso, USA and Linköping University, Sweden)

Faculty of Transportation Sciences
Faculty Departments

- → Department of Applied Mathematics
- → Department of Transportation Systems
- → Department of Applied Informatics in Transportation
- → Department of Languages and Humanities
- → Department of Vehicle Technology
- → Department of Smart Cities and Regions
- → Department of Mechanics and Materials
- → Department of Transport Telematics
- → Department of Air Transport
- → Department of Forensic Experts in Transportation

Faculty of Transportation Sciences
Study Programs

Bachelor's Degree Programs

- → **Technology in Transportation and Telecommunications study fields:**
  - → DOS Transportation Systems and Technology
  - → ITS Intelligent Transport Systems
  - → LED Air Transport
  - → LOG Logistics and Transport Processes Control

- → **Professional Pilot** (PIL)
- → **Technology of Aviation Maintenance** (TUL)

Master's Degree Programs / Ph.D.

- → Transportation Systems and Technology
- → Intelligent Transport Systems
- → Logistics and Transport Management
- → Air Transport Operations and Management
- → Smart Cities

Internationalization at FTS
Strategic Direction

FTS emphasizes global collaboration, mobility, and excellence in transportation research and education.

- → Expanding doctoral education and attracting international researchers.
- → Deepening participation in EU programs (e.g., Horizon Europe, EIT Urban Mobility, COST Actions, bilateral…).
- → Leading joint research with global partners, industry, and academic institutions.
- → Organizing international events, e.g. SCSP and NTCA (IEEE conf)
- → Summer Schools, workshops (e.g. with US students)
- → Dual-degree, Joint-degree study programmes, International MSC in Railway Engineering

Dual-Degree Study Programs
ITS & Smart Cities

ITS – joint-degree with Linköping University (Sweden)

Smart Cities – dual-degree with University of Texas at El Paso (USA)

New: International MSc study programme in Railway Engineering (Germany, Switzerland, Austria)

Programs promote:

→ Cross-border academic exchange.

→ Collaborative research projects.

→ Exposure to innovative urban mobility solutions.

→ Growing number of students from abroad (MSc/PhD).

LINKÖPING UNIVERSITY

UTEP

Global Professional Associations and Conferences

Active in **European Platform of Transport Sciences** and **Czech Association of Scientific and Technical Societies**.

Memberships:

- → **ALICANTO** - International Association of Aviation and Aerospace Education
- → **PEGASUS** - Aerospace Engineering Universities
- → **EPTS** - European Platform of Transport Sciences
- → **ERRAC** - European Rail Research Advisory Council
- → **EURNEX** - European Rail Research Network of Excellence
- → **FRAME** forum – organisation responsible for the European ITS Framework Architecture
- → **ITS-EduNet** - European Network for Training, Education and Outreach in the field of ITS

Organizers of **Smart Cities Symposium Prague** (SCSP)

Organizers of **New Trends in Civil Aviation** (NTCA)

Contributors to **European Transport Congress** and other events.

EURNEX

European Platform of Transport Sciences

ALICANTO

edunet foundation

ETRA European Transport Research Alliance

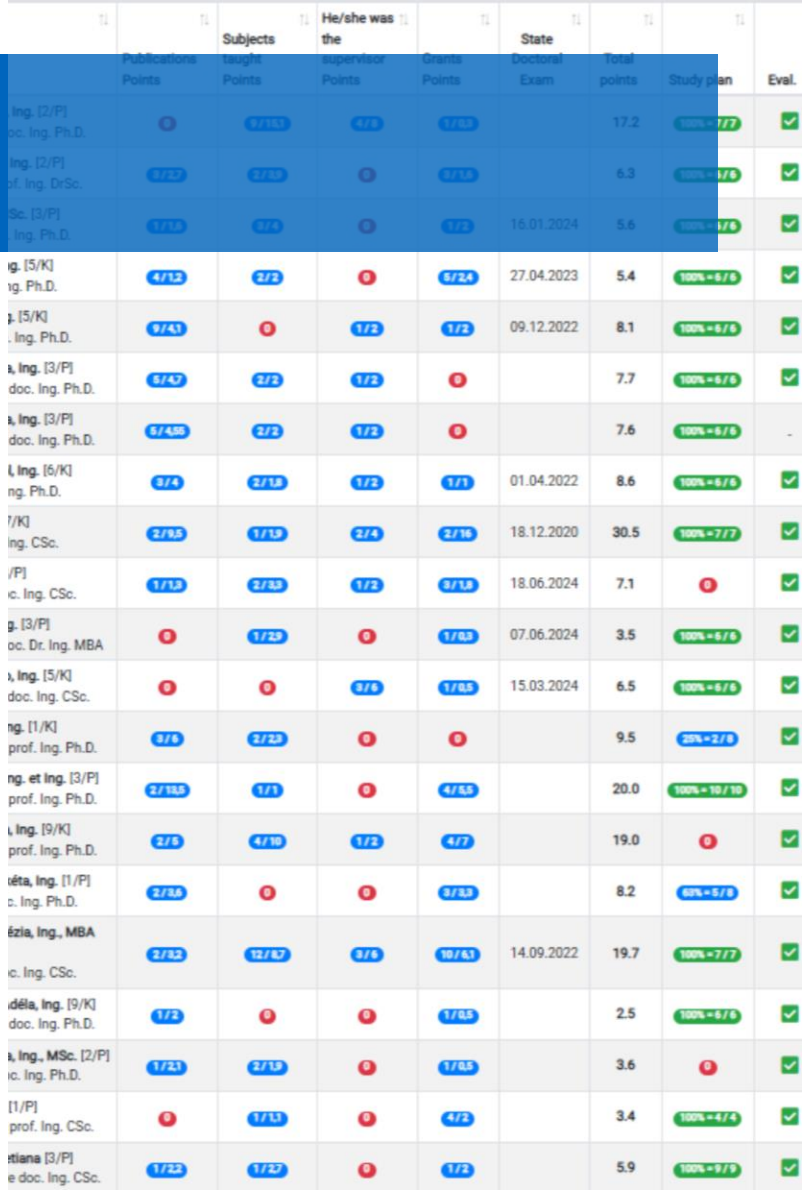
IEEE

ERRAC The European Rail Research Advisory Council

PhD Student Growth & Evaluation

- → 106 doctoral students in 2023 with **growing international presence** (still small number, ~ 10%).
- → **Research focus:** Smart Cities, ITS, Transport Systems/Technic, Logistics, Air Transport.
- → **Electronic system for evaluation of PhD students**, at least 2x year, monitoring of publication activity, grant activity, participation in conferences.
- → **Mandatory Abroad Experiences** & Training (1 month minimum)
- → Funding from Erasmus+, EIT Urban Mobility, and EEA Norway Grants.
- → Support includes scholarships and national grant programs.

Financial support for outstanding journal publications for young researchers.



Stronger Quality Framework for PhD Studies
Positive Impact Since Last Evaluation

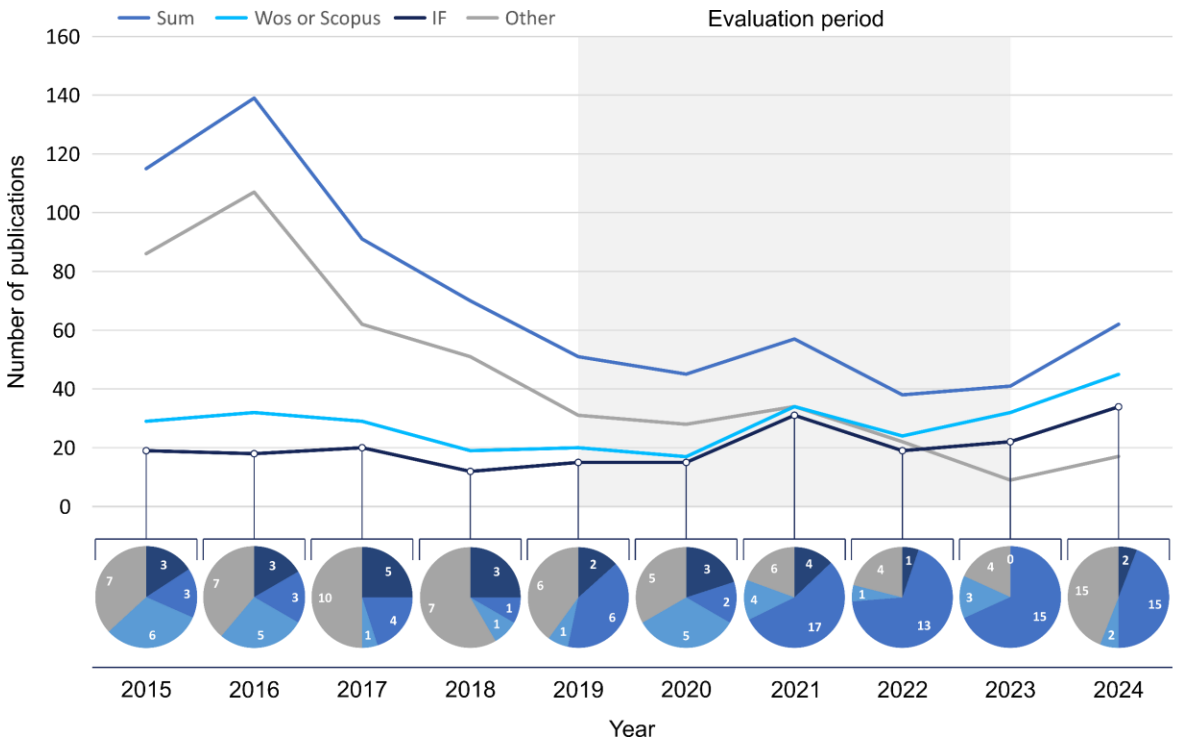
Strict academic benchmarks introduced (2021):

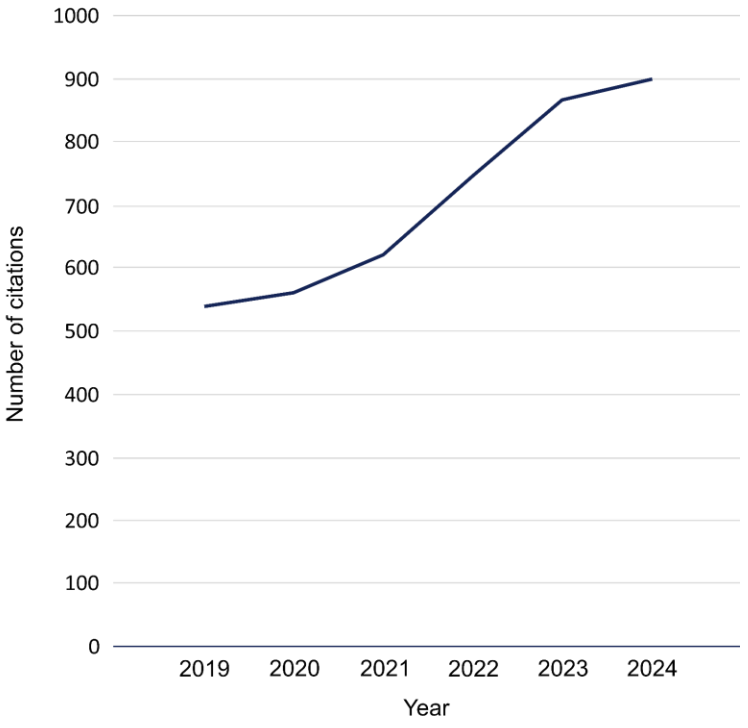
- → Minimum 2 WoS/Scopus impact-factor papers before defence (more expected)
- → ≥ 1-month international research stay
- → Bi-annual progress reviews via online portal assessed by supervisor, department head & Subject Area Board
- → Dean's directives & CTU regulations codify admissions, monitoring & defence procedures
- → Boards of the PhD programme rigorously approve thesis topics and check supervisor competence & research support

Impact:

- → Supervisor eligibility linked to publication & grant record; primarily associate professors or professors
- → Completion rate target raised to 50 %; early trend upward (though still not there)
- → Impact-factor publications from PhD work tripled 2019–23; citations also up markedly
- → More PhD projects funded by GAČR, TAČR & Horizon Europe, enabling international collaboration
- → Continuous quality culture: annual PhD boards reports & 5-year program reviews

Impacts of Measures to Improve Publication Activity and PhD Studies





High-Quality Doctoral Supervision & Evaluation

Dean's **Directive on Supervisors** requires:

- → **active** Associate Professors/Professors with strong publication record in recent (5) years & leadership of on-going research projects.
- → **annual review** of success rates for every supervisor can lead to reduced number of currently supervised PhD students.
- → **PhD Study Programme Boards** review each PhD topic & lab funding before approval.
- → **Online evaluation/progress system** with bi-annual reports assessed by supervisor, Head of Department & Board; red-flag triggers mentoring panel.

Faculty-wide self-evaluation day each year to discuss outcomes & share best practices. Best practices discussed at meetings with PhD students and supervisors.

Regular PhD seminars to bring researcher from different fields together & share best practices.

Postdocs and International Researchers

Visiting professors from e.g. NC State University (Billy Williams, Fuh-Gwo Yuan), UTEP (Carlos Ferregut), Austria (Zoltan Major), other as short term visits (see below)

Hosted foreign postdocs (CTU Global Postdoc Fellowship Programme and newly also MSCA Global Postdoc Fellowship).

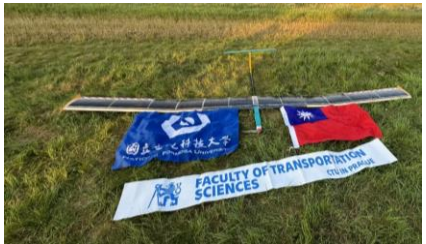
Visiting researchers from all over the world, e.g. Germany, Austria, … Taiwan, USA, etc. (typical: 2 week stay at a laboratory for a PhD student, 1 week with presentations/lectures for a professor)

Bilateral projects support long-term international cooperation (cross-border cooperation with Germany and Austria, GACR-supported bilateral projects, submitted projects with USA, Taiwan (new calls), TACR international projects)

Student Teams
Participation in international Competitions & Innovations

Support for teams in **international competitions** and projects:

- → **CTU Lions** – participation in Motostudent competition, see https://www.ctulions.cz
- → **Green Gliders** – student team in the fuel-efficiency competition – Shell Eco-marathon.
- → **Moonflyer** – in cooperation with National Formosa University (Taiwan) broke the record for continuous flight of a civilian unmanned aircraft.
- → **Other teams** in autonomous driving, smart infrastructure.



Research Motivation & Modern Funding Tools

Revised faculty financing model (2020-2024): performance-based budget rewards **high-impact publications** and income from **research project**.

Fund for the Future launched: seed money for risky, interdisciplinary pilot studies led by early-career teams.

Best Paper Awards for young researchers – financial award per papers accepted in Q1/Q2 journals; target: young researchers under 35.

Internal grant scheme - supports open-access fees and prototyping costs, accelerating idea-to-impact cycle.

Sharp growth in external grants: +40 % GAČR & +35 % TAČR projects, and also Horizon Eurc grants.

Talent Attraction, Teaching Excellence & Support for young researches/talents

Flagship scholarships & marketing campaign **increased MSc applications** by 30 % (2024 intake).

New **Teacher of the Year Award** celebrates innovative pedagogy; first laureates honoured at Academic Day 2025.

Foundation Courses 'Math for first-year students' offered to bridge incoming students' gaps.

Active cooperation with **Student Club** (CTU Lions, Green Gliders) – joint hackathons, outreach to high-schools (one faculty high school, more to come).

Relaunched English-friendly faculty **website** with interactive labs map.

Focus on **large joint projects** with industry & cities – Digital Twins, Sustainable Logistics, Urban Air Mobility.

Strengthen **support for young researchers**: start-up funds, mentorship network, grant-writing bootcamps.

Strategic Cooperation with Industry
Flagship Platforms & Growth Targets

- → **Industrial Council** (25 executives guiding R&D and curriculum)
- → Over €8.5 m contract research in 2021-2023
- → **Railway Competence Centre** Dětenice with industry leader AŽD Praha
- → Chairing the Czech Association for Autonomous and Cooperative Mobility (CzeCCAM)
- → Expert panel for strategy of transport telematics for TSK
- → Membership of professional organizations and advisory boards
- → Autonomous Smart Rail trolley demo vehicle (students involved, both MSc & PhD)
- → **CzeCCAM** living-lab for V2X/5G (Škoda Auto, Siemens Mobility, T-Mobile)
- → Student & SME hackathons via Transportation Studio
- → 2025-28 roadmap: €10 m contract R&D, new corporate PhD tracks, hydrogen-train module at Dětenice
- → More **industrial PhDs** (topics supported by our lead industry partners)
- → More **PhD students and postdocs** from abroad (competetive salaries problem)

T-Mobile

Prague Airport

SIEMENS

Air Navigation Services of the Czech Republic

era

AŽD

EUROCONTROL

ŠKODA

Faculty of Transportation Sciences
International Conferences

Smart Cities Symposium Prague

- 12th edition in 2026
- the multidisciplinary forum for exchanging ideas and best practices in the field of Smart Cities not limited to theory but also including real world applications
- symposium connects researchers with different background to participate and share their findings
- it covers whole range of topics, from the system point of view, through data mining and data processing, smart grids, up to multi-agent systems and other soft computing approaches

New Trends in Civil Aviation

- 25th edition in 2026
- international conference focused on civil and military aviation, bringing together researchers, practitioners, and industry professionals to exchange knowledge and discuss innovations in the field.
- fostering collaboration between academia and industry.
- Topics cover a wide range of aviation-related areas, including air traffic management, aircraft technologies, unmanned systems, human factors, safety, and emerging digital solutions.

IEEE Scopus® Clarivate Web of Science™

Faculty of Transportation Sciences

Establishment of a Railway Competence Centre in Dětenice

Faculty of Transportation Sciences

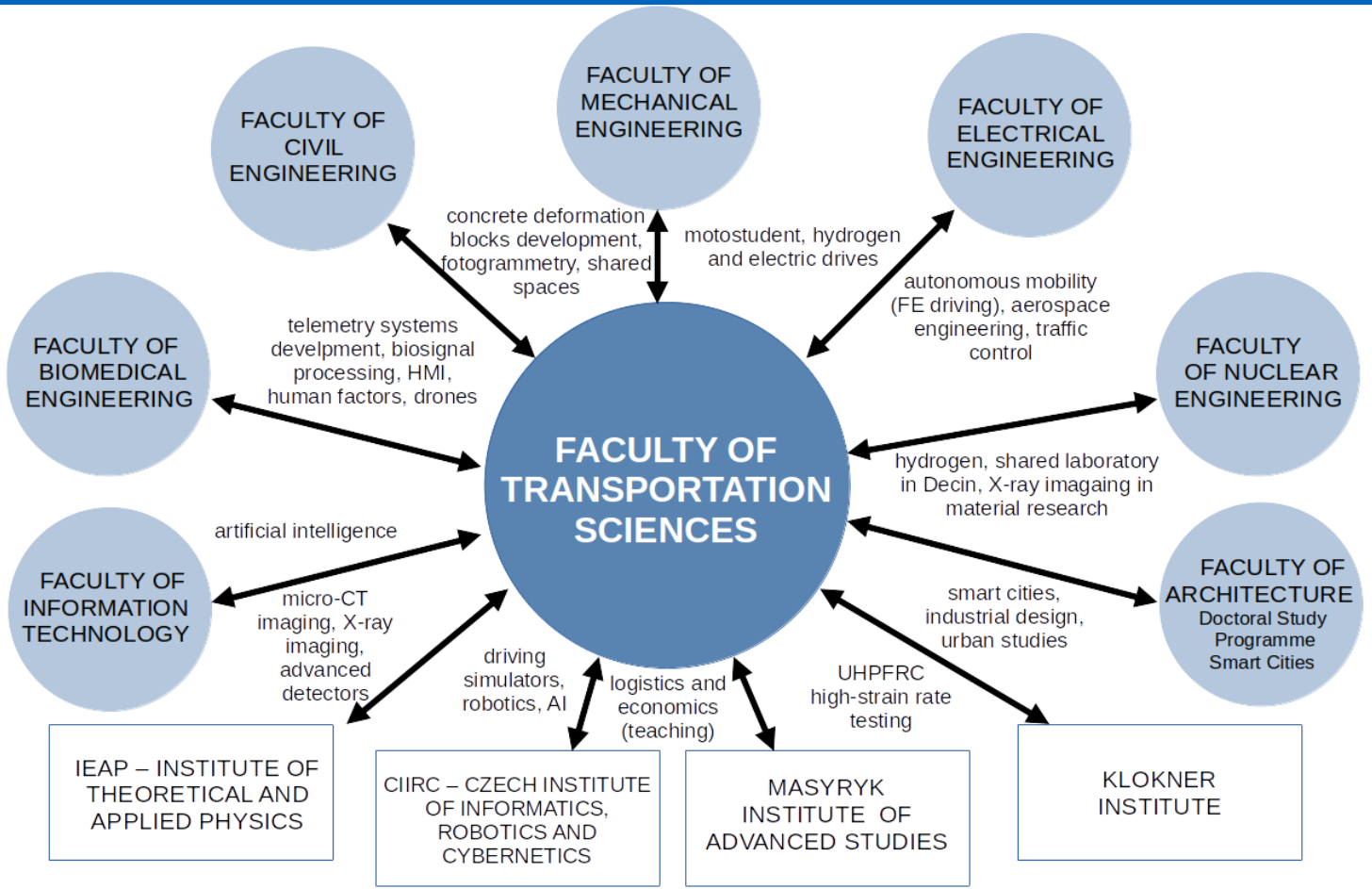
Awarding the Title of Faculty-Affiliated Secondary School

Faculty of Transportation Sciences
Programme Ukraine – Aviation Training Support

- → Financed and endorsed by the Czech Government as part of broader post-war reconstruction efforts
- → Joint initiative of the Czech Ministries of Foreign Affairs, Education, and Industry & Trade
- → Focused on practical aviation training for Ukrainian partners during wartime recovery
- → 18 Ukrainian pilots trained to date
- → Academic and organizational support provided by the Faculty of Transportation Sciences, CTU in Prague
- → Implemented in close cooperation with the Kyiv Aviation Institute
- → A tangible example of capacity building and long-term support for Ukraine's civil aviation sector

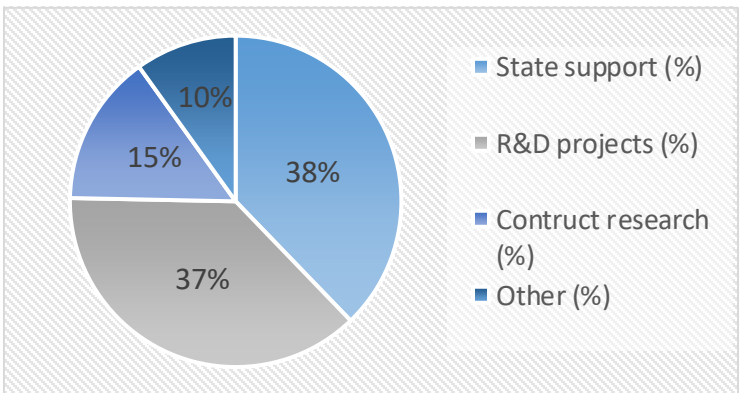
Faculty of Transportation Sciences

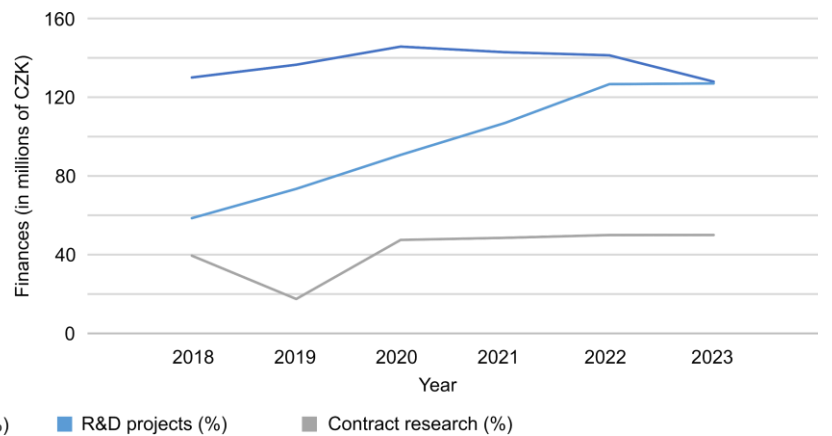
Cooperation is the key for success – within CTU



Faculty of Transportation Sciences
Financing

Year	2018	2019	2020	2021	2022	2023
State support (CZK)	130 022 254	136 515 395	145 704 797	142 837 042	141 283 863	127 912 549
State support (%)	53 %	52 %	48 %	43 %	40 %	38 %
R&D projects	58 546 821	73 486 889	90 686 118	106 918 312	126 639 721	127 000 000
R&D projects (%)	24 %	28 %	30 %	32 %	36 %	38 %
Contract research	39 493 447	17 486 889	47 503 492	48 557 792	49 988 725	50 000 000
Contract research (%)	16 %	7 %	16 %	15 %	14 %	15 %
Other	17 187 320	34 998 255	21 960 092	33 867 473	31 657 983	33 532 456
TOTAL	**245 249 842**	**262 446 911**	**305 854 499**	**332 180 619**	**349 570 292**	**338 445 005**





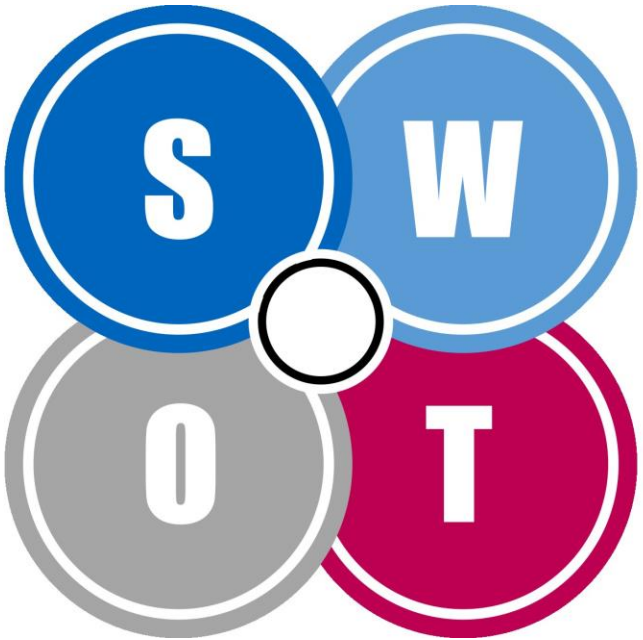
SWOT Analysis

STRENGTHS

Strong links with industry & public sector (internships, projects).
Active in EU/international research (Horizon, CEF, etc.).
Supportive academic environment, early student research involvement.
Applied research with real-world impact.

OPPORTUNITIES

High demand for experts in smart & sustainable mobility.
More applied research & funding via industry partnerships.
Expand international & hybrid study programs.
Grow lifelong learning for public & private sectors.



WEAKNESSES

Chronic underfunding limits infrastructure & talent retention.
Low internationalization; few English-taught programs.
Complex, fragmented administration; limited digital tools.
Outdated facilities; lack of modern shared spaces.
Weak long-term financial support from industry.

THREATS

Brain drain due to low salaries and unclear career paths.
Systemic underfunding and burdensome grant schemes.
Weak coordination across departments.
Limited support for international students & researchers.

Research Highlights

Konviktská Building

- → Certilab Laboratory
- → Urban Engineering and Lighting Technology
- → Laboratory (LAMIST)
- → Passenger Handling and Information Systems Laboratory
- → Traffic Control and Modelling Laboratory
- → Tunnel Systems Laboratory

Horská Building

- → Transport Hall of the Faculty of Transportation Sciences
- → Mobile Laboratory for Transport Analyses
- → ATM Systems Laboratory
- → Human Factors and Automation in Aviation
- → Air Transport Operations Laboratory (incl. Simulators)
- → Laboratory of Measurement Methods in Transport
- → Laboratory of Interactive Vehicle Simulators
- → Vehicle Research Laboratory

Florenc Building

- → Laboratory of Applied Mathematics in Transport and Logistics (LAMbDA)
- → Electron Microscopy Laboratory
- → Experimental Mechanics Laboratory
- → Laboratory for Dynamic Testing of Materials and Structures (DYNLAB)

Děčín Building

- → Annotation Center
- → Simulation and Visualization Laboratory
- → Vehicle Simulator

Our Laboratories
Driving Simulation Research Group

- → **Design and construction of driving simulators**, including hardware design (moving platforms, vehicle cockpits, steering wheel simulation) and complete creation of virtual environment for these simulators.
- → Studying and evaluation **of driver behaviour** and development of suitable methods and technics for driver behaviour evaluation.
- → Creating of different **virtual environments for driving simulators**. Design and creation of the special software modules for automatic scene generation for new scene design.
- → Research and development of possible methods to use **GIS data for scene creation** (generation of the landscape and road characteristics based on real geographic data) to maximize the impression of reality in the driving simulators
- → **Research in the area of HMI**, impact of HMI design (radio controls, climate control or navigation system HMI evaluation) on driving quality
- → Driver's behaviour evaluation in critical situations such as driving inside road tunnels, or under fatigue and etc. Those methods are mainly based on **evaluation of complex biological (EEG) and technical data** measured during the experiment.

Our Laboratories
Mobile Laboratory for Traffic Analysis

- → focused on the support of project-oriented teaching in bachelor's and master's study programs and on the support of scientific research activities of the faculty even within doctoral study programs
- → one of the main tasks of the laboratory is to ensure **traffic engineering data and traffic characteristics** directly from field research e.g., traffic intensity, noise, road condition, accidents)
- → focuses on the processing of data
- → the laboratory is equipped with state-of-the-art measuring technology, which enables extensive data collection of all kinds
- → closely works with the **Capital City of Prague**, to which it has been supplying data for 5 years to update the **transport model** of the entire territory
- → also deals with the analysis of traffic at rest, including the **movements of people** near shopping centers

Our Laboratories
Transportation Hall

- This project uses the Transportation Hall, a laboratory designed for practical **research in the field of railway security technology** and **railway traffic management technology**.
- With the help of simulations, newly developed systems for the control and security of railway traffic are being tested, which optimize train movements, enable efficient use of infrastructure and increase the safety of railway traffic.
- Further development of the Traffic Hall aims at the development of a **train simulator**, which will enable practical training of train operators and train protection systems, including the ETCS system.

Faculty of Transportation Sciences

U SMART ZONE – Virtual Testing Polygon (Děčín)

- → Advanced virtual testing environment for **autonomous and ADAS vehicle systems**.
- → Functions as a near-complete **digital twin of an urban road network**.
- → Enables complex, heterogeneous, and stochastic simulations for traffic and vehicle testing.
- → Supports Human-in-the-Loop (HiL) and Vehicle-in-the-Loop (ViL) scenarios.
- → Focus on **evaluating human behavior and vehicle responses in realistic simulations**.
- → High-fidelity visual rendering with support for parallel testing – same road segment tested in real and virtual environments.

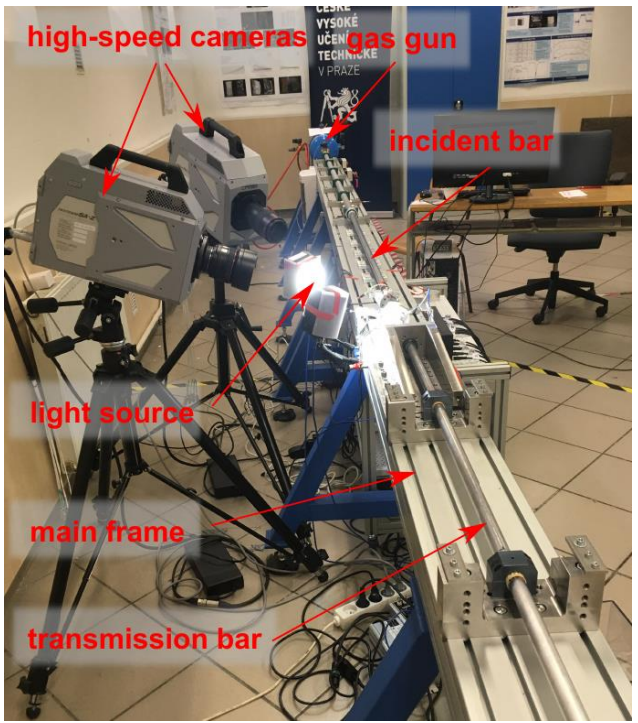
REAL SCENE

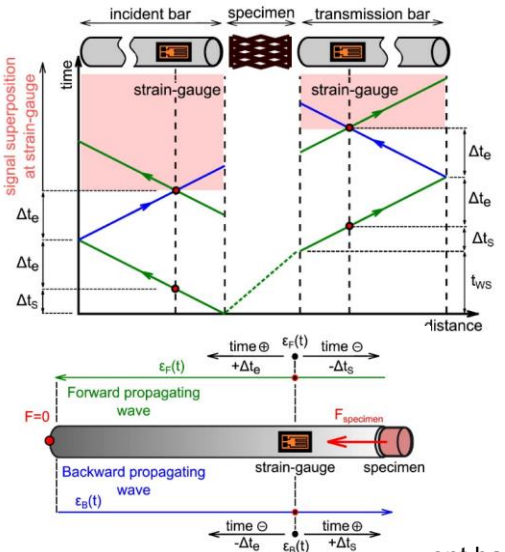
VIRTUAL SCENE

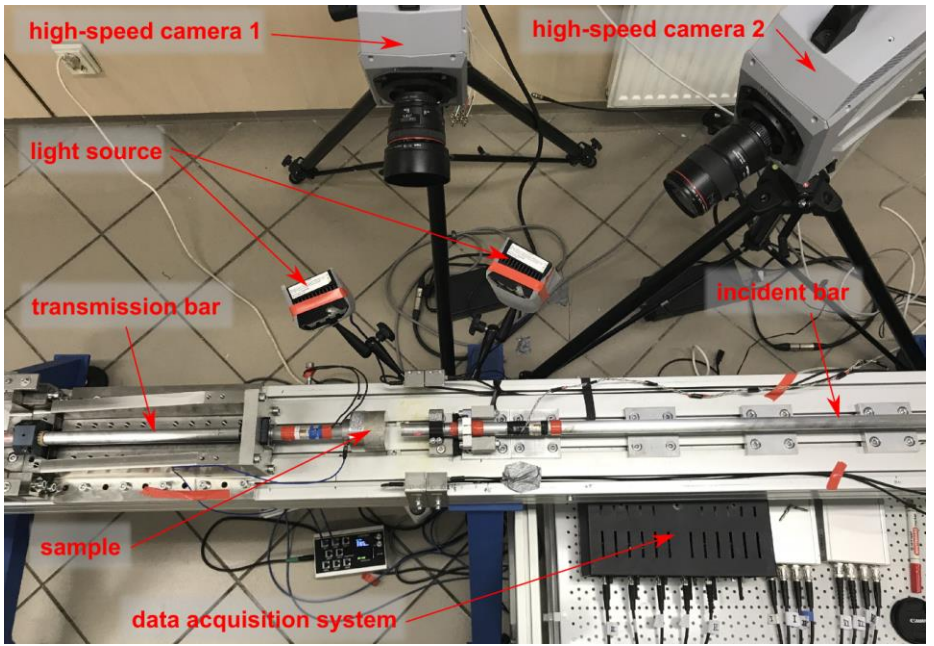
DYNLAB

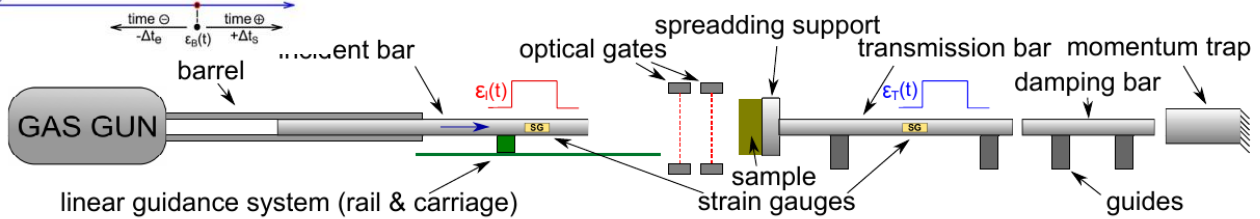
Laboratory for dynamic testing of materials and structures

- → SHPBs (Split Hopkinson Pressure Bars)
- → OHPB (Open HPB, instrumented strB)
- → Drop tower, LIMA (Linear Motors) – all designed by students during PhDs





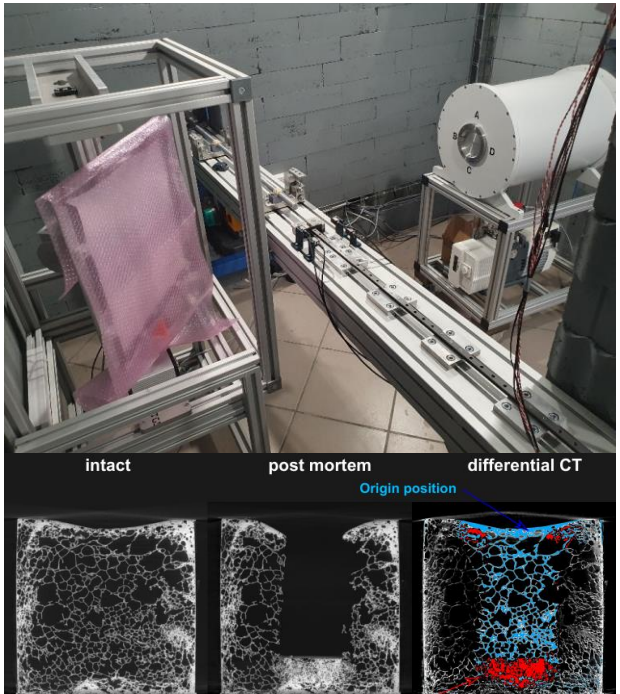


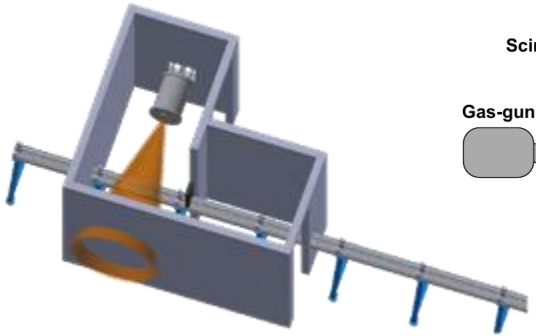


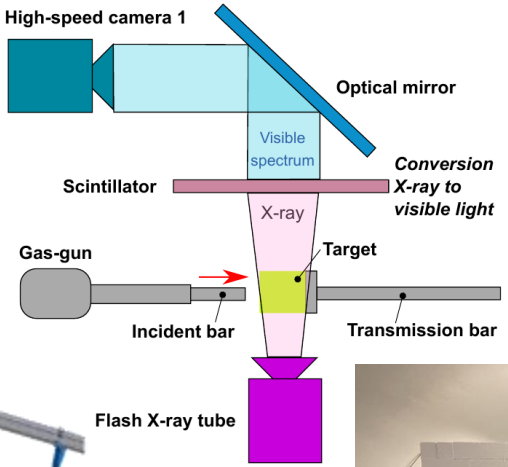
DYNLAB
World unique Flash X-ray lab

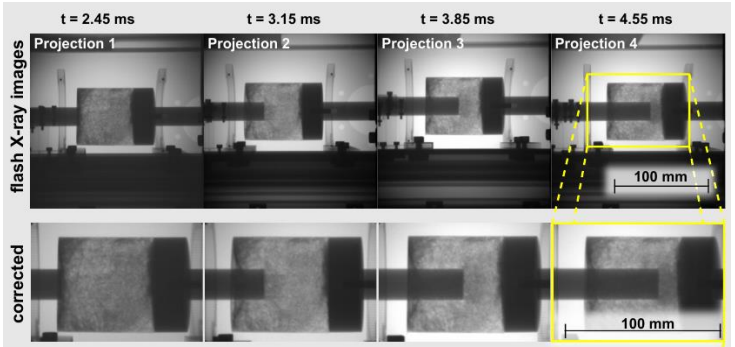
Flash X-ray system (Scandiflash SCF300, 300kV, 10kA, 20ns pulse, 1 µs gap, 18mm steel at 2.5m)

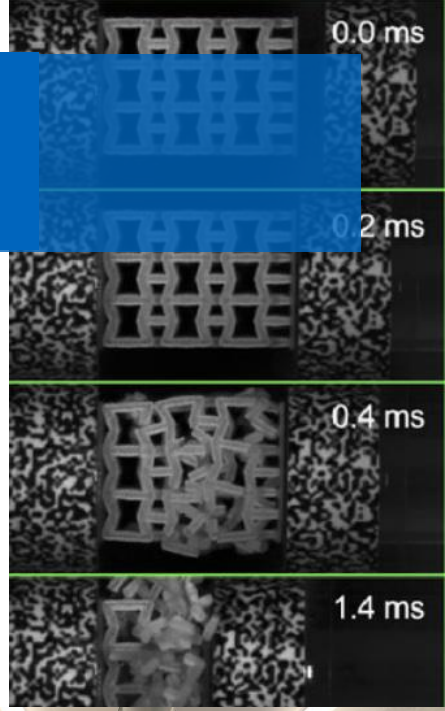
- → Multianode tube & Marx surge generators
- → Scintillators, High speed cameras (2x Photron SA-Z)
- → Capture deformation behaviour, FE modelling





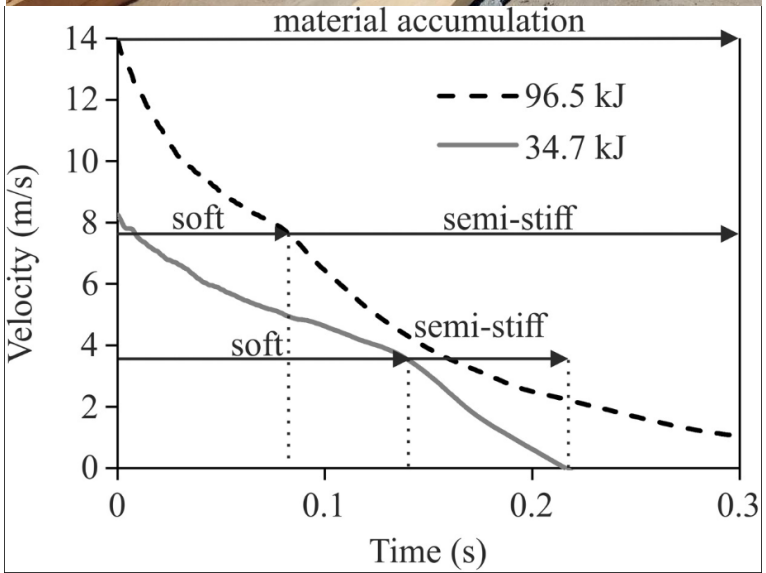


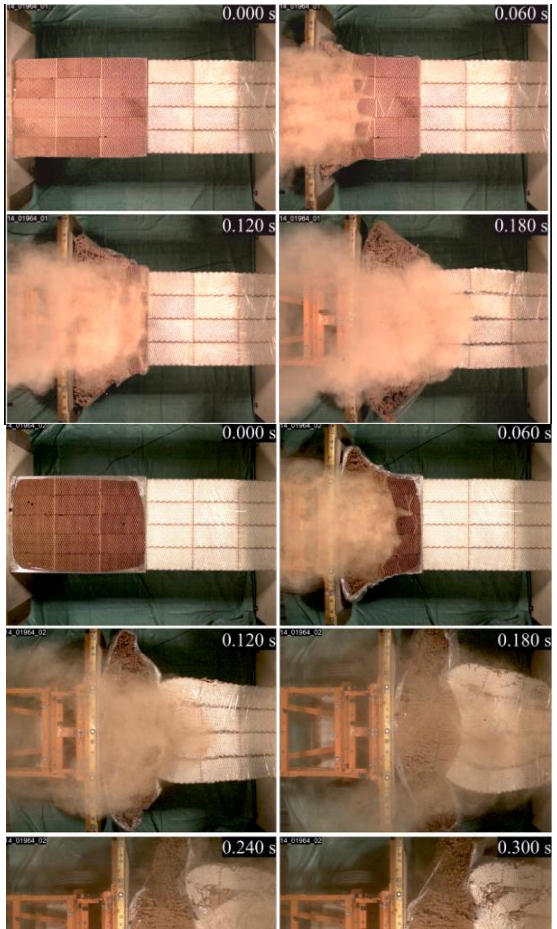




Department of Forensic Experts in Transportation

Ceramic blocks with thin-walled cellular structures under impact loading





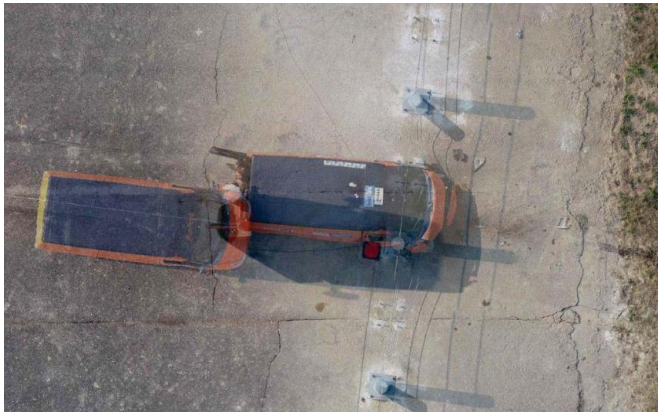
Collision of Skoda Fabia vehicle with deformable ceramic blocks

Department of Forensic Experts in Transportation

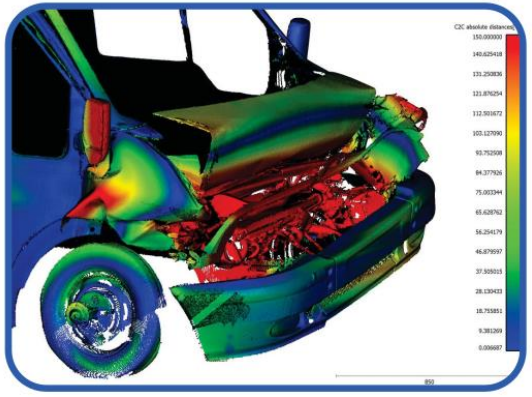
Dynamic Tests of the Protective and Security Barrier System PROBAR

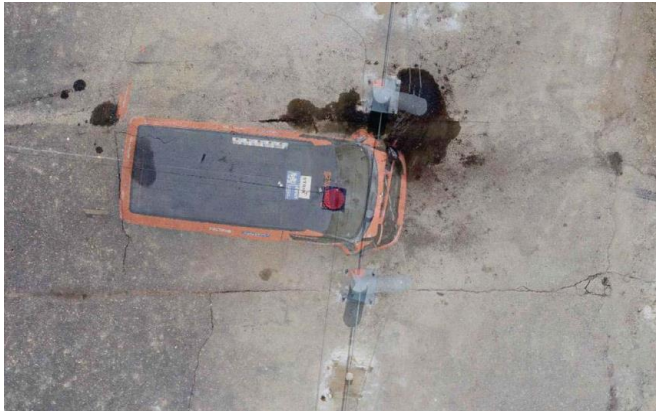
Safety system designed and developed to specifically prevent unwanted intentional or accidental vehicle access into protected and defined secure areas, such as civil pedestrian walkways, government compounds, military facilities etc.

Crash Tests Evaluation



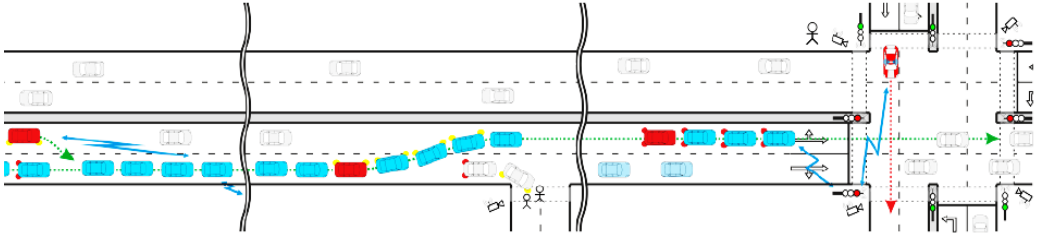
Crash Tests Evaluation: Acceleration Severity Index (ASI) and Theoretical Head Impact Velocity (THIV)



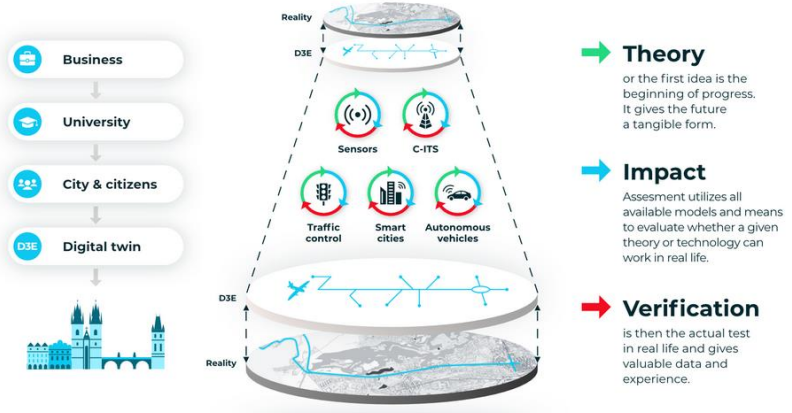


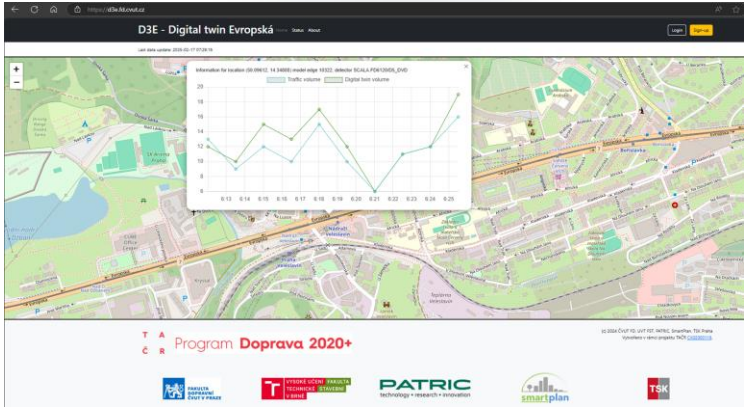
LAMbDA
Laboratory of Applied Mathematics in Transport and Logistics

- LAMbDA is a competence center that solves problems of transport and logistics using appropriate mathematical methods and approaches.
- The main knowledge of the laboratory includes mathematical modeling, statistical data processing, operational research and traffic simulations.
- Main focus on
  - CCAM
  - Digital twins, or
  - Travel behavior research



Living Lab - Traffic Digital Twin

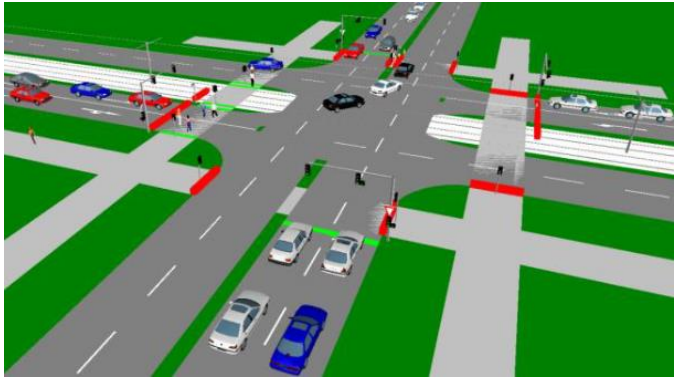




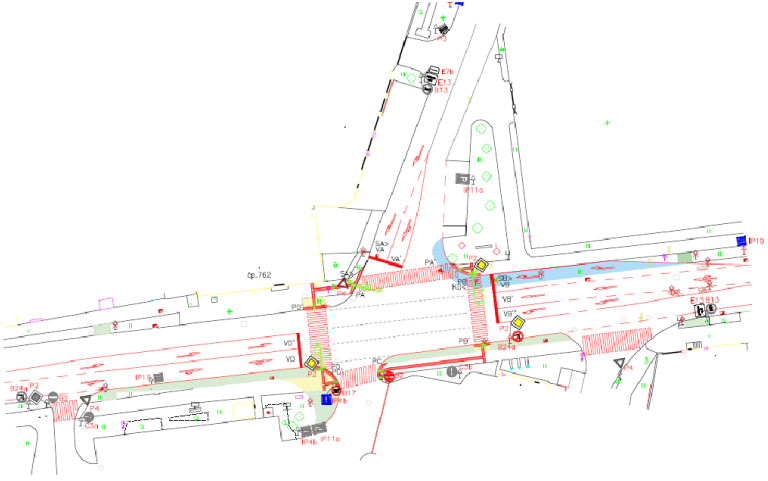
Laboratory of Traffic Control and Modelling

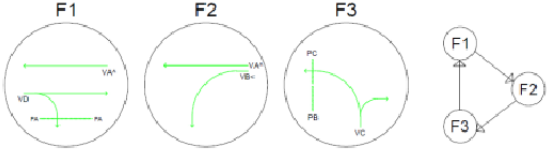
Data measurement and processing, traffic modelling, traffic control

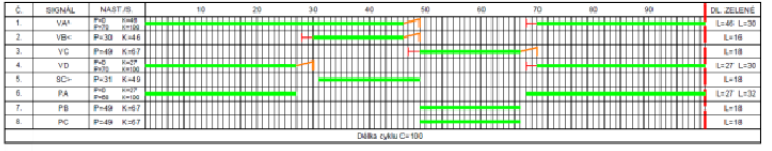
Tunnel Systems Laboratory



Simulation of real traffic situations and conflicts in actual locations, capacity calculations. Simulations using VISSIM, AMISUN, LISA+







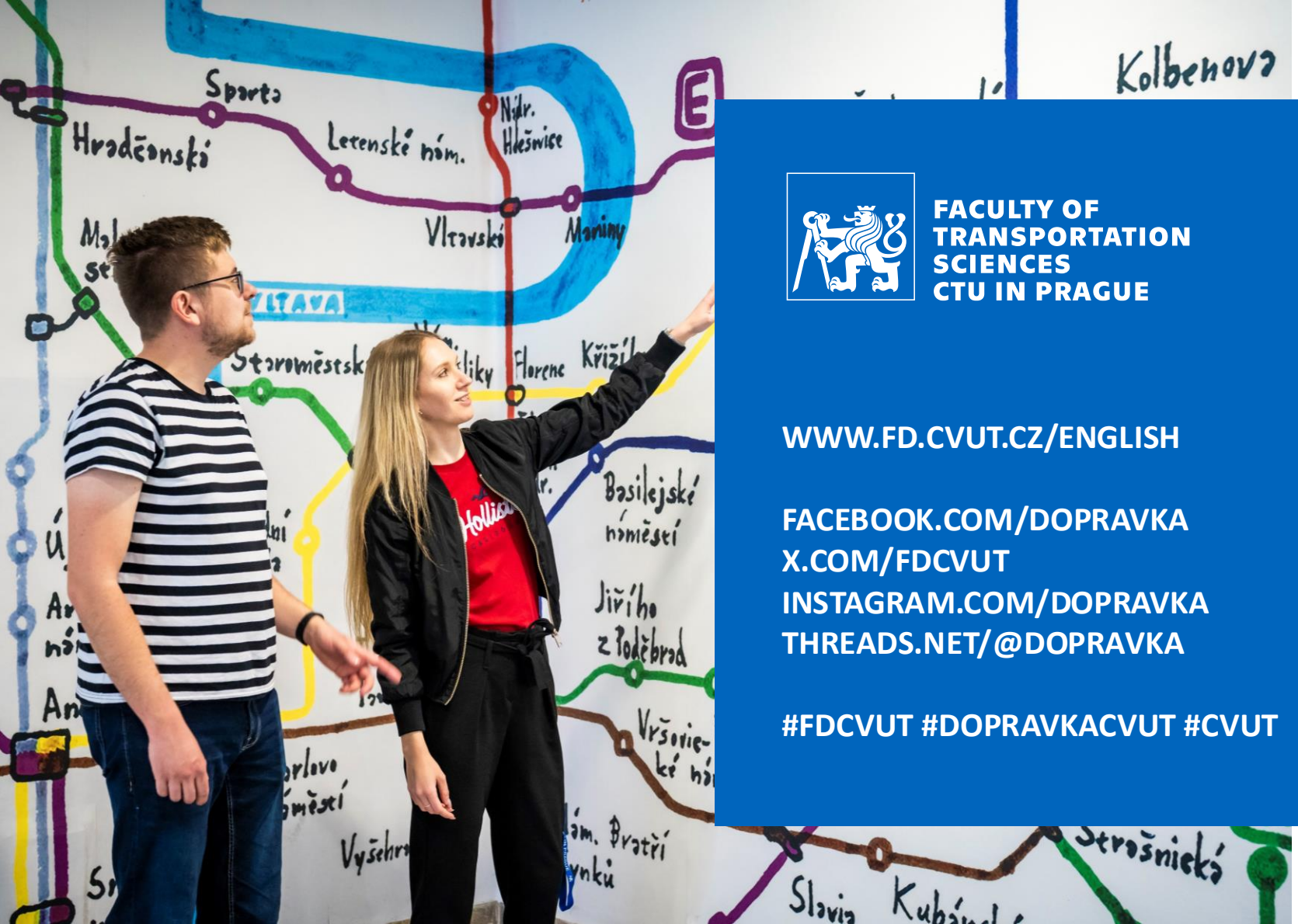
Faculty of Transportation Sciences
MEP - Next steps

→ Session with Questions

→ *Laboratory tour (Horská only):*

- → Driving simulators
- → Air traffic controller simulator
- → Forensic engineering/crash testing
- → Digital Twin & Smart Cities
- → CTU Lions
- → Green Gliders

A successful graduate of our faculty should be able to combine all of this knowledge to work on projects that have a long-term effect on the whole of society.



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