

**KLOKNER
INSTITUTE
CTU IN PRAGUE**





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INSTITUTE
CTU IN PRAGUE**





Ministerstvu

školsství a národní osvěty

v P r a z e .

Profesorský sbor usnesl se ve svém sezení dne 17. února 1919 vřele doporučit přiložený návrh podaný profesorským sborem odboru stavebního inženýrství. Podpsaný rektorát předkládá tento návrh s tímto doporučením k příznivému vyřízení.

Rektorát české vysoké školy technické
v P r a z e .



t.č. rektor.

CTU IN PRAGUE, KLOKNER INSTITUTE

ACTIVITIES OF THE INSTITUTE

The Klokner Institute (KI) was founded in 1921 as the Research and Experimental Institute of Materials and Building Structures. Today the Institute bears the name of its founder and first director, Frantisek Klokner, an outstanding CTU professor and researcher of that time. KI is mainly involved in research and scientific activities, standardization and the transfer of research and scientific results into practical applications.

The range of activities carried out at the Klokner Institute is as follows:

- Scientific and research activities
- Education
- Expert and consulting activities - cooperation with industry and with the public administration
- Accredited testing laboratory activities
- National and international standardization

The Klokner Institute, being the first research institute established at the Czech Technical University in Prague, is one of the four oldest research institutes of its type in Europe.



Management:

Director: Assoc. prof. Ing. Jiří Kolísko, PhD

Chief Economist: Miloslava Bezděková

Secretariat: Petra Řehořová

Collegium of the Director:

prof. Ing. Milan Holický, DrSc., PhD

Ing. Petr Tej, PhD

Ing. Ivo Šimůnek, CSc.

Ing. Miroslav Vokáč, PhD

Ing. Lukáš Balík, PhD

Miloslava Bezděková

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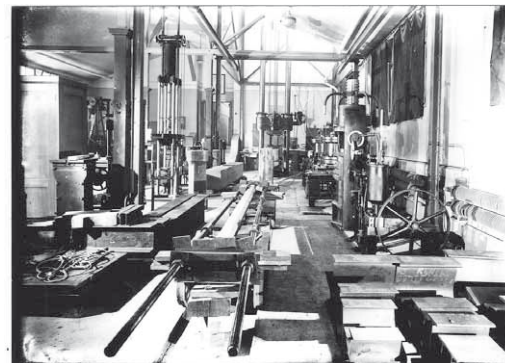
The Klokner Institute (KI) is the oldest research institute at CTU in Prague, established in 1921.

- 1912** – Frantisek Klokner proposed the establishment of an institution for the research and testing of building materials and building structures at CTU in Prague.
- 1919** – The proposal was reconsidered and approved by the Ministry of Education and National Enlightenment.
- 1921** – The Research and Experimental Institute of Materials and Building Structures started operating in the restricted conditions of a timber pavilion on Charles Square in Prague, under the leadership of Frantisek Klokner.
- 1926** – A proposal was submitted for a suitable new building.
- 1933** – The Institute was moved to a new building in Šolínova Street, Prague 6.
- 1940** – Bedřich Hacar, a student of František Klokner, became the new head of the Institute.
- 1947** – On the occasion of František Klokner's 75th birthday, the Institute was renamed the Klokner Research and Experimental Institute of Materials and Building Structures.
- 1947–1949** – Professor Bechyně was a co-founder of RILEM.
- 1953** – Establishment of the Czechoslovak Academy of Sciences (ČSAV).
- 1958** – A measuring system based on string tensiometry, developed by a team of researchers from KI, under the leadership of Miloš Petřík, was awarded the Grand Prix at the EXPO 58 International Exhibition.
- 1963** – The Institute was divided into the Klokner Institute and the Institute of Theoretical and Applied Mechanics (ÚTAM AV ČR).
- 1970** – KI employees used 66 tanks in a static loading test, of the Nuselsky Bridge (a prestressed concrete bridge over the Nusle valley in Prague).





- 1970** – The 6th international congress of the Fédération Internationale de la Précontrainte (FIP) was organised by KI in Prague.
- 1977** – Researchers at KI co-authored the new ČSN 73 0032 standard for dynamic calculations: Calculation of Building Structures Loaded by the Dynamic Effect of Machines.
- Since 1986**, KI has been accredited as a forensic civil engineering centre with a range of accreditations for diagnostics, failure analysis and tests of concrete, timber and masonry structures and their structural elements, structural mechanics (deformations of concrete and steel structures), the impact of dynamic effects on steel and concrete structures, and the use of plastic materials in construction.
- Since 1993**, KI has been accredited by the Czech Accreditation Institute as Testing Laboratory ČIA No. 1061.
- 2005** – Establishment of the Centre of Technical Standardization, which works on developing Czech standards and on implementing Eurocodes and ISO standards in the fields of reliability, risk and loading of structures.
- 2015** – The Physical Chemistry Laboratory Center of the Klokner Institute was established with support from project no. CZ.2.16/3.1.00/21543.



10 | INTERNATIONAL COOPERATION

The international cooperation of KI is mainly in the fields of seismic and materials engineering, and reliability analysis and risk assessment of structures and technical systems. The Klokner Institute has been involved in many national and international research and education projects.

Experts from KI are actively involved in many international research organizations, including:

- JCSS – Joint Committee on Structural Safety
- fib – International Federation for Structural Concrete
- ISO – International Organization for Standardization
- IABSE – International Association for Bridge and Structural Engineers
- RILEM – International Union of Laboratories and Experts in Construction Materials, Systems and Structures
- CIB – International Council for Building

RECENT INTERNATIONAL PROJECTS

- Assessment of Historical Immovables, www.heritage.cvut.cz
- Innovation Transfer in Risk Assessment and Management of Ageing Infrastructures, www.llp-infra.cvut.cz
- TU 1402 Quantifying the Value of Structural Health Monitoring, www.cost-tu1402.eu
- Vocational Training in the Assessment of Existing Structures, www.klok.cvut.cz
- Development of Skills Facilitating the Implementation of Eurocodes





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Since its establishment in 1921, KI has built a strong position in the field of national and international research, mainly in the following focus areas:

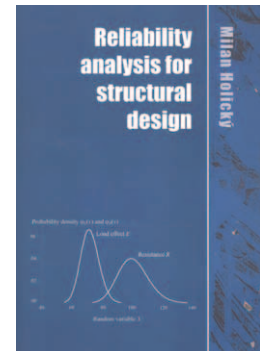
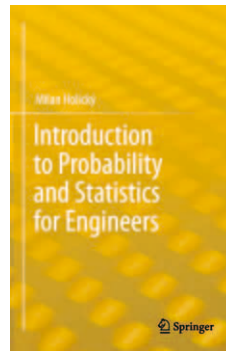
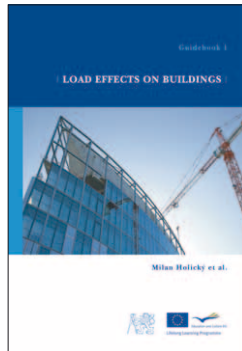
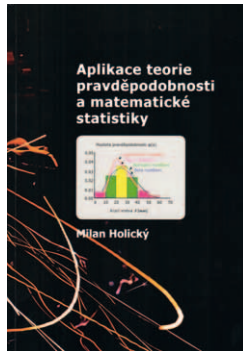
- Reliability theory and risk assessment of structures, including probabilistic analysis of failure development and assessments of structural serviceability; complex reliability and durability assessment of structures exposed to accidental and environmental actions
- Material engineering focused on the technology, micro and macro mechanics of building materials, especially concrete, masonry, fibre composites, steel and glass
- Numerical models of structures, impacts from load effects and structural responses
- Wind and seismic engineering, verification of static and dynamic effects caused by wind, natural and technical seismicity, climatic loads, impacts from machinery, etc.
- Diagnostics, monitoring and assessment of structures; development of long-term monitoring systems for the assessment of structural behaviour
- Degradation of reinforced concrete and masonry structures due to environmental effects, and methods for repairing these structures

In recent years, KI has been involved in 23 basic and applied research projects supported by national grant agencies and by Czech ministries. Projects are supported by GAČR, MPO-TRIO, TAČR, MK-NAKI and MŠMT.

The Klokner Institute educates doctoral students in study program P 3607 Civil Engineering, within two fields of study:

- Theory of Non-Metal Building Materials,
- Theory of Structures.

KI employees teach Statics I, II, Loadbearing Structures I, II master's and bachelor's courses at the Faculty of Architecture, and also Construction Technology and Management I, II courses. Seminars and courses for practising engineers are regularly organized by KI within its lifelong learning programme.





SOCIAL EVENTS

Traditional advent concerts are held every year in December in the historical Bethlehem Chapel in Prague.

A national conference will be held on September 22, 2016, on the occasion of the 95th anniversary of establishment of the Klokner Institute.





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The Centre of Technical Standardization (CTS) was established on the basis of a contract between the Czech Office for Standards, Metrology and Testing (ÚNMZ), the Klokner Institute, and Technical Standardization Committee TNK 38 for Structural Reliability. CTS cooperates with Technical Committee CEN/TC 250, with its Sub-committee CEN/TC 250/SC1 for actions on structures, and also with Technical Committee ISO/TC 98. The main task of the Centre is to prepare national annexes to Eurocodes and to implement ongoing amendments to these Eurocodes.

CTS is involved in the following expert groups:

- Expert group for EN 1990 on the Basis of Design
- Working group on the assessment of existing structures
- Working group on structural robustness
- Working group on actions from icing
- Working group on traffic loads on bridges and the Horizontal group for bridges in CEN/TC 250
- Committee for construction products within ÚNMZ
- Group of European Correspondents for Eurocodes (ENC)

In addition, CTS:

- Provides consultancies for members of ČKAIT (the Czech Chamber of Certified Engineers and Technicians Active in Construction) concerning the implementation of standards into practical applications
- Monitors the development of international, European and national technical standardization in technical committee CEN/TC 250 and its subcommittee SC1, and in technical committee ISO/TC 98
- Monitors the needs of ČSN users with the aim to push through their justifiable requirements on the development of European, international and national technical standards
- Participates in Technical Committee TNK 38 Reliability of Structures, and in the work meetings of international standardization bodies
- Provides expert reports and judgements

The KI mechanical testing laboratories are equipped with unique devices and electronic systems for controlling and making measurements. The devices include an Amsler testing press with a capacity of 10 MN, and an MTS modern loading machine for static and dynamic tests, with a force range of ± 500 kN. The TESTSTAR controlling unit is used in destructive tests for the simultaneous control of two INOVA hydraulic cylinders. The Frigera and Heraus Vöthc freezing chambers are used for automatically controlled cyclic freeze/ thaw tests of concrete and other building materials, in the temperature range from -30°C to $+30^{\circ}\text{C}$, with optional exposure to water and to aggressive solutions such as NaCl. The loading regimes can be adjusted according to the applicable testing rules, or according to client requirements.

Considerable funds have recently been allocated for modernizing the KI laboratory equipment.

Recently purchased devices include:

- The Instron 3 MN Compressive Testing System, with a control unit and Merlin software, used mainly for investigations of the material properties of concrete
- An AEDSP-32/16B Physical Acc. Corp. Acoustic Analyser, which is used for monitoring and analysing the acoustic emissions due to loading of structural elements
- The Spectroscan MAKC GVII sequential wave dispersive X-ray device with a fluorescent spectrometer
- An Olympus LEXT microscope - a precision measuring instrument for observations with the highest level of reliability
- An Ahura First Defender Mobile Raman Spectrometer for special analyses of liquids, powders and solid specimens
- A MYTRON Climatic Chamber with controlled temperature, moisture, UV and solar radiation. This is currently the only device of its kind for corrosion tests within the whole Czech Technical University
- A Testo 885-2 thermocamera set, with the SuperResolution function and the radio measurement of humidity function
- A modernized Tiratest Loading Machine for tests with low loading forces



Recently upgraded software:

- **SCIA Engineering**, for static and dynamic analyses of structures
- **ATHENA**, for nonlinear analyses of materials and structures
- **AUTOCAD**, for technical drawings



More than 600 expert reports are elaborated each year for Czech and international clients. They deal with:

- Applied research and diagnostics of residential, industrial and agricultural buildings with various structural systems and materials (concrete, masonry, timber and steel)
- Static loading tests of road and railway bridges
- Dynamic tests (e.g. vibrations of turbo-generator foundations, desulphurizers, industrial chimneys, bridge structures)
- Diagnostics and long-term monitoring of buildings
- Moisture surveys and chemical analyses of buildings, recommendations on structural interventions
- Tests on pre-stressed bars, high-voltage insulators, structural elements, material strength tests, tests of corrosion and frost resistance, UV resistance, resistance to aggressive liquids and gases, etc.

Examples of tests that have been carried out:

- Vibration measurements - turbo-generator foundations in the heating plant at Kralupy nad Vltavou, the desulphurizer in the Dětmarovice power plant, the chimney foundations in the Vřesová heating plant and in Motol University Hospital, the bridge at Prackovice, etc.
- Diagnostics of cooling towers, chimneys and other structures in Czech power plants, Florenc and Vltavská metro stations, and the historical buildings of Nejsvětějšího srdce Páně Church in Prague, the Queen Anna Summer Residence at Prague Castle, and other heritage structures

More than 600 test reports and expert reports are submitted each year within the expert activities of the Institute

- An investigation of buildings in the area affected by the recent extension of Line A of Prague underground railway system
- An experimental investigation of the loadbearing capacity of precast concrete panelling segments for the Prague underground railway
- Mechanical tests on ceramic, glass and plastic insulators (NGK Japan, IAC Malaysia, PCI Austria, SEFAG Switzerland, CERAM Austria)
- Mechanical tests on the decorative lattice of the Louis Vuitton building in Paris
- Tests on the steel structural elements in the glass shell structure of the new National Technical Library in Prague
- Static loading tests on road and railway bridges for leading construction companies: Bögl and Krýsl, Metrostav, SSŽ, SMP Construction, Skanska, etc.
- Technical surveys and diagnostics of the buildings of the US and Japanese embassies in Prague, and of the Czech embassies in London and Moscow
- Experimental verification of hangers loaded by axial and transverse forces – Troja Bridge, Metrostav a.s.

**Diagnosis of steel structures
of the Main Railway Station in Prague**







Head of Department: prof. Ing. Milan Holický, DrSc., PhD

The Department of Structural Reliability undertakes

- structural reliability and risk assessments of structures and technical systems,
- the development of national and international standards and their implementation into the Czech standards,
- various national and international research and educational projects.

The department's researchers are active in many international research standardization organizations.

Activities:

- Develop probabilistic and semi-probabilistic methods for verifying structural reliability
- Make risk assessments of structures and technical systems
- Make statistical data analyses
- Make probabilistic analyses of structures
- Ensure national implementation of the Eurocodes on actions and structural design
- Develop national annexes and revisions of Eurocodes and ISO standards

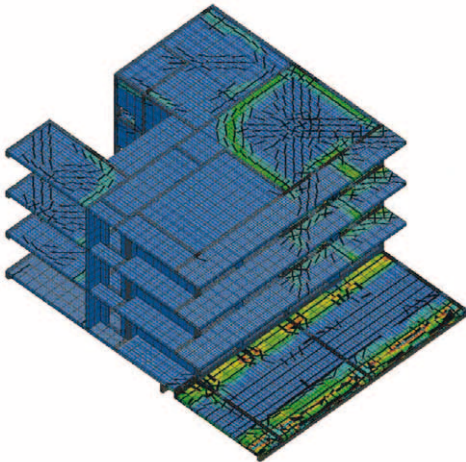
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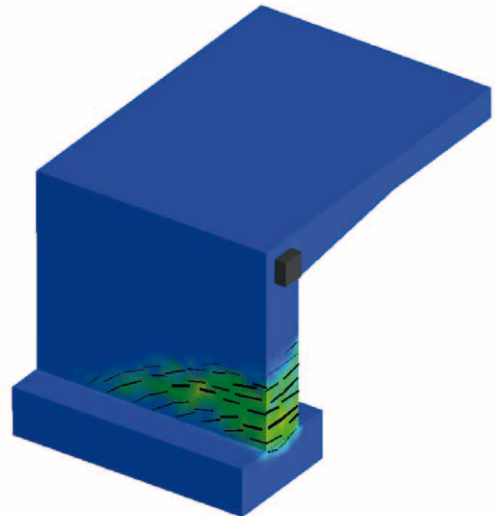
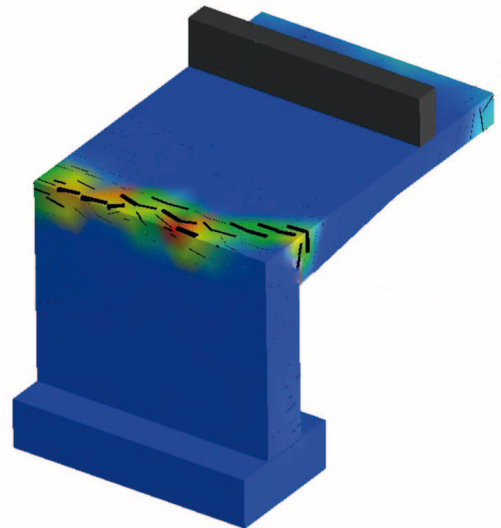
Head of the Department: Ing. Petr Tej, PhD

The Department of Mechanics investigates the static and dynamic behaviour of structures on the basis of theoretical analyses and also through practical tests on real structures. It also carries out tests and makes numerical models of the properties of fibre composites and their practical utilization. The research results are applied in practical case studies.

Activities:

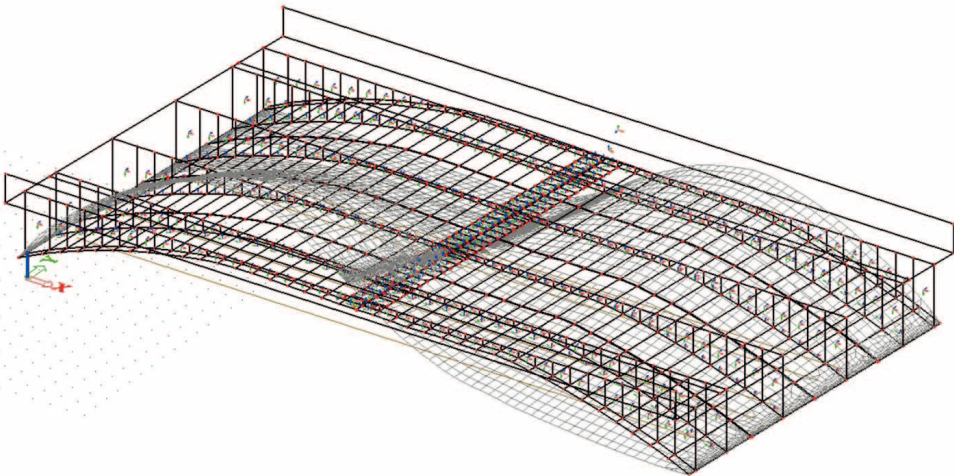
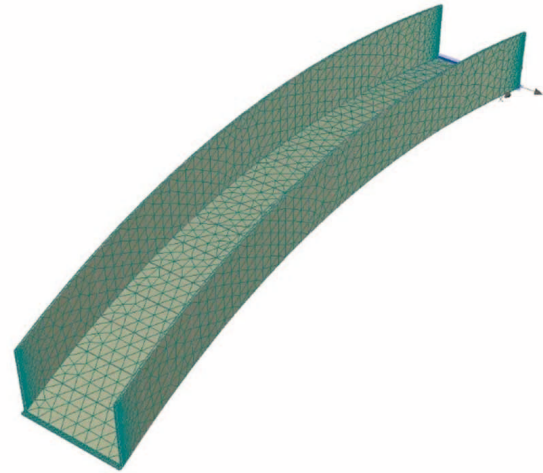
- Make static and dynamic analyses of structures
- Make assessments of static and dynamic failure mechanics in structures, assess the serviceability of structures on the basis of crack development
- Make numerical models and analyse structural behaviour
- Make vibration measurements and data analyses to assess the effects on the structure, the installed equipment and the users; plan possible interventions
- Investigate natural and technical seismicity, make numerical analyses of the response of the structure to seismicity, design structural interventions and other anti-seismic interventions
- Predict the impacts on structures of blasts, terrorist attacks and accidental explosions. Make numerical analyses and assessments of affected structures







- Analyse the dynamic effects of operating machinery, the criteria for designing machine foundations, the design of dampers, wind effects on structures. Make models of wind actions , make assessments of aerodynamic instability, carry out wind tunnel experiments and make models
- Make experimental and numerical analyses of the mechanical properties of silicate composites under static and dynamic loads
- Study the failure and defects of polymer composites: make numerical analyses and carry out experimental verifications
- Study the behaviour of fibre composites exposed to corrosion
- Investigate the use of fibre composites for strengthening structures
- Implement Eurocodes for wind and snow loads, and for traffic loading on bridges. Develop national annexes and amendments to Czech versions of the Eurocodes



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DEPARTMENT OF EXPERIMENTAL METHODS

Head of the Department: Assoc. prof. Ing. Jiří Kolísko, PhD


The Department of Experimental Methods is involved in research and educational activities (in bachelor, master and PhD study programmes), and offers expert consultations. The department operates an accredited laboratory with testing devices that are continuously upgraded. Testing procedures are developed. A substantial part of the department's work involves offering expert advice and consultancies for companies.

Activities:

- Material engineering of composite silica-based materials, especially applied research on UHPC
- HVFAC concretes
- Application of new layered glass technologies in structures
- Creep and shrinkage of mortars and concretes
- Hydrophobization of the pore system of silica materials
- Measurements and long-term crack monitoring of concrete
- Bond of reinforcements in concrete
- Moisture-induced volumetric changes of porous ceramics
- Assessments of building materials, based on laboratory and in-situ tests
- Diagnostics of various types of structures; static and dynamic loading tests; assessments and methods for structural interventions
- Surveys of residential, transport and industrial structures, assessments of corrosion and methods for structural interventions
- Long-term monitoring of physical and mechanical parameters in real structures



Cast-iron column
head at Brno
Railway Station

A close-up photograph of a person's hand holding a circular, red, porous material sample above a laboratory scale. The sample has a rough, textured surface with some dark spots. The scale is white and has a digital display and buttons. In the background, there are other similar scales and laboratory equipment, all within a glass-enclosed area. The lighting is bright and focused on the hand and the sample.

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Head of the Department: Ing. Lukáš Balík, PhD

The Department of Building Materials is active in research and teaching, and also engages in construction practice, carrying out analyses, preparing expert reports and offering consultations. Researchers in the department work on developing new building materials, new rehabilitation methods and control mechanisms, studying the microstructural stability of cement composites, monitoring the impacts of the environment on ageing processes in building materials, etc. Classical chemical procedures are used in conjunction with modern devices e.g. XFR, a KPK400 U climatic chamber, a Claisse M4 gas fluxer – Fusion XRF, AA and ICP, a Mastersizer 3000 laser diffraction particle size analyser, a Mill RS 200 vibratory disc, inductively coupled plasma optical emission spectrometry (ICP-OES), thermal analysis – a simultaneous TGA & DTA / DSC thermal analyser, a Secotom-15/50 table-top cut-off machine, etc.).

Activities:

- Concrete technology, assessment and design of concrete recipes
- Determining the physical and mechanical parameters of concrete, mortars and other materials, in the laboratory and in-situ
- Moisture surveys and rehabilitation proposals
- Quality assessment of in-situ rehabilitation of structures
- Assessments of failures and defects of floors in residential and industrial structures, rehabilitation proposals
- Effects of electric fields on the electro-osmotic flow in building materials
- Monitoring the impact of aggressive environmental components on building materials, e.g. impacts of the flow of liquid media on the components of silica materials
- Chemical analyses of a broad range of materials – silica materials, organic materials, etc.
- Assessments of the resistance of building materials to physical factors, environmental components (temperature changes, aggressive agents, etc.)
- Durability analysis of building materials
- Construction supervision and consultations



Test of a panelling segment of the extension of Metro Line A in Prague

ACCREDITED LABORATORY

Head of the Laboratory: Ing. Miroslav Vokáč, PhD

The Laboratory is accredited by the Czech Accreditation Institute (CAI) in accordance with ČSN EN ISO IIEC 17025:2005. It is accredited for: Testing of mechanical, physical and rheological properties of building materials, static and dynamic tests of building structures, parts and components, including the determination of dynamic effects on structures.

Activities:

- Tests of concrete and mortars (compressive, tensile and bending strength, modulus of elasticity, workability, amount of air, frost resistance, etc.)
- Tests of fresh concrete
- Tests of welded reinforcements in concrete
- Quality investigations of cable elements and pre-stressing cables
- Static loading tests of bridges
- Dynamic loading tests of building structures, and assessments of the effects of machine vibration on structures and on human beings
- Tests of electrical insulators in tension, compression, bending and torsion
- Quality assessment of building materials on the basis of laboratory experiments (concrete, fibre concrete, mortar, stone, timber, glass, masonry elements, masonry structures, insulations and protective coatings)
- Tests of the frost resistance of building materials
- Tests of anchor systems
- Pull out tests
- Assessments of the resistance of materials to penetration by water vapour







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November 10th, 1872 – January 8th, 1960

Founder of the Research and Experimental Institute of Materials and Building Structures

1872 – Born in the Karlín district of Prague as the son of a blacksmith

1885 – Started to attend school in Karlín (graduated with honours)

1896 – Graduated from the University of Agriculture Engineering, with honours

1897 – Assistant of prof. Šolín, gave lectures on elasticity, strength and geometry

1898 – Graduated from the University of Civil Engineering, with honours

1902 – Professor at the State Technical School in Pilsen

1908 – Professor of structural engineering at CTU in Prague

1909 – Gave Pioneering lectures on reinforced concrete structures

1909 – Awarded the academic degree of “Extraordinary Professor” in the field of reinforced concrete and steel structures

1917 – Awarded the academic degree of “Professor” (reinforced concrete and steel structure)

1921–1939 – Head of the Research and Experimental Institute of Materials and Building Structure

1928–1929 – Rector of the Czech Technical University in Prague

1946 – Awarded the degree of “Honorary Doctor of Technical Science” of CTU in Prague

1953 – Member of the Czech Academy of Sciences

1959 – Received the Czechoslovak President’s Award

8. 1. 1960 – František Klokner died



U P O M Í N K A

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ho vysokého učení tec
ne 14. prosince 1943 v
v betonovém stavitel
ích inženýrů v domě Z

Za:

W. K. Kucel
Ing. Karol



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