

Federica Lollini, Ph.D.
Assistant professor
Politecnico di Milano, Italy

Education and experience

In 2004 Federica Lollini graduated cum laude in Building Engineering at Politecnico di Milano and in 2008 she got a Ph.D. in Materials Engineering at Politecnico di Milano. After the Doctorate award she had a post doctoral position at Politecnico di Milano. Since October 2011 she is assistant professor in the field of Materials Science and Technology.

Scientific activity

The scientific activity of Federica Lollini takes place at the Chemistry, Material and Chemical Engineering Department "Giulio Natta" (CMIC) of Politecnico di Milano and considers different aspects related to the durability of construction materials.

The main research topic deals with the design of concrete composition and constructions details in relation with the design service life, with regard to corrosion of steel reinforcement, in order to construct durable and sustainable concrete structure and infrastructures. Deterioration due to corrosion induced by carbonation and chloride penetration has been considered and the behaviour of different materials under different exposure conditions have been studied and quantified. She has studied the resistance of different types of concrete to chloride and carbonation penetration, considering both accelerated methods and natural exposure conditions and she has investigated the relationship among these parameters. The effect of factors such as temperature and relative humidity on concrete resistivity and corrosion rate has been considered. She has studied models for the deterioration of concrete structures and the parameters needed for a performance-based evaluation of the service life, according to the recent indications for the design of durable reinforced concrete structures.

A part of the research activity deals with the evaluation of the utilization of seawater and salt-contaminated aggregates (natural or recycled) for a sustainable concrete production when combined with non-corrosive reinforcement to construct durable and economical concrete infrastructures. The corrosion behaviour of different grades of stainless steel bars has been investigated with the aim of detecting the appropriate bars for the required combination of design service life and environmental exposure.

She has also investigated the durability aspects of concrete made with nanoparticles mixed-in. In particular, the effects of addition of different nanosilica and nanoalumina dosages on compressive strength and durability properties of concretes with different water /binder ratios have been investigated. Furthermore, photocatalytic concrete, i.e. concrete obtained by adding TiO₂ photocatalyst nanoparticles to the mixture has been studied. The mutual interaction between the photocatalyst and the hosting material, which is of fundamental importance to identify possible criticisms in the obtaining of long-lasting products, has been analysed. In particular the respective influence between TiO₂ and concrete on the rheological and mechanical properties, resistance to carbonation, as well as photocatalytic activity of hydraulic binders, has been investigated.

The research activity has also considered methods of inspection of existing reinforced concrete structures aimed at the diagnosis of conservation state and at the choice of the most suitable repair technique. In particular, buildings and structures that, owing to their historical and architectural relevance, belong to the cultural heritage, as for instance the Marchiondi Institute and the Velasca Tower in Milan, have been considered.

A part of the research activity has dealt with the use of FEM models for the determination of current and potential distribution in reinforced concrete elements subject to the application of cathodic protection, with localized and distributed anodes. In particular the throwing power of this electrochemical technique has been studied for carbonated and chloride contaminated concrete structures. Moreover numerical models have been applied to evaluate the initiation and propagation phases in submerged hollow concrete structure.

Part of her research activity has investigated the colour fading of concrete block paving and the development of methods aimed at its characterization. In particular she has studied the main factors, such as environmental and mechanic actions, which lead to the colour variation and has analysed the microstructural variation of the block paving surface layer.

She has studied particular cementitious materials used in the past for the restoration of the façades of the Church of San Fedele in Milano to replace the original Angera stone in order to characterize their composition and to evaluate their conservation state.

Scientific production

She is author and co-author of about 90 scientific papers published either in national or international journals or in proceedings of conferences on topics connected with materials durability.

The paper “Investigation on the effect of supplementary cementitious materials on the critical chloride threshold of steel in concrete”, of which she was co-author, was awarded as Outstanding Paper 2016.

The paper “Service life estimation and comparison with present conditions of existing reinforced concrete structures”, of which she was co-author, was awarded in the session W80: Prediction of service life of building materials and components, in the International Congress CIB World Congress, 10-13 May 2010, The Lowry, Salford Quays, United Kingdom.

Scientific roles

- She is a Reviewer of scientific papers for international Journals in the field of materials science and engineering and for international congresses.
- She chaired a session in the International Conference on Concrete under severe conditions-environment & loading, Consec 2016, which was held in Lecco, Italy, in September 2016.
- She chaired a session in the International Symposium on Cement & Concrete Materials, which was held in Ningbo, China, in November 2011.

Teaching activity

The teaching activity of Federica Lollini takes place at Politecnico di Milano and, from 2005, she has held the following courses and seminars:

- Course in Structure, properties and applications of materials (bachelor degree in Building Engineering) – since Academic Year 2014;
- Course in Deterioration of reinforced concrete and its diagnosis (Graduate School in Architectural and Landscape Heritage) –Academic Year 2016;
- Course in Construction Materials (bachelor degree in Building Engineering) – since Academic years 2011-2014;
- Course in Materials assessment in cultural heritage building (bachelor degree in Architecture) – Academic Years 2008-09 and 2009-10;
- Course in Materials science and technology (bachelor degree in Architecture) – Academic Year 2009-10.

- Seminars, practices and laboratories in the following classes (Building Engineering, Civil Engineering, Materials Engineering, Architecture): Materials technology, Materials Durability, Cementitious and ceramic materials, Materials science and technology.
- Seminars in the Ph.D. program in Preservation of Architectural Heritage and in the Master “Il cantiere di conservazione: progetto, materiali, tecniche e gestione”.

She supervises Building and Civil Engineering students during their bachelor and master theses (she has been assistant supervisor of more than 40 among master and bachelor theses). Both the bachelor and the master theses are mostly experimental works, during which she organizes and plans the activities to finish them on time. In the supervision of the theses, she trains and educates the students in the assigned works, discussing the obtained results, encouraging, however, their autonomy.

National and international collaborations and projects

- **Collaborations:** She was involved in the European project (FP7 People Marie Curie Actions), DOSECOPS - Development of sustainable electrochemical corrosion protection systems for reinforced concrete structures (Project coordinator name: prof. Long-yuan Li, University of Plymouth, UK) which dealt with the exploration of new repair methods for reinforced concrete structures by combining electrochemical treatments with injection of nanoparticles. This European project was intended to support exchanges of researchers between European and Chinese universities. Within the framework of the project she attended workshops, in Italy and in China, which involved all the partners and also a number of colleagues from external parties. The workshops was intended to share ideas and to discuss the areas where the research collaboration should be developed/expanded between individual partners.

In 2010, she actively took part to the experimental activities of the validation test program “Validation exercise on chloride penetration and carbonation test methods” proposed by CEN TC51(TC104)/JWG12 where several European laboratories were involved.

In 2007 she was a visiting student in the laboratories of TNO, Built Environment and Geosciences, Delft (NL), under the supervision of Dr. Rob Polder. She was involved in several research activities, regarding the use of FEM models for reinforced concrete elements subject to the application of cathodic protection as well as the study of the concrete microstructure by means of thin section. The collaboration, which has been continued even after the internship, led to several publications.

In 2005, during the research project “Formulation of guidelines for the diagnosis and repair of reinforced concrete structures damaged by corrosion” (funded by CESI - Centro Elettrotecnico Sperimentale Italiano Giacinto Motta SpA.) she collaborated with the Dipartimento di Elettronica e Informazione of Politecnico di Milano for the development of an expert system aimed at the evaluation of the conservative state of reinforced concrete structures, with particular regard to electrical plants, and the detection of the most suitable repair techniques.

- **Research projects:** She participates, as collaborator, to the SEACON project - Sustainable concrete using seawater, salt-contaminated aggregates, and non-corrosive reinforcement (<http://seacon.um-sml.com>), (principal investigator of Politecnico di Milano: prof. L. Bertolini; leader of the project: prof. A. Nanni – University of Miami) financed by the Infravation Program (Advanced systems, materials and techniques for next generation infrastructure). This project is aimed at demonstrating the safe utilization of seawater and salt-contaminated aggregates (natural or recycled) for a sustainable concrete production when combined with non-corrosive reinforcement to construct durable and economical concrete infrastructures.

She participated, as collaborator, to the research project PRIN 2008 “Procedures for the design of reinforced concrete structures in relation with steel reinforcement corrosion” (local scientific

coordinator: prof. L. Bertolini; national scientific coordinator: prof. G. Mancini) and to the research project PRIN 2005 “Assessment of time of initiation and propagation for corrosion of steel in concrete” (local scientific coordinator: prof. L. Bertolini; national scientific coordinator: prof. G. Mancini).

Selected publications

Lollini, F., Redaelli, E., Bertolini, L., “Investigation on the effect of supplementary cementitious materials on the critical chloride threshold of steel in concrete”, *Materials and Structures*, Vol. 49, pp. 4147 – 4165, 2016.

Torabian Isfahani F., Redaelli, E., Lollini, F., Li, W., Bertolini, L., “Effects of nanosilica on compressive strength and durability properties of concrete with different water to binder ratios”, *Advances In Materials Science And Engineering*, pp. 1-16, 2016.

Lollini, F., Redaelli, E., Bertolini, L., “A study on the applicability of the efficiency factor of supplementary cementitious materials to durability properties”, *Construction and Building Materials*, Vol. 120, pp. 284-292, 2016.

Carsana, M., Gastaldi, M., Lollini, F., Redaelli, E., Bertolini, L., “Improving durability of reinforced concrete structures by recycling wet-ground MSWI bottom ash”, *Materials and Corrosion*, Vol. 67, pp. 573-582, 2016.

Lollini, F., Redaelli, E., Bertolini, L., “Corrosion assessment of reinforced concrete elements of Torre Velasca in Milan”, *Case studies in Construction Materials*, Vol. 4, pp. 55-61, 2016.

Lollini, F., Carsana, M., Gastaldi, M., Redaelli, E., Bertolini, L., “The challenge of the performance-based approach for the design of reinforced concrete structures in chloride bearing environment”, *Construction and Building Materials*, Vol. 79, pp. 245-254, 2015.

Lollini F., Redaelli, E., Bertolini, L., “Effects of portland cement replacement with limestone on the properties of hardened concrete”, *Cement and Concrete Composites*, Vol. 46, pp. 32-40, 2014.

Della Pergola A., Lollini F., Redaelli E., Bertolini L., “Numerical modeling of initiation and propagation of corrosion in hollow submerged marine concrete structures”, *Corrosion*, Vol. 69, No. 12, pp. 1158-1170, 2013.

Bertolini L., Carsana M., Gastaldi M., Lollini F., Redaelli E., “Binder characterisation of mortars used at different ages in the San Lorenzo church in Milan”, *Materials Characterization*, Vol. 80, pp. 9-20, 2013.

Diamanti M.V., Lollini, F., Pedefferri M.P., Bertolini L., “Mutual interactions between carbonation and titanium dioxide photoactivity in concrete”, *Building and Environment*, Vol. 62, pp. 174-181, 2013.

Redaelli E., Lollini F., Bertolini L., “Throwing power of localised anodes for the cathodic protection of slender carbonated concrete elements in atmospheric conditions”, *Construction and Building Materials*, Vol. 39, pp. 95-104, 2013.

Lollini F., Bertolini L., “Factors That Affect Color Loss of Concrete Paving Blocks”, *ACI Materials Journal*, Vol. 110, No. 1, pp. 45-55, 2013.

Lollini F., Redaelli E., Bertolini L., “Analysis of the parameters affecting probabilistic predictions of initiation time for carbonation-induced corrosion”, *Materials and Corrosion*, Vol. 63, No. 12, pp. 1059-1068, 2012.

Redaelli E., Carsana M., Gastaldi M., Lollini F., Bertolini L., “Electrochemical techniques for the repair of reinforced concrete suffering carbonation-induced corrosion”, *Corrosion Reviews*, Vol. 29, No. 5-6, pp. 179-190, 2011.

Bertolini L., Lollini F., “Effects of weathering on colour of concrete paving blocks”, European Journal of Environmental and Civil Engineering, Vol. 11, No. 6, p. 936-957, 2011.

Bertolini L., Lollini F., Redaelli E., “Durability design of reinforced concrete structures”, ICE – Construction Materials Journal, Vol. 164, No. CM6, p. 273-282, 2011.

Milano, 18 aprile 2017

Autorizzo al trattamento dei miei dati personali ai sensi della legge 675/96 e successivo D. Lgs. 196/03 “Ai sensi del D. Lgs n. 196 del 30 giugno 2003 “Codice privacy”, il sottoscritto autorizza il Politecnico di Milano a pubblicare sul sito WEB di Ateneo il proprio Curriculum Vitae, per i fini istituzionali e in ottemperanza al D. Lgs n. 33 del 14 marzo 2013 “Decreto trasparenza” come modificato dal D. Lgs. 97 del 2016. “