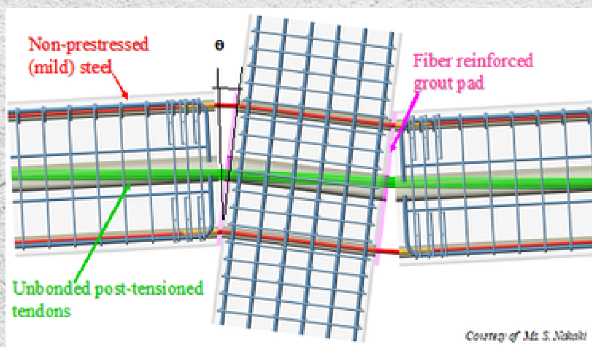
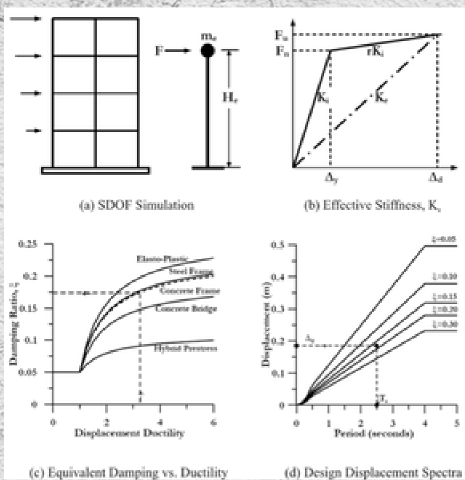
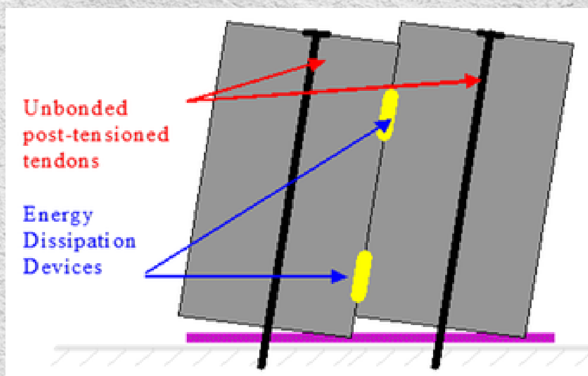
ASOCIACIÓN GUATEMALTECA DE
INGENIERÍA ESTRUCTURAL Y SÍSMICA







DIPLOMADO ONLINE

DISEÑO SÍSMICO AVANZADO
CONCRETO REFORZADO Y PREFABRICADO DE BAJO DAÑO
DESARROLLOS Y APLICACIONES PARA GUATEMALA

PROF. ING. STEFANO PAMPANIN
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Departamento de Ingeniería Estructural y Geotécnica
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BACKGROUND AND MOTIVATION

Earthquake Engineering is facing an extraordinary challenging era, the ultimate target being set at increasingly higher levels by the demanding expectation of our modern society: to provide low-cost, more widely affordable, still architecturally appealing, high-seismic-performance structures capable of sustaining a design level earthquake with limited or negligible damage, minimum disruption of business (downtime) or, in more general terms, controllable socio-economical losses.

These compelling requirements of cost-effectiveness and high-performance are leading to a major effort towards the development of damage-control design approaches and technologies.

The 22nd Feb 2011 Christchurch earthquake (sequence) in New Zealand and the 2012 Emilia earthquake in Italy event have further highlighted the mismatch between the expectations of building occupants and owners over the reality of engineered buildings' seismic performance.
On one hand (Christchurch earthquake 2011): ductile plastic hinges, typically of reinforced concrete or precast emulative approach, designed to concentrate the damage in discrete location and thus prevent the collapse of a buildings, have proven to lead, under a severe seismic event, to a severe level of damage, often resulting into several months of downtime and loss of occupancy of the building if not to the need for demolition.
On the other (Emilia Earthquake), inadequate structural detailing and design philosophy, as well as the general lack of considerations on overall displacement compatibilities issues between vertical and horizontal structural components (including the diaphragms) and the non-structural elements (partitions/facades).
On the other (Emilia Earthquake 2012): inadequate structural detailing and design philosophy, as well as the general lack of considerations on overall displacement compatibilities issues between vertical and horizontal structural components (including the diaphragms) and the non-structural elements (partitions/facades) have led to partial or total collapse or significant damage, downtime and economic losses to numerous precast concrete industrial buildings.

SCOPE

In this series of webinars an overview of recent developments on innovative high performance (or low-damage) solutions for precast concrete buildings based on dry jointed ductile connections, typically referred to as PRESSS-Technology (PREcast Seismic Structural Systems) and alternative to both the emulation of cast-in-situ approach as well as to the more traditional structural systems adopted for industrial buildings in southern European regions as well as in many seismic.prone countries around the world, will be given.

The combination of unbonded post-tensioning techniques and of additional sources of internal or external dissipaters leads to self-centering and dissipative systems, capable of undergoing major earthquake with minor damage when compared with traditional solutions.

Not only for seismic application and resilience: the same concepts and technical solutions can be successfully implemented in low- or no-seismic regions, as a valuable alternative to the more traditional construction typology of industrial buildings (plants, warehouses) consisting of single- to two-three portal frames relying upon statically determined schemes with beams simply supported or “hinged” to cantilever columns.

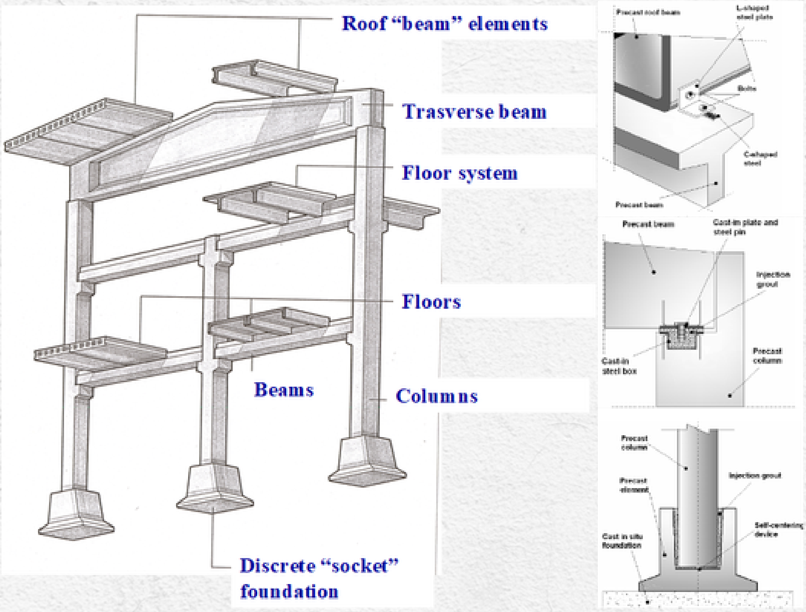

Figure 1 – Typical structural system and connections details for precast industrial buildings in European construction practice
(modified after Dassori, 2000 (left); Calvi et al., 2006 (right))

More specifically, the main aspects related to the conceptual behaviour and design criteria will be discussed based on extensive experimental testing and numerical analysis. Examples of the several on site-applications in New Zealand and overseas (Italy, United Stated, Argentina, Costarica, Japan etc) will be given, as a confirmation of the rapid and increasingly wide acceptance of such construction technique within different construction markets and realities.

The course, organized within the auspices of the **AGIES (Association of Guatemala Structural and Seismic Engineering Society)** and the **Concrete and Precast Concrete Industry in Guatemala**, intends to provide an update for practical implementation to the Engineering community, (Precast) Concrete and Construction Industry, with the latest developments on low-damage concrete and (precast) concrete technologies to be adopted for buildings and/or bridges.

At the end of this series of interacting webinars, the participants (practicing engineers, architects, precasters, contractors) will be expected to gain familiarity with the **conceptual behaviour, the design criteria and step-by-step procedure as well as modeling aspects** of alternative type of precast concrete systems, from precast emulative of cast-in-situ to dry jointed ductile connections.
Updates on **current trends in major international seismic code provisions** will be provided along with **real examples of on site applications** as a further confirmation of the advantages associated to the easy constructability and speed of erection.

LECTURES (ONLINE MODE)

Topics covered:

Block 1 – Motivations and Innovative Solutions for Low-Damage Concrete Systems

-Overview of the Canterbury earthquakes sequence: lessons learnt, impact on performance-based design philosophy and opportunity for a wide implementation of the next generation of damage-resisting structures
-Alternative design philosophies and solutions for the seismic design of precast concrete structures. Emulation of cast-in situ concrete. Introduction to jointed ductile connections, PRESSS-Technology and the hybrid system concept. Research & Development of these systems.

Block 2 - Fundamentals of Displacement Based Design

-Introduction to Displacement Based Design (DBD). Review of limitation of current Force-Based (FBD) approaches. Closed-Form solution for non-iterative FBD. Role of residual deformations as additional performance-based damage indicator. Enhanced performance of self-centering systems.
-Example of DBD for Single-Degree of Freedom (SDOF) and Multi-Degree-of-Freedom (MDOF) frame and wall systems.

Block 3 - Connection Design, Analysis and Modeling
-Analysis and design criteria for post-tensioned rocking/dissipative frames and single or coupled walls.
-Simplified analytical/numerical modeling techniques using lumped plasticity approach. From section and connection moment-rotation to overall structural system modeling.
-Connection between floors and lateral resisting systems. Displacement incompatibility issues and suggested design solutions. Non-Tearing floor solutions.

Block 4 – On-site implementations and miscellaneous
-Examples of on-site applications worldwide of PRESSS-technology in low-, medium- or high-seismic areas. Constructability aspects, sequence and detailing.
-Miscellaneous. Advanced Flag-Shape, Application to Bridges, Low-Damage Non-structural Elements, Loss Modeling, Expected annual Losses (EAL), Integrated Low-Damage Building System (SERA Project).

DESIGN PROJECT/WORKSHOP

As part of the course, participants will be assigned (either individually or in group of two people) the task to design and analyze the seismic response of a multi-storey precast concrete building comparing traditional and innovative technologies.

The design will follow either a Force-Based Design (FBD) (traditional and/or closed-form “retrofitted’ solution) and a Displacement Based Design.

The participants will develop connection and structural detailing of the critical sections/connection.

A lumped plasticity model will be created using commercial software as SAP2000, ETABS, Ruaumoko, OpenSees or other similar platform at discretion of the participants, who are expected to have already gained familiarity with the basics of numerical modeling.

LECTURES SCHEDULE

Week	Monday	Tuesday	Wednesday	Thursday	Friday
March 16 y 17	**SP** **9:00-11:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP** **9:00-11:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			
March 23 y 24	**SP** **9:00-11:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP** **9:00-11:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			
March 30					
April 6					
April 13 y 14	**SP** **8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP** **8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			
April 20 y 21	**SP** **8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP** **8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			

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Week	Monday	Tuesday	Wednesday	Thursday	Friday
April 27 y 28	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			
May 4 y 5	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			
May. 11					
May 18 y 19	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)	**SP 8:00-10:30** (Guatemala Time GMT-6 =16.00-18.30 Italian Time)			

Course
Total Lecture: approx. 35 hrs Lectures + Design Classes

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PRESENTER

Prof. Ing. Stefano Pampanin

Stefano Pampanin is Full Professor of Structural Engineering at the Department of Structural and Geotechnical Engineering at La Sapienza University of Rome, where he joined in 2015 after 16 years at the University of Canterbury in New Zealand.

He has received a Laurea (cum laude) in Civil Structural Engineering at the University of Pavia, a Master in Structural Engineering at the University of California, San Diego and a PhD in Earthquake Engineering at the Technical University of Milan. He was a Fulbright Visiting Scholar at the University of California, San Diego from 1998-1999.

In 2002 he joined the Department of Civil ad Natural Resources Engineering at the University of Canterbury, Christchurch in New Zealand where he became Professor of Structural Design and Earthquake Engineering and Chair of the Structural and Geotechnical Cluster.

He has been President of the New Zealand Society for Earthquake Engineering, NZSEE, (2012-2014) and was nominated Fellow of NZSEE in 2017.

In the past 30 years he has been dedicating a significant effort in the research and development, codification and practical implementation through design and peer review, as well as knowledge-dissemination of innovative solutions for the seismic design of low-damage structural systems in concrete and timber, as well as for the seismic retrofit of existing reinforced concrete structures.

He has been actively involved in a number of national and international code and technical committees for the preparation of design guidelines and standards including: fib, international federation of concrete: WG 7.4, WG7.5 (Co-Chair), WG7.6, WG6.10, WG6.6 (Co-Chair) ACI440-F, NZS3101:2006 (appendix B), Department of Building and Housing (DBH) guidelines for the design, assessment and retrofit of hollowcore floors; current revision of NZS3101 (concrete), NZS3603 (timber), NZSEE2006 guidelines on "Assessment and Improvement of the Performance of Existing Buildings" (Task Leader), Minister of Business Innovation and Employment (MBIE) special technical committees to produce "White Paper on Residual Capacity of Reinforced Concrete Structures"; "Base Isolation Guidelines"; "Guide for Good Practice on Low-damage Design".

He has been Principal Investigator (PI) or Co-PI of externally funded and competitively granted research project for over NZ$20Million since 2002 with strong focus on development and implementation of new technological solutions for seismic resisting structures, either newly designed or existing ones.

He is author of more than 500 peer-reviewed scientific publications in the field of earthquake engineering, including 10 journal papers and book chapters, 2 edited books, 3 patents and has received several awards for his research and professional activities including:

- PCI (precast Concrete Institute) Martin P. Korn Award 2000
- fib Diploma 2003 for Younger Engineers (under 40-years old)
- 2005 EQC/NZSEE Ivan Skinner Award "for the advancement of Earthquake Engineering in NZ" (inaugural recipient).
- NZSEE (NZ Society for Earthquake Engineering) Best Research Paper Awards 2005,2007,2008, 2010
- Otto Glogau Award 2005, 2013
- NZ Concrete Society, Sandy Cormack Award 2004, 2010
- Supreme Concrete Award 2008
- ·structE Henry Adams Award, 2012
- UC Innovation Medal, 2013
- ACI Design Award 2015
- Fellow, IPENZ (FIPENZ), NZ Institute of Professional Engineers, 2015
- Fellow, NZSEE (New Zealand Society for Earthquake Engineering, 2017

PRESENTER

He has delivered numerous invited/keynote lectures at conferences, universities, research institutions and groups of practicing engineers worldwide.

Following the 22 February 2011 earthquake in Christchurch, Prof. Pampanin has played an active and key role in the recovery and post-earthquake investigation activities: a) Leader of the Recovery Project “Seismic Performance of RC Buildings” under the Natural Hazard Research Platform; b) Expert Panel of the Department of Building and Housing, investigating the collapse of critical buildings, namely CTV, PGC, Forsyth Barr and Grand Chancellor Hotel reporting to the Canterbury Earthquake Royal Commission of Enquiry; c) Main author of a technical report commissioned by the Royal Commission on low-damage design philosophy and technology; d) Engineering Reference Group advising the Ministry of Business Innovation and Employment on policy making related to the civil design and construction industry sector.

In 2015 he was elected Fellow of IPENZ “for his application of engineering technology in the community and innovation in creating technological products. As an internationally-regarded researcher, educator and innovator, he progressed the theory and practice of earthquake engineering. His work alongside others on developing earthquake-resistant buildings and materials aims to reduce seismic risk…”

As a Charter Professional Engineer in Italy and in New Zealand he has assisted with the design and/or acted as peer reviewer on a number of special projects implementing: a) advanced design methodology, such as Displacement-Based-Design; b) numerical modelling for non-linear time history analyses; c) innovative/advanced technology, such as rocking-dissipative solutions for concrete, timber steel base isolation and supplemental damping; d) Seismic Assessment and Retrofit solutions.