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Polo Territoriale di Lecco
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Italy

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ORGANIZED BY

COLLEGIO DEI TECNICI DELLA INDUSTRIALIZZAZIONE EDILIZIA

ASSOCIAZIONE ITALIANA CALCESTRUZZO ARMATO E PRECOMPRESSO

THE INTERNATIONAL FEDERATION FOR STRUCTURAL CONCRETE

FIFTH EDITION

2025 • Lecco - June 30 / July 3

CAPACITY ASSESSMENT OF CORRODED REINFORCED CONCRETE STRUCTURES: FROM RESEARCH TO DAILY ENGINEERING EVALUATION

WITH THE UNCONDITIONAL SUPPORT OF

exemplar solutions for complexity

TOTO COSTRUZIONI GENERALI

UNDER THE PATRONAGE OF

ASSOCIAZIONE TECNOLOGI PER L'EDILIZIA

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Consiglio Nazionale delle Ricerche

POLITECNICO MILANO 1863

reluis

UNIVERSITÀ DI PARMA

Federbeton CONFINDUSTRIA

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CAPACITY ASSESSMENT OF CORRODED REINFORCED CONCRETE STRUCTURES

TOPIC

The ***fib*CACRCS 2025 5th edition** will focus on practical engineering applications achieved through consolidated research on corroded reinforced concrete and prestressed concrete structures. The workshop will cover a range of topics, starting with the definition of corrosion damage indicators and analysis of material characteristics, moving on to the evaluation of the structural behaviour of corroded members, and concluding with the prediction of the remaining service life of corroded structures and intervention strategies.
Case studies on the assessment of deteriorated structures are of particular interest.
Since 2019, the Workshop has attracted participation from experts in the capacity assessment of corroded reinforced concrete structures. Starting in 2025, the CACRCS DAYS Workshop is officially become the ***fib*CACRCS 2025** Conference, being integrated into fib's global network of conferences and initiatives.
The workshop is open to young researchers, experts, and practitioners.
During the ***fib*CACRCS 2025**, professional engineers will have the opportunity to connect with a community of experts who can assist in practical problem-solving and optimizing decision-making procedures for the assessment, interventions and maintenance of existing structures. Additionally, a Round Table discussion will be scheduled to stimulate debate on the analysis of available codes and guidelines for the evaluation of deteriorating existing structures affected by corrosion, as well as identify gaps and future research areas based on the contributions submitted to this workshop.

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CAPACITY ASSESSMENT OF CORRODED REINFORCED CONCRETE STRUCTURES

ORGANIZING COMMITTEE

Coordinators: **Beatrice BELLETTI** (University of Parma), **Dario CORONELLI** (Politecnico di Milano), **Marco DI PRISCO** (Politecnico di Milano)

Olha Palii (University of Parma)
Anna Magri, Ludovica De Cobelli (CTE)
David Fernández-Ordóñez (*fib* Secretary General)
Luc Taerwe (Ghent University, Editor-in-Chief Structural Concrete Journal)
Simone Ravasini, Marco Carlo Rampini, Biagio Calcavecchia, Katherina Flores, Giulio Zani (*fib* Italy Young Members Group)
Mitsuyoshi Akiyama (Waseda University), **Carmen Andrade** (CIMNE - UPC), **Véronique Bouteiller** (Université Gustave Eiffel), **Walter Kaufmann** (ETH Zurich), **Beatriz Martin-Pérez** (University of Ottawa), **Elena Miceli** (Politecnico di Torino), **Jesus Rodriguez** (UPM), **Takumi Shimomura** (Nagaoka University of Technology), **Els Verstrynge** (KU Leuven University), **Joost Walraven** (Em. TU Delft), **Weiping Zhang** (Tongji University)

SCIENTIFIC COMMITTEE

Lucas Adelaide (University Gustave Eiffel), **Fabio Bolzoni** (Politecnico di Milano), **Joan Ramon Casas** (UPC), **Robby Caspeele** (Ghent University), **Antoni Cladera** (Universitat de les Illes Balears), **Matteo Colombo** (Politecnico di Milano), **Marta Del Zoppo** (University of Naples Federico II), **Pieter Desnerck** (University of Cambridge), **Michael Fardis** (University of Patras), **Severin Häfliger** (ETHZ), **Rade Hajdin** (Infrastructure Management Consultants, Switzerland: IABSE), **Chris Hendy** (Atkins, University of Cambridge), **Christopher Higgins** (Oregon State University), **Stefania Imperatore** (Niccolò Cusano University of Rome), **Akio Kasuga** (Sumitomo Mitsui Construction), **Federica Lollini** (Politecnico di Milano), **Fausto Minelli** (University of Brescia), **Boumediene Nedjar** (University d'Evry Paris-Saclay), **Camillo Nuti** (Università degli Studi Roma Tre), **Antonino Recupero** (University of Messina), **Claude Rospars** (University Gustave Eiffel), **Peter Tanner** (IETcc-CSIC), **Francesco Tondolo** (Politecnico di Torino), **Tamon Ueda** (Shenzhen University)

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The venue of the *fib*CACRCS 2025 will be the Politecnico di Milano Polo Territoriale di Lecco

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CALL FOR ABSTRACTS

The ***fib*CACRCS 2025** welcome all contributions related to the behaviour of reinforced concrete, fibre reinforced concrete and prestressed concrete structures damaged by corrosion, with both numerical and experimental approaches, and including some recommendations for the daily engineering evaluation of corroded structures.
You can submit abstracts and papers to the website of the ***fib*CACRCS 2025** event: **http://cacrcs.cte-eventi.com**

PAPER SUBMISSION

Authors willing to present their work at the ***fib*CACRCS 2025** are invited to kindly submit an abstract in accordance with the sessions of the workshop.Papers (8 pages long) will be reviewed and will be included in the Proceedings of the Workshop if they will be accepted.The Authors of the paper will be invited to submit a full manuscript to a Special Issue of Structural Concrete.The submission of full manuscripts will undergo the usual peer-review process of Structural Concrete.
In order to promote and facilitate the transfer of knowledge from Research to Daily Engineering Evaluation, the template for extended abstracts contains a paragraph dedicated to a description of the use of the presented results in engineering applications. The template for abstracts and papers is available on the ***fib*CACRCS 2025** website (http://cacrcs.cte-eventi.com).

IMPORTANT DATES

ABSTRACT SUBMISSION	30.06.2024	**ABSTRACT ACCEPTANCE NOTIFICATION**	30.07.2024
PAPER SUBMISSION	31.12.2024	**PAPER ACCEPTANCE**	31.01.2025
FINAL VERSION OF THE PAPER SUBMISSION	31.03.2025	**AUTHOR'S REGISTRATION**	01.04.2025
PRESENTATION SUBMISSION	15.06.2025	**ATTENDEES' REGISTRATION**	30.06.2025
FULL MANUSCRIPT SUBMISSION FOR A SPECIAL ISSUE OF STRUCTURAL CONCRETE			30.11.2025

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AWARDS

Awards will be conferred to the most outstanding paper presented by a young researcher and to the most excellent paper presented in the workshop.

REGISTRATION FEES

are VAT exempted and include participation to the workshop, gala dinner and electronic proceedings.

Standard fee	**€ 600,00** (including **CTE** membership)
Reduced fee for Young People	**€ 530,00** (valid only for people aged <30 years and including **CTE** membership)
Reduced fee for CTE fib Member	**€ 500,00** (valid only for **CTE**, ***fib***, Member 2025)

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DETAILED PRELIMINARY PROGRAM

Monday, June 30th

9:00 (*CET) **OPENING OF THE WORKSHOP**

*Central European Time

Welcome & Introduction

9:15 **B. Belletti, D. Coronelli**, Event Coordinators
9:30 **Enrico Nusiner**, CTE President
9:45 **David Fernández-Ordóñez**, *fib* Secretary General
10:00 **Luc Taerwe**, Editor-in-Chief of Structural Concrete

• OPENING KEY-NOTE LECTURES

10:15 **Joost Walraven** (Em. TU Delft, Delft, The Netherlands)
Capacity assessment of existing structures according to fib Model code 2020

10:45 **Rade Hajdin** (Infrastructure Management Consultants GmbH, Zurich, Switzerland / University of Belgrade, Serbia)
Bridge Management Systems – The next generation

11:15-11:50 Coffee Break

S1) DAMAGE INDICATORS OF CORROSION IN RC, SFRC AND PC MEMBERS AND MODELS FOR DETERIORATED MATERIALS

• KEY-NOTE LECTURES

11:50 **Edoardo Proverbio** (University of Messina, Messina, Italy)
Corrosion in PT Tendons: Review of Estimation & Forecasting Models

12:20 **Carmen Andrade** (CIMNE – UPC, Barcelona, Spain)
Effect of local climate in the concrete degree of water saturation and on the corrosion rate

13:00-14:00 LUNCH

• PRESENTED PAPERS

14:00 **Giglio M., Proverbio E., Di Vita C.P.**
Corrosion induced damage evaluation on post-tensioned reinforced concrete structures

14:15 **Russo N., Redaelli E., Lollini F.**
Electrochemical and gravimetric measurement of corrosion rate of steel bars in carbonated concrete

14:30 **Belletti B., Bernardi P., Sirico A., Zanotto F., Balbo A., Malcevschi A.**
Bond performance for uncorroded and corroded steel reinforcement in biochar-added concrete

14:45 **Ravasini S., Belletti B.**
A fib database on the mechanical performance of corroded prestressing reinforcement

15:00 **Martens C., Caspeele R., Verstrynge E.**
Exploring the Effects of Mechanical Cracking on the Corrosion Rate in Reinforced Concrete

15:15 **Imperatore S., Monteleone C., Nerilli F., Capozzoli L., Di Gennaro D., De Martino G., Vasanelli E.**
Novel NDT methodologies for identifying corrosion damage in reinforced concrete structures

15:30 **Coronelli D., Rosati G.**
Calculation of resistance for corroded strands with localized pits

15:45 **Bolzoni F., Brenna A., Beretta S., Ormellese M., Diamanti M.V., Pedeferri M.P.**
Reinforced concrete structures affected by chloride induced corrosion: effect of preventative methods on service life

16:00-16:30 Coffee Break

16:30 **Imperatore S., Monteleone C.**
Corrosion assessment and mechanical characterization of naturally corroded reinforcements

16:45 **Tondolo F., Biondini F.**
Bridge|50 research project: study on long term performances of precast concrete bridge girders

17:00 **Sirico A., Palii O., Ravasini S., Belletti B., Sánchez J.**
Pitting morphology of prestressing strands subjected to naturally chloride environment

17:15 **Flores Ferreira K., Rampini M.C., Russo N., Lollini F., Scaccabarozzi D., Zappa E., di Prisco M.**
The effects of artificial corrosion on reinforced concrete structures: experimental campaign on small-scale beam specimens

18:00 (*CET) **CLOSING OF THE 1st DAY**

Tuesday, July 1st

9:00 (*CET) **OPENING OF THE 2nd DAY**

S2) ANALYTICAL AND NUMERICAL MODELS FOR THE CAPACITY ASSESSMENT OF CORRODED RC BEAMS, PC BEAMS AND BRIDGE DECKS COMPONENTS

• KEY-NOTE LECTURES

9:00 **Antonino Recupero** (University of Messina, Messina, Italy)
Prestressing Concrete in Italian Bridges: Seventy years of light and shadows in a winning challenge

9:30 **Chao Jiang** (Tongji University, Shanghai, China)
Corrosion-induced failure mode change and bearing capacity degradation of RC beams

• PRESENTED PAPERS

10:00 **Ferche A., Habibi S., Vecchio F.**
Modelling of Corroded Rebar in Concrete Members: Scratching the Surface

10:15 **de la Fuente A., Oller E., Todisco L., Sosa P.M., Ruiz G., Martínez F., Ribas C., Rodriguez J., Andrade C.**
ESTRUCOR: The Spanish research network on structural assessment of concrete structures

10:30 **Mezera A., Holý M., Řeháček S.**
Assessment of Actual Conditions of Posttensioned Cables for Reliability Analysis of Existing Bridges

10:45 **Galano S., Losanno D., Parisi F.**
Finite element analyses of post-tensioned concrete bridge girders with corroded tendons in different grouting conditions

11:00-11:30 Coffee Break

11:30 **Lenticchia E., Tondolo F., Ceravolo R.**
Experimental test on a ferrocement beam: structural capacity reduction in presence of corrosion

11:45 **Granata M.F., Colajanni P.**
Structural behaviour of old reinforced concrete bowstring bridges affected by corrosion

12:00 **Haefliger S., Weber C., Casprini E., Kaufmann W.**
Influence of pit location on the load-deformation behaviour of corroded reinforced concrete members

12:15 **Di Carlo F., Rinaldi Z., Meda A.**
Analytical modelling strategies comparison to predict the structural behaviour of corroded reinforced concrete beams

12:30 **Granata M.F., La Mendola L.**
Influence of partial bond and degradation on post-tensioned prestressed girders

12:45 **Bontempi A., Di Stefano N., Minelli F., Ravasini S., Belletti B.**
Analytical Models for the Prediction of the Shear Capacity of PC Beams with Corroded Reinforcement

13:00-14:00 LUNCH

14:00 **Spinella N., Rossi P.P., Messina D., Recupero A.**
Modelling at different levels of complexity of RC beams with corroded reinforcing steel

14:15 **Anghileri M., Biondini F.**
Experimental Validation of Nonlinear Structural Analysis of RC/PC Beams with Corroded Stirrups

14:30 **Torabian Isfahani F., Vittone M., Nava G., Beltrami C.**
Corrosion rate assessment of bridge deck post-tension cables with different environmental/maintenance and exposure scenarios

14:45 **Di Carlo F., Molaioni F., Stella A., Talledo D.A.**
Analysis of flexural behaviour of corroded reinforced concrete beams considering results of digital image correlation

S3) ANALYTICAL AND NUMERICAL MODELS FOR THE CAPACITY ASSESSMENT OF CORRODED RC COLUMNS, BRIDGE PIERS AND VERTICAL MEMBERS OF STRUCTURES AND INFRASTRUCTURES

• KEY-NOTE LECTURES

15:00 **Stavroula Pantazopoulou** (York University, Toronto, ON, Canada)
Modelling Parameters for Members with Corroded Bars in Seismic Assessment of Existing Structures

15:30 **Mehdi Kashani** (University of Southampton, Southampton, United Kingdom)
Recent Advances in Modelling Nonlinear Seismic Performance of Corrosion- Damaged RC Bridges

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• PRESENTED PAPERS

16:00 **Michelini E., Dudziak S., Ravasini S., Belletti B.**
Capacity assessment of corroded reinforced concrete frames subjected to differential ground settlements

16:15-16:45 Coffee Break

16:45 **Ruta D., Bernardini D., Cardone D.**
On the influence of the choice of the steel degradation law on the modeling of corroded Reinforced Concrete structures

17:00 **Santarsiero G., Masi A., Gaetano R., Picciano V.**
Seismic behaviour of simply supported reinforced concrete bridges with corroded piers

17:15 **Islam T., Singh Y.**
Experimental and Numerical Investigation of the Effect of Rebar Corrosion on the Lateral Load Capacity of RC Frames

17:30 **Coronelli D., Martinelli L.**
Bridge piers load and deformation capacity: tests and numerical modelling

17:45 **Zucca M., Stochino F., Vecchi E., Crespi P.**
On the seismic performance of existing RC motorway viaducts subject to corrosion effects

18:00 **Poeta A., Scozzese F., Micozzi F., Dall'Asta A.**
Influence of degradation uncertainties on seismic risk of reinforced concrete bridge pier: preliminary investigation

18:30 (*CET) **CLOSING OF THE 2nd DAY**

19:00 GALA DINNER

Wednesday, July 2nd

9:00 (*CET) **OPENING OF THE 3rd DAY**

S4) ANALYTICAL AND NUMERICAL MODELS FOR THE CAPACITY ASSESSMENT OF CORRODED HALF JOINTS, SQUAT MEMBERS, ETC.

• KEY-NOTE LECTURES

9:00 **Marco di Prisco** (Politecnico di Milano, Milan, Italy)
The half-joint in the Italian bridges: residual bearing capacity and smart solutions for retrofitting

• PRESENTED PAPERS

9:30 **Luyten K., Botte W., Caspeele R.**
Effect of time-dependent degradation on the structural reliability of concrete half-joint bridge girders

9:45 **Řeháček S., Citek D., Pokorny P., Krystov M., Citek A.**
Evaluation of the condition of prefabricated prestressed girder bridge after about 65 years of use

10:00 **Pizzini P., Di Stefano N., Facconi L., Minelli F., Plizzari G.**
Experimental, analytical and numerical analyses of artificially corroded half-joint beams

10:15 **Tenca P., Calcavecchia B., Luyten K., Caspeele R., Ravasini S., Bernardi P., Belletti B.**
Numerical assessment of the load-bearing capacity of existing bridges with dapped-end beams

10:30 **Martinelli P., Colombo M., di Prisco M.**
Robustness assessment of half-joint RC girder bridges under corrosion

10:45 **Flores Ferreira K., Rampini M.C., di Prisco M.**
Analytical investigation on the structural impact of chloride-induced corrosion in reinforced concrete dapped-end beams

11:00-11:30 Coffee Break

S5) VERIFICATION METHODS FOR CORRODED STRUCTURES

• KEY-NOTE LECTURE

11:30 **Alan O'Connor** (Trinity College Dublin, Dublin, Ireland)
Probabilistic Assessment of Existing Bridges

12:00 **Alfred Strauss** (University of Natural Resources and Life Science, Vienna, Austria)
Quality management in concrete structures – from construction throughout the lifetime

12:30 **Mitsuyoshi Akiyama** (Waseda University, Tokyo, Japan) and **Dan M. Frangopol** (Lehigh University, Bethlehem, USA)
Probabilistic prediction of the residual service life of corroded structures

13:00-14:00 LUNCH

14:00 **Lollini Federica** (Politecnico di Milano, Milan, Italy)
Durability design of tunnels: present and future

• PRESENTED PAPERS

14:30 **Baldassari A., Piemonti A., Conforti A., Plizzari G.**
Influence of pitting corrosion on the flexural behavior of RC beams

14:45 **Vescovi M., Belletti B., Ferretti D., Pagliari F.**
Experimental tests on bond-slip of corroded post-tensioning strand

S6) MONITORING AND DIGITAL TWINS FOR THE PREDICTION OF THE RESIDUAL SERVICE LIFE OF CORRODED STRUCTURES

• KEY-NOTE LECTURES

15:00 **Javier Sanchez** (Institute Edoardo Torroja, Madrid, Spain)
Monitoring corrosion in reinforced concrete structures: case studies, results, analysis and outputs

15:30 **Mauro Dolce** (University Federico II, Naples, Italy)
Research on the deterioration of infrastructures in the Reluis project: visual inspections and experimental tests

• PRESENTED PAPERS

16:00 **François R., Garcia D., Hess L., Charron J.-P., Ben-Ftima M.**
Electrochemical tomography to quantify and describe the corrosion state of corroded concrete structures

16:15 **Messina D., Venturi V.D., Recupero A., Proverbio E.**
Analytical and experimental procedure for in situ stress measurements in prestressed concrete structures

16:30-17:00 Coffee Break

17:00 **Jamal J.**
Experimental assessment of corroded RC structures using non-contact techniques

17:15 **Bouteiller V., Bonnet A., Da-Silva V., Marie-Victoire E., Bouichou M., Thauvin B., Queguiner R., Duros E., Villain G., Achenbach R., Raupach M.**
Assessment of chloride-induced corrosion of reinforced concrete by non-destructive testing and continuous monitoring

17:30 **Keßler S., Köhncke M.**
Enhancing Corrosion Condition Assessment via Digital Modeling

17:45 **Marie-Victoire E., Bouichou M., Ducasse-Lapeyrusse J., Bouteiller V., Bonnet A., Da-Silva V., Thauvin B., Queguiner R., Villain G.**
Long-term non-destructive assessment of corrosion induced by chloride ingress and carbonation

18:00 **Fritz B.**
Long-term Corrosion Monitoring for Evaluating the Performance of Repair Measures

18:30 (*CET) **CLOSING OF THE 3rd DAY**

Thursday, July 3rd

9:00 (*CET) **OPENING OF THE 4th DAY**

S7) UPGRADING OF DETERIORATED STRUCTURES BY REACTIVE AND PROACTIVE INTERVENTIONS

• KEY-NOTE LECTURES

9:00 **José Matos , Sousa Hélder** (University of Minho, Guimarães, Portugal)
The implementation of reactive *and proactive interventions towards increasing the resilience of RC structures*

9:30 **Steffen Marx** (Dresden University of Technology, Institute for Concrete Structures, DB Netz AG, Germany)
The Carola Bridge – from construction to failure

• PRESENTED PAPERS

10:00 **Van Den Hende K.**
Optimization of preventive repair strategies for a prestressed concrete girder subjected to chloride-induced corrosion

S8) CASE STUDIES

• KEY-NOTE LECTURES

10:20 **Mario Petrangeli e Luigi Fieno** (MPA, Roma, Italy)
Corrosion effects of post-tensioned strands on the safety of highway viaducts - The case study of mountain viaducts

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10:50-11:10 Coffee Break

11:10 **Joan Ramon Casas** (UPC-BarcelonaTech, Barcelona, Spain)
Capacity assessment and proactive intervention in damaged bridges: two case studies

11:40 **De-Cheng Feng** (Southeast University, Nanjing, China)
Integrated model updating, probabilistic assessment, and digital twin of nuclear containment structures considering time-dependent corrosion effects

• PRESENTED PAPERS

12:10 **Bernardini S., Papworth F., Newby R.**
Investigation and Repair of an Immersed Concrete Box Subject to Restrained and Structural Cracking

12:25 **Newby R., Papworth F., Bernardini S.**
Residual Life and Repair for an Existing Concrete Wharf

12:40 **Miceli E., Gino D., Giordano L., Castaldo P., Mancini G.**
Experience from experimental testing of an existing PRC bridge beam

12:55 **Khaddija A., El Mendili Y., Cherkaoui M.**
Mechanical, and electrochemical (EIS) characterization of reinforced concrete by Natural Moroccan Pozzolan and fly ash

13:10-14:00 LUNCH

14:00 **Newby R., Papworth F., Bernardini S.**
Corrosion Assessment of Post-Tensioned Cables

14:15 **Casprini E., Passoni C., Haefliger S., Todisco L.**
Defining corrosion parameters from naturally corroded bars: the CORR-DATA database

14:30 **Citek A., Krystov M., Citek D., Rehacek S.**
Inspection of a Reinforced Concrete Frame Bridge Following a Tire Fire Incident

15:00 **Duarte N., Bairán J.M.**
Assessment of corroded prestressed concrete wharves in Catalan Marinas

15:15 **Reale S., Furinghetti M., Pavese A.**
Experimental and Numerical Studies on the Seismic Response of a Corroded RC Bridge

15:30 **Lollini F., Carsana M., Gastaldi M., Giannini L., Redaelli E.**
Experimental tests for the evaluation of the durability of a tunnel under construction

15:45-16:15 Coffee Break

16:15 **Round table on identifying the technical gaps for the structural evaluation of corroded concrete structures for future guidelines and code on short and long-term assessment of corroded structures**

CHAIR: Walter Kaufmann, ETH Zurich, Switzerland

CLOSING CEREMONY

18:00 • **AWARDS**
• **CONCLUSION OF THE WORKSHOP**

18:30 (*CET) **CLOSING OF THE WORKSHOP**
*Centre European Time