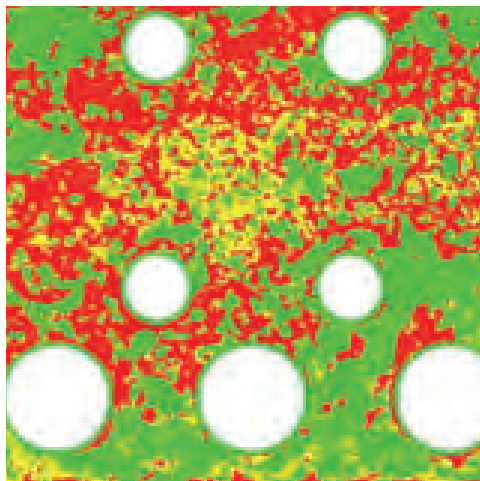




LABORATÓRIO NACIONAL  
DE ENGENHARIA CIVIL

TESTING  
and METROLOGY



- New methods developed by UEC
- Detection of nickel sulfide particle in tempered glass
- Experimental characterization of the deferred behavior of the concrete
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National Laboratory for Civil Engineering has a significant experimental activity support to the Construction Sector in various aspects, one of which is the development of methods and performance of applied tests in different contexts (marking, product certification, conformity assessment, calibration, among others).

Currently, LNEC has 33 laboratory units whose action is aimed at the different domains of Civil Engineering. Due to their size, these units are integrated since 2013 in a single structure, called LNEC-EM (Testing and Metrology), sharing the same Quality Management System (QMS), which results from the experience of accreditation of laboratories started at LNEC in 1994.

Taking advantage of the opportunity created by the commemoration of the Accreditation Day (9 June), with the particularity of the chosen theme by ILAC for this day to

be associated with the impact of the of accreditation in the construction industry and the fact that LNEC has recently completed 70 years of activity, and given the interest shown by several entities to better understand the capacities and competences of LNEC, it was decided to carry out the 2nd Edition of the "Open Day LNEC" Laboratories with the theme "Contribution of Laboratories for building confidence", in June 6, 2017, where there will be a Workshop in the morning at the LNEC Congress Center, and the possibility to visit different LNEC laboratory units during the afternoon, among other associated events.

Considering the interest of this initiative, we invite all interested parties to participate in the dissemination activities of the experience and knowledge of LNEC.

Álvaro Ribeiro

Diretor da Qualidade do LNEC-EM

CONTRIBUTION  
OF LABORATORIES  
FOR BUILDING  
CONFIDENCE

6 junho  
2017

open  
day

# newsletter





# New methods developed by UEC

Answering different external requests, UEC has increased the scope of its technical activities with the development of two new internal test procedures. These procedures, which are based on ASTM D2688-15 and EN 990:2002 standards, aim respectively to assess the corrosivity of water and the corrosion protection of reinforcement.

The corrosivity of water, determined by the corrosion rate of metallic specimens after a given exposure period, is assessed by weight loss tests or microscopic analysis, depending on the main observed deterioration type, i.e. respectively uniform or pitting corrosion (fig. 1).

The suitability of a corrosion protective system in combination with a defined manufacturing process for the production of reinforced components, determined by the area of the corroded surface, is assessed by visual or macrographic observation applying image analysis tools, after the specimens being exposed under controlled accelerated corrosive conditions for a specified series of exposure cycles (fig. 2).



Carbon steel                      Copper                      Stainless steel                      Galvanized steel

figure 1 | Metallic specimens assessed by the corrosivity of water test: left – after test; right – after chemical cleaning of the corrosion products.

ASTM D2688-15, Standard Test Method for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Method), ASTM International, West Conshohocken, PA, 2015, [www.astm.org](http://www.astm.org)

EN 990:2002 - Test methods for verification of corrosion protection of reinforcement in autoclaved aerated concrete and lightweight aggregate concrete with open structure, European Committee for Standardization, Brussels, 2002.

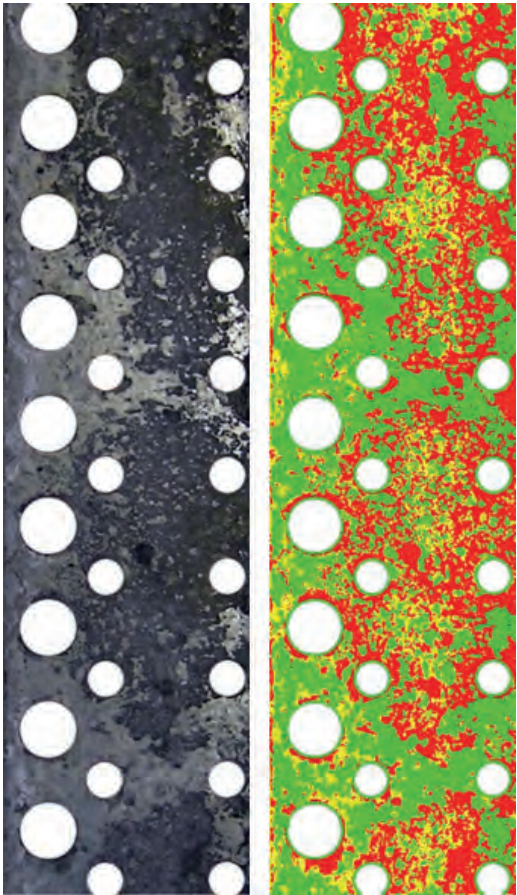


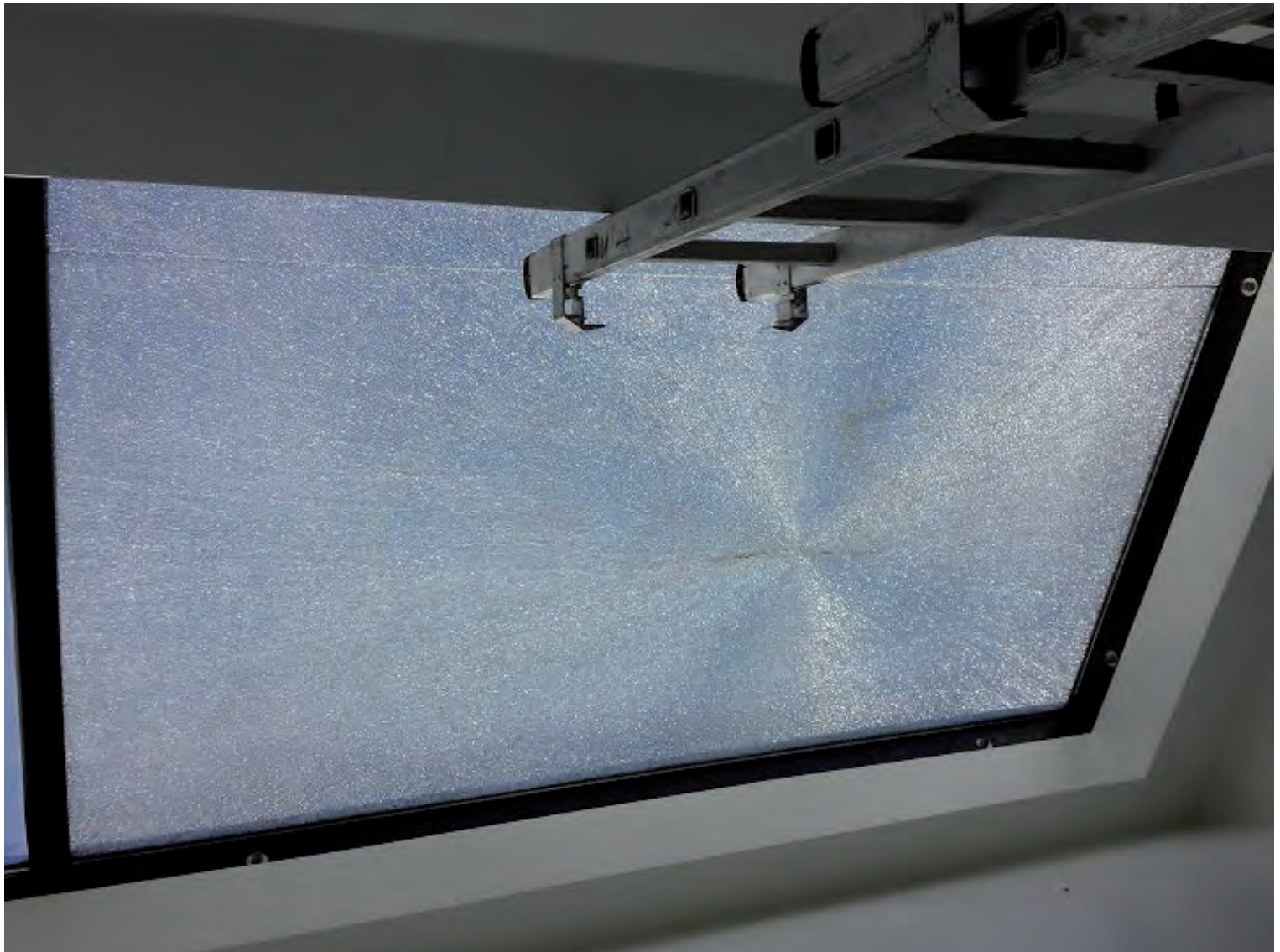
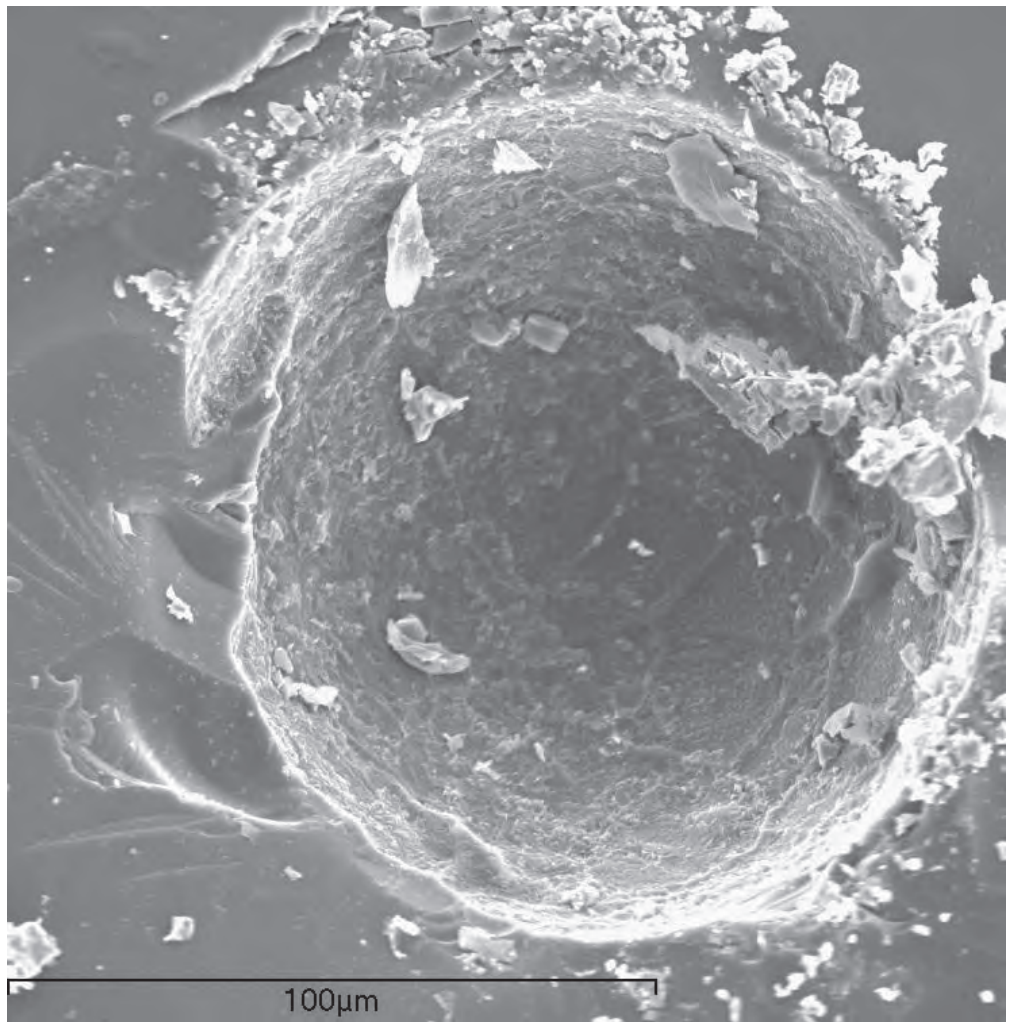
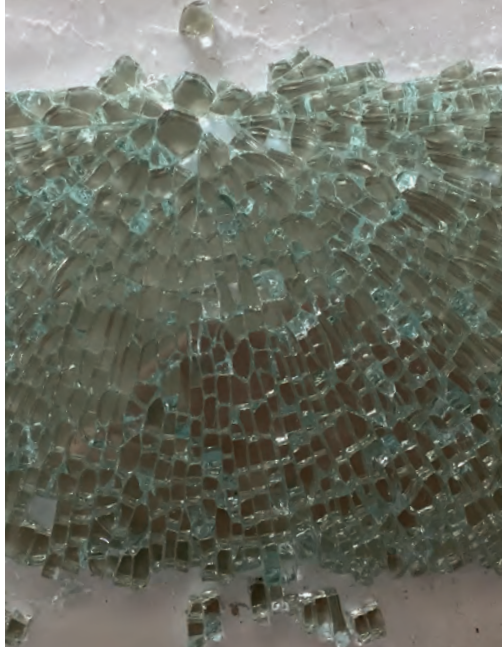
figure 2 | Panels evaluated in the test of the suitability of a corrosion protective system. Specimen detail after test and respective image analysis result.



## Detection of nickel sulfide particle in tempered glass

The tempered glass contains sulphide nickel impurities from the manufacturing process, which may induce spontaneous rupture.

U3M developed a methodology, by SEM, to detect the presence of NiS inclusions, which give relevant information on the probable causes of ruptures of this type of glass.





# Experimental characterization of the deferred behavior of the concrete

## Tensile strength tests

Dissertation to obtain the Master's Degree in Civil Engineering - Area of specialization: Structures.

Advisor: Dr. Sérgio Bruno Martins de Oliveira, Department of Concrete Dams

Coordination: Dr. Maria Sofia Coelho Costa e Sousa Ribeiro, Department of Materials

The main objective of this work was to contribute to the development of methodologies for the performance of the laboratory test of creep in direct traction, in concrete test pieces. In particular, the experimental study of linear viscoelastic creep (primary creep) and secondary and tertiary creep (creep rupture due to creep extensions).

This work is part of the activity of UBC-AEF - Concrete and Cement / Physical Testing Area of LNEC-EM for the characterization and evaluation of concrete performance and support to research studies of the Concrete, Stone and Ceramics Laboratory (NBPC) and other laboratory of the LNEC, fulfilling one of the objectives of the Research and Innovation Plan (P2I) "FluênciaTB - Creep in Concrete Traction" of DM.

The implementation of the procedures for conducting the test of creep in traction

of concrete test pieces used the specific equipment conceived and developed in the Nucleus of Electrotechnical and Mechanical Systems (NSEM) of the Center of Scientific Instrumentation (CIC) of the LNEC, inserted in the project with Funding from the Foundation for Science and Technology (FCT) entitled "Study of evolutionary deterioration processes in concrete dams. Control of safety over time ", from the Nucleus of Modeling and Mechanics of Rocks (NMMR), Department of Dams (DBB).

The tensile creep test system developed in the LNEC consists of a lever mechanism in which the tensile force is transmitted to the specimen (bone shaped) by spherical plain bearings and steel plates bonded to the specimen .

For the measurement of deformations, two displacement transducers of the LVDT type and a load cell for the measurement of applied force are used in each specimen.

The acquisition system consists of Data Taker-type devices and a computer that allows the visualization of the results.

In the study, the main issues involved in the LNEC equipment system and in the construction of the test specimens were identified and data processing and adjustment programs were developed in the Solidification Theory to predict and understand the behavior of concrete long-term.





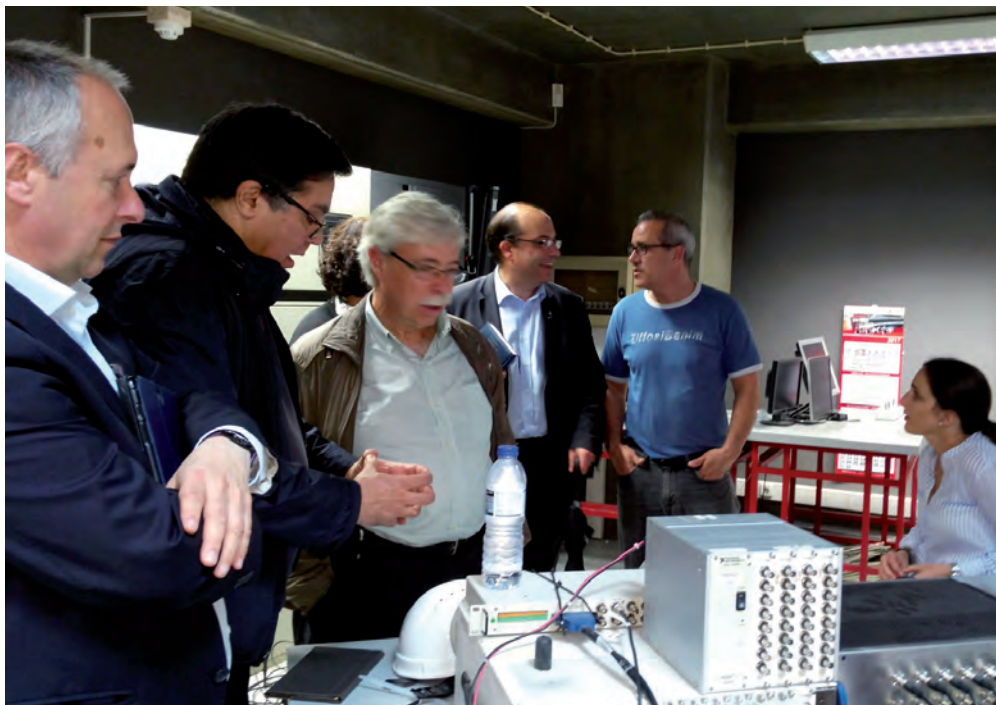
## TECNALIA visit

On the 10th of May, a visit of TECNALIA to LNEC occurred, with the purpose of promoting a better understanding of the competencies and capacity of the Laboratories of LNEC-EM (Tests and Metrology) in different areas, as well as some of its trials International infrastructure

in areas where we intent to deepen the partnership between TECNALIA and LNEC.

This cooperation is the opportunity to reconcile experimental and technical activities with I & D & I where LNEC has an experience that allows us to participate in joint research projects and where

the existing experimental infrastructures in can effectively ensure the quality of the results of these studies.





## Symposium of RELACRE Challenges of Innovation

On May 9, 2017, at the LNEG in Alfragide, as part of the celebration of its 26th Anniversary, RELACRE-Association of Accredited Laboratories of Portugal organized a Symposium entitled "Challenges of Innovation".

This Symposium was an opportunity to discuss current issues, namely: 4th Industrial Revolution, BIGDATA, Technological Interface Centers, Innovation and Development and new challenges associated with the revision of ISO / IEC 17025 and ILAC questionnaire for Accredited Laboratories.

This event, that ended the cycle of commemoration of 25 years of RELACRE, dedicated to the new challenges, understanding that the requirement will help entities with laboratory activity to prepare the future and to develop their skills.

The ability to adapt to new realities, the training of human resources, the permanent evolution of processes and their specialization, and the growing need to face new expectations of citizens and consumers will determine success of the laboratory

activity in the future. To this end, RELACRE sought to highlight the growing importance of the economic sector in which the entities performing conformity assessment, and in particular accredited laboratories, have an increasingly important role to play in safety and quality of life.



## UCE Building Parts Laboratory

### Overview

The Building Parts Laboratory (UCE) is part of the Buildings Department of LNEC Acoustics, Lighting, Building Components and Facilities Unit.

LNEC performs testing on exterior window frames since 1969 and this laboratory performs tests in accordance to European standards of pedestrian doors and windows since 2005, and as a notified laboratory, under the harmonized standard EN 14351-1 NP, since 2007. It aims to support the construction industry and innovation in the field of technological development of frames. It also performs tests on other building elements.

### Field of expertise

UCE is equipped with the technical and human resources to carry out the tests or calculations according to the harmonized characteristics of the product standard windows and pedestrian doors (NP EN 14351-1), which support the EC marking of outer frames.

### Testing

UCE performs the following tests on prototypes of pedestrian doors and windows, for which it has been certified:

- Air permeability;
- Watertightness;
- Resistance to wind load;
- Resistance to static torsion.

### Other services

In addition to the tests for which it has been certified UCE also develops and performs other tests, such as:

- Testing for determination of operating forces on windows and doors;
- Testing for the determination of resistance to racking on windows;
- Testing for the determination of resistance to vertical load on doors;
- Test of resistance to repeated opening and closing on windows and doors;
- Static and dynamic tests on guards of buildings;

- Sound insulation calculation on windows;
- Air permeability tests, watertightness, resistance to wind load and impact tests on curtain walling;
- In situ air permeability and watertightness tests;
- Mechanical and functional testing on internal pedestrian doorsets, according to European Standards (EN 14351-2).

