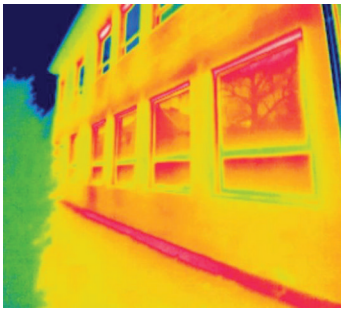
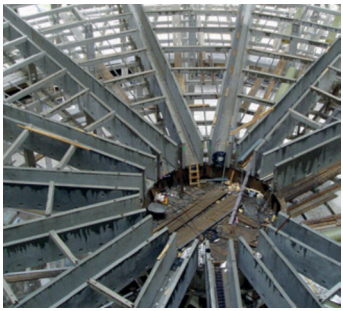
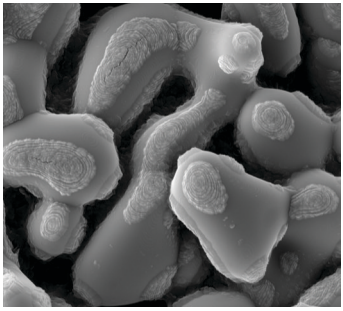
AdMaS®

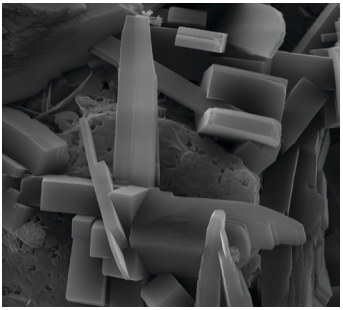
ADVANCED MATERIALS, STRUCTURES AND TECHNOLOGIES

BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF CIVIL ENGINEERING







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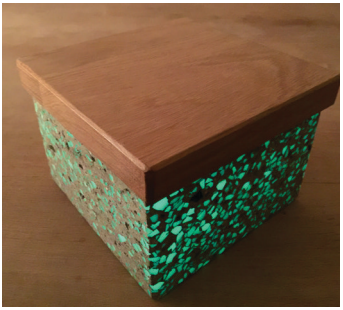

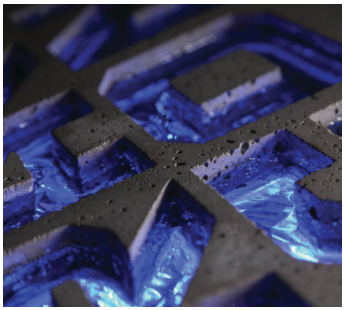

The AdMaS Centre

(AdMaS: Advanced Materials, Structures and Technologies)

The AdMaS Center is modern science center and multidisciplinary civil engineering research institution affiliated to the Faculty of Civil Engineering, Brno University of Technology.

The center focuses on research and development in the area of advanced building materials, structures and technologies, and their application in civil engineering, and in the transport systems and infrastructures of cities and municipalities. We also provide for the needs of real-estate investors by performing comprehensive feasibility studies and assessments of the economic efficiency of investments in construction projects.

The Faculty of Civil Engineering is an expert institute registered in the list of expert institutes led by the Ministry of Justice of the Czech Republic for the fields of expert activities in construction, geodesy and cartography and property valuation.

Structure of the centre

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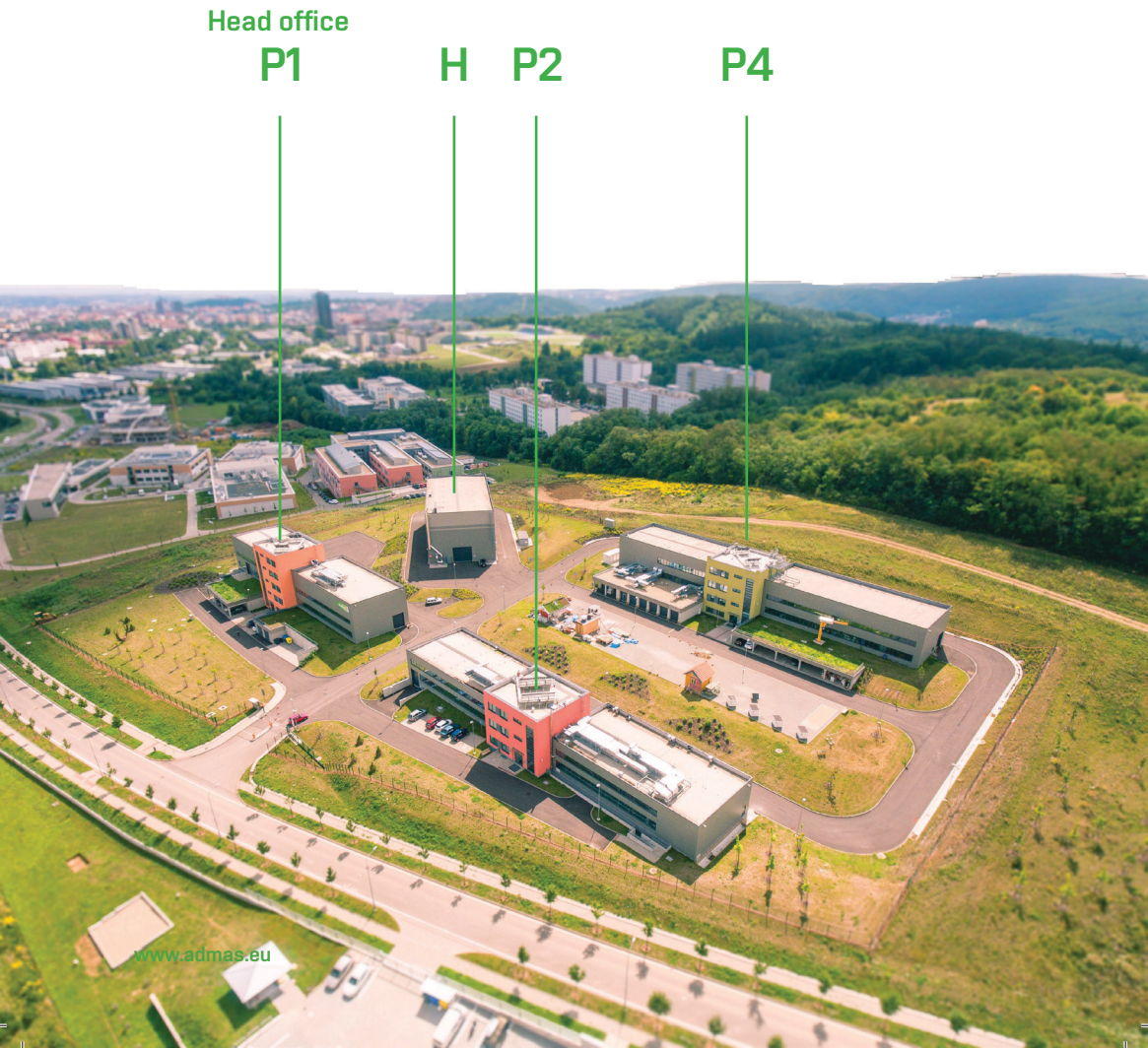

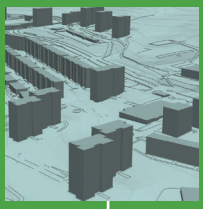

Advanced
Building
Materials

Advanced Building
Structures
and Transport
Constructions

Economics
and
Environment

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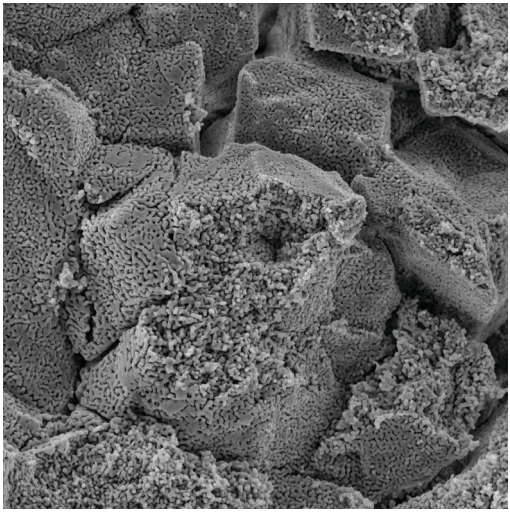

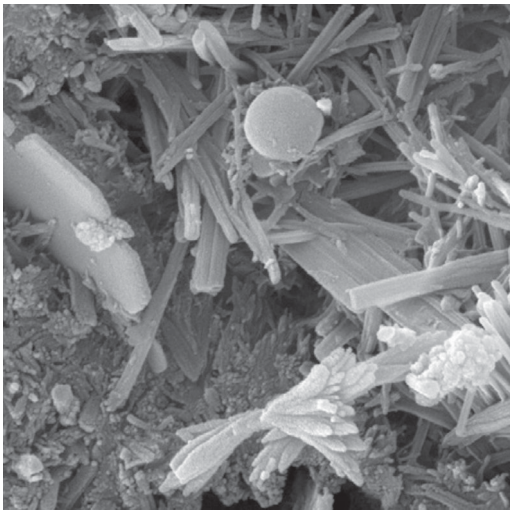

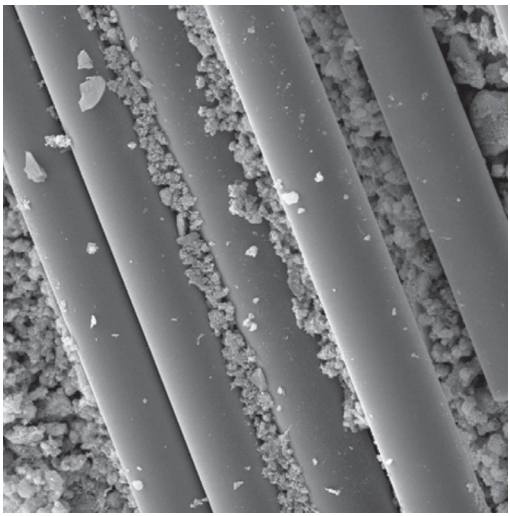

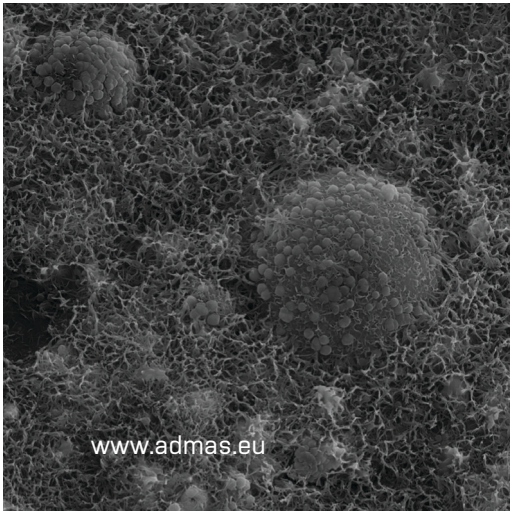
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Advanced Building Materials

One of the main specializations in the field of Advanced Building Materials is study and evaluation of the structure and microstructure of materials and raw materials with the aim of determining the most significant properties necessary for their optimum application in building materials. An integral part of the comprehensive testing of materials is the monitoring and exploration of the causes of degradation processes that affect them. This is carried out in combination with the development of procedures for improving material durability. The latest destructive and non-destructive test methods are used for studying the structure and microstructure of materials while simultaneously developing new methods and procedures for verifying their properties.

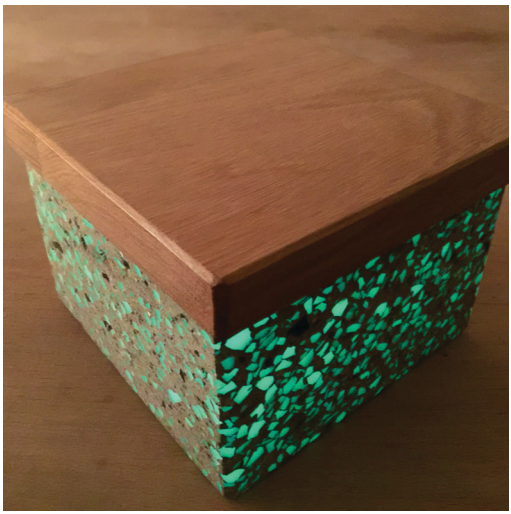
The modern instrumentation allows:

- comprehensive evaluation of the properties of building materials;
- analysis of the microstructure of materials, including the determination of the phase composition of examined materials and the determination of the contents of subcomponents;
- 3D visualization of the micro- and macrostructure of examined materials;
- analysis of the behavior of materials at different temperatures of up to 1600 °C;
- detection and localization of faults and defects in materials; monitoring of the development of material deformation, and the development of cracks and corrosion;
- simulation of the action of aggressive effects to assess the durability of building materials;
- evaluation of the environmental impact of selected materials;
- modelling and simulation of the properties of materials based on findings obtained by experimental testing;
- complex material and technological solutions for the repair of existing structures.

Another important field that the research of Advanced Building Materials specializes in is research and development in the area of new building materials and advanced production technologies, including the optimization of existing production processes. The group's activities in this field are aimed at the development of advanced materials with higher utility parameters and durability with the main focus on sulphurous, siliceous and cement-free binders, modern concrete technologies, ceramics, woods, polymeric and insulating materials.

The special instrumentation allows:

- testing of self-compacting, high performance, ultra-high-strength, sprayed and more fire resistant concrete;
- determination of volume changes in materials under different temperatures and humidity conditions;
- determination of the physical and chemical characteristics of building materials;
- comprehensive testing of the rheological properties of fresh composites;
- testing of thermally insulating, acoustic, diffusion and other physical properties;
- proposals for the optimum utilization of secondary and renewable raw materials as a substitute for primary raw materials, and in the development of new building materials;
- simulation of climatic effects on building materials, and the forecasting of their life span;
- monitoring of the effects of different temperature loads and their cycling on the durability of building materials;
- simulation of the behavior and durability of building materials and components in chemically aggressive environments of all types;
- comprehensive engineering testing of concretes, binders, aggregates, plasters and ceramic products in an accredited testing laboratory;
- diagnostics tests and assessments (technical surveys of structures, expert opinions) of building materials in structure;
- experiments in test furnaces and devices for imposing extreme stress on building materials, components and structures (determining their reaction to fire, evaluation of fire resistance).



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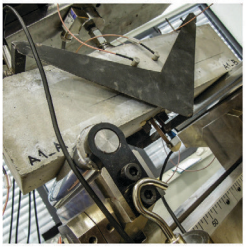

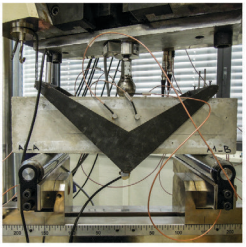


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Advanced Building Structures and Transport Constructions

The main activities in the field of the Structural and Transport Engineering are focused on research and development in the field of the load-bearing structures of buildings and transport structures. These activities concentrate on the development of new structural and material designs for the structural elements and components of the load-bearing structures of buildings, as well as modern structures utilized in transport infrastructure. Emphasis is placed on advanced structures and technologies in terms of their improved reliability, durability and economy during their entire life cycle, with regard to the mutual relationships and connections between monitored and solved problems. An integral part of the group's activities is the experimental verification of load-bearing structures and systems, as well as the application of modern simulation methods. Another important research topic is the development of BIM technologies.

- comprehensive structural, technical and material surveys of wooden, masonry, concrete and steel structures; full-scale testing;
- analyses, reconstruction projects, rehabilitation and revitalization of all types of building structures including bridges;
- experimental verification of the real-world behavior and load capacity of ferroconcrete structural elements made of advanced materials;
- analysis and long-term evaluation of pavement surfaces and structures, pavement diagnostics, research and development in the area of new materials, and the full-scale testing of pavement structures;
- determination of traffic flow characteristics, transport and pedestrian modelling, design of safety improvements for roads, modelling of fire spread and fire safety in buildings and transport structures;
- effective and reliable railway structures, high speed rail infrastructure, development of switch and crossing design, assessment of dynamic behavior;
- testing of structural elements, details and models during extreme mechanical and thermal stress, including dynamic and fatigue testing;
- study of the structures of sloping green roofs and the physical processes affecting them, and the advanced thermal insulation of wooden buildings and energy self-sufficient buildings;
- robotic construction issues;
- comprehensive methods for investigating the response of building structures and structural elements with respect to their reliability and durability;

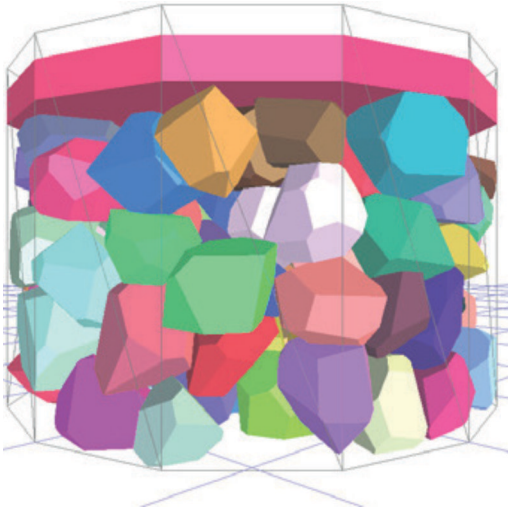
- modeling of people's movement and fire spreading models;
- advice on BIM implementation;
- extra-dimensional 3D printing, scanning and advanced modelling - rapid formation of extra-large functional prototypes of up to 690x690x1900 mm using an optical scanner and the largest FDM printer available on the market.

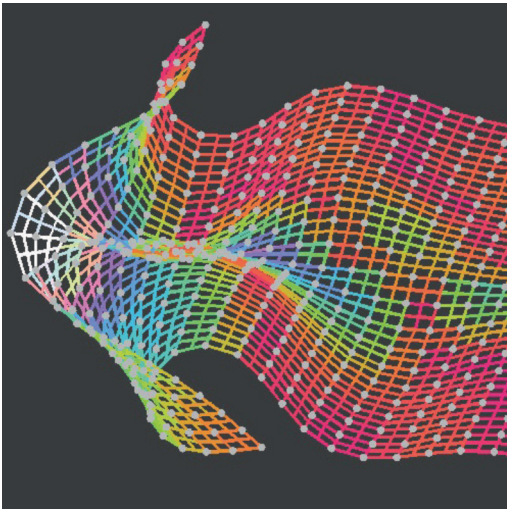
Geotechnical research focuses on:

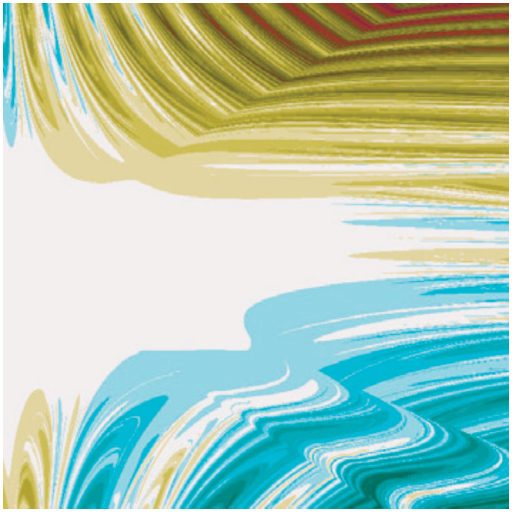
- geomechanical characteristics and their mechanical behavior in interaction with geotechnical structures; research into the exploitation of geothermal energy;
- development and verification of methodologies for testing the practical applications of field and laboratory measurements; the performance of evaluations (including the use of mathematical modelling), and the development of methodologies in the field of geotechnical methods of carrying out surveys and the diagnostic assessment of the foundation conditions of structures.

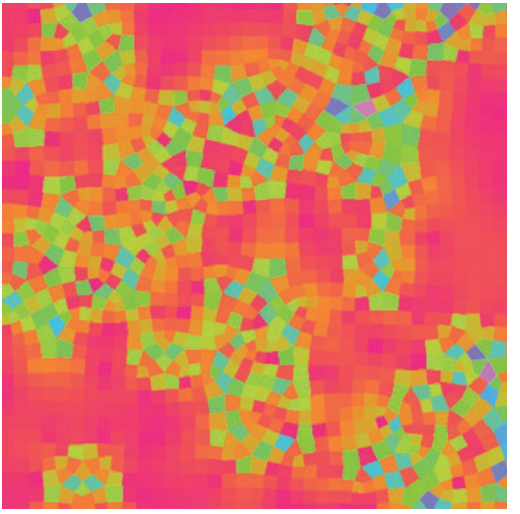
Another important area of interest is the research, development and practical application of complex methods of investigation of building structures and structural elements responses with regard to their reliability and durability:

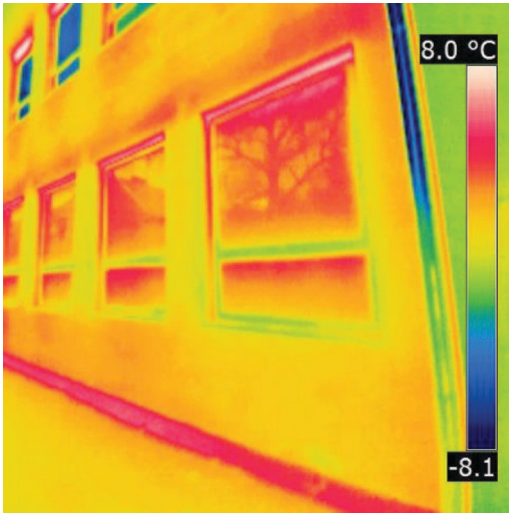
- Analysis of supporting structural systems - support for the experimental verification of the properties of building structures using modern simulation methods that allow a significant reduction in the necessary number of simulations; theoretical verification of the properties of building structures with the help of analytical or numerical solutions using the finite element method, and other methods.
- Support for structural design using interdisciplinary procedures - simulation methods; optimization of structural design via deterministic and stochastic approaches.
- The performance of calculations and simulations:
    - mathematical modelling of structural details, elements and components;
    - simulation of structural stresses using experimental data;
    - simulation of the effect of extreme stress on structural elements;
    - statistical simulations and evaluations;
    - modelling of selected technological processes;
    - processing of data from “in situ” measurements.
- Development and verification of new methodologies - for the verification of practical applications in terms of durability analyses; improvement and application of the integral method for complex analyses of cement composite elements.







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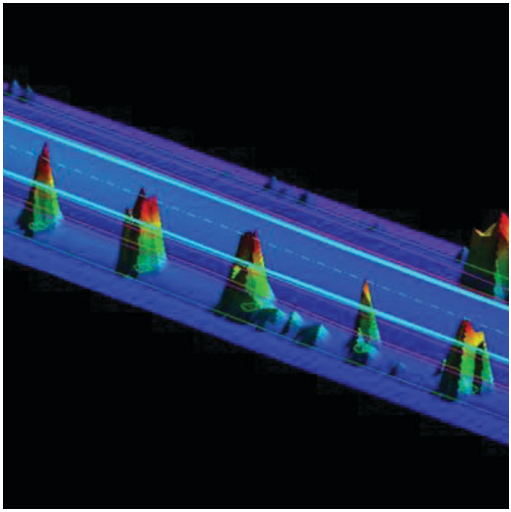


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Economics and Environment

Economics and Environment is engaged in applied research in the fields of Environmental Technologies, Geodesy and Construction Management.

- Construction Management - assessing the economic efficiency of construction projects, appraising real estate, assessing the overriding public interest, examining the impact of infrastructure construction on regional development.
- Urban Engineering - wastewater treatment technology; drinking water treatment; waste management; the study, measurement, diagnosis and evaluation of the technical condition of infrastructure; drinking water and wastewater chemistry; investigating the interdisciplinary linkage between buildings, infrastructure and region;
- Energy Diagnostics of Buildings and Regions "Smart Cities and Regions"- optimization and streamlining of energy flow in regions, local areas, buildings; planning and management of buildings with nearly zero energy consumption; energy management of territorial units;
- Geoinformatics - survey of the current status of land, contemporary building design, including 2D and 3D documentation; processing and digitization of maps, GIS applications included; the inventorizing of the status of structures and technical units; creation of 3D models using both stationary and mobile terrestrial and airborne laser scanners.

Main area of specialization of the research group:

- testing and development of new wastewater and drinking water treatment technologies;
- energy, ecological and sustainable concepts for the development of urban settlements and regions;
- geodetic, photogrammetric and metrological support for building activities and research;
- development and verification of methodologies for measuring the thermal and microclimatic properties of buildings and parts of structures;
- research into methodologies for the economic analysis of macroeconomic projects.

AdMaS centre

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