



UNIVERSITY  
OF TRENTO - Italy

Department of Civil, Environmental  
and Mechanical Engineering



EXTREME LOADING ANALYSIS OF  
PETROCHEMICAL PLANTS AND DESIGN OF  
METAMATERIAL-BASED SHIELDS FOR ENHANCED  
RESILIENCE

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## SEMINAR ANNOUNCEMENT

The following seminar will be organised on 05.07.2019 at 11.30 in room 1B

### MONITORING, DIAGNOSIS AND PRESERVATION OF 20TH CENTURY ARCHITECTURAL HERITAGE: FROM THE FIRST INDUSTRIAL SHELLS TO THE ICONIC STRUCTURES BUILT BY NERVI AND MORANDI IN TURIN

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#### **Abstract:**

Architectural heritage consists of a great variety of buildings and monuments that significantly differ from each other in terms of typology, historic period, construction techniques, and materials. Among those, modern architectural heritage, including industrial heritage, raises many issues connected to its preservation or rehabilitation. For instance, much of the world's industrial heritage is unrecognized or undervalued, many buildings are abandoned, or even demolished, and are thus at risk and in need of protection. This situation can be attributed to a variety of factors; in fact, 20th century buildings still struggle to be considered part of a heritage, moreover their original functions have substantially changed, and the materials or technological innovations employed for their construction have not always endured long-term stresses. Indeed, the recent collapse of Polcevera Viaduct in Genoa has raised strong concerns on the durability of concrete structures conceived at that time. The scientific community has once again underlined the important role played by maintenance and continuous structural health monitoring (SHM) in avoiding these disastrous events. Moreover, modern architecture buildings were designed and built with no, or very limited, seismic provisions, due to the lack of reference technical standards at the time of their construction. With a view to the restoration and renewal of these buildings, a careful assessment of the performance of their structures is a priority. In order to demonstrate a correct approach to these issues, the lecture will present some significant results recently obtained on the structural analysis, seismic assessment and diagnosis of four important 20th century heritage buildings. The former clinker warehouse, also known as the "Paraboloide" of Casale Monferrato, Italy, was built at the beginning of the past century as part of the Italcementi factory, and it is the only survived building of this larger industrial complex located near the historical city centre. The Paraboloide is the first building in Italy that was built using a thin shell structure in concrete with a parabolic shape. This structural configuration was extremely innovative for the period and it allowed the creation of a unified internal space of considerable height, without any intermediate floors. The scheme, conceived to suit perfectly its industrial use, especially the need for large spaces to stock or produce materials, would spread throughout the country in the following decades, especially for industrial facilities buildings.



The other three analysed cases are different pavilions of the monumental complex of Turin Exhibition Center, which represents a milestone in the history of modern engineering and architecture. The main buildings of the Center (Halls B and C) were the subject of several numerical investigations aimed at the seismic assessment and optimal sensor placement. In these roofing systems, Pier Luigi Nervi combined innovative prefabrication procedures with ferrocement. For Pavilion V, a hypogeum hall designed by Riccardo Morandi, the authors have conducted extensive numerical analyses and investigations, evidencing its inherent vulnerability to seismic actions. The possible retrofitting and reuse of this building as a part of the Architecture Faculty Campus is currently under consideration by Politecnico di Torino, which has recently started an extensive campaign of experimental tests.

### Short Biography:



Prof. Rosario Ceravolo, MSc in Civil Engineering and PhD in Structural Engineering both from Politecnico di Torino. Associate Professor of Earthquake Engineering at the Politecnico di Torino, head of the Earthquake Engineering & Dynamics lab, vice-head of the Responsible Risk Resilience interdepartmental Centre (R3C). Invited researcher at the Ecole des Ponts (2001), professor of Structural Health Monitoring at Université Paris-Est (2009), invited professor at Columbia University, NY (2017-18). Member of the multidisciplinary PhD board in Architectural Heritage. Author of over 200 research papers, including 70 contributions on international journals, in the fields of Earthquake Engineering, Structural Health Monitoring, Analysis and Restoration of Structures of Architectural Heritage, and Reduction of Seismic Risk. Member of ISCARSAH, IASS, IASS-WG17, ISHMII, ASCE. Active role in many international and national projects and networks regarding earthquake engineering, risk, resilience, architectural heritage and infrastructure, including FP7 IRIS, SERIES, RETRO', UNPLUGGED, FABRIC, MSC-ITN XP-RESILIENCE, DPC-ReLUIS. He is in charge of the monitoring programs for many important structures, including the Sanctuary of Vicoforte with its world's largest masonry oval dome and Turin Exhibition Center pavilions.

The seminar is organised by the XP-RESILIENCE research group

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Prof. Oreste S. Bursi