

Report

RILEM Doctoral Course

Concrete Life Cycle – From cradle to grave

Universidad Autónoma de Nuevo León, Instituto de Ingeniería Civil, Monterrey, Mexico, 14-18 October 2024

International organization: Ole Mejlhede Jensen, Konstantin Kovler, Alejandro Durán-Herrera and Pedro Castro-Borges

Local organization by: Alejandro Durán-Herrera, Iliana M. Garza Gutiérrez, Magda Elizondo Elinzondo, Erick Villanueva Rodriguez, Ana Durán-Herrera and Cristhofer González Sosa

Participants

A total of 28 PhD students, MSc final-year students and industry professionals from several countries participated in the doctoral course where the Faculty of Civil Engineering of the Autonomous University of Nuevo León was the host institution and local organizer. Additional 10 students from East Asia were signed up for the course, but they were unfortunately prevented from participation due to an 8-month visa application procedure.



Participants and teachers of the RILEM Doctoral Course

Scope of course

Modern concrete is a highly sophisticated material, where it is possible to accurately engineer a broad range of specific properties, for example based on selection of the concrete ingredients, by controlling the concrete mix composition, or by appropriately operating the subsequent mixing, casting and curing process. The course aimed at enriching the participants with up-to-date knowledge on advanced materials and technologies related to Portland cement concrete, and at transferring in-depth knowledge on selected areas of concrete science and technology stretching from its design to its end-of-life. The topics dealt with included: Fresh properties, non-destructive testing, curing and hydration, industrial by-products, property development, shrinkage and cracking, standards and specifications, life cycle assessment, durability, service life evolution.

Course content

The course included lectures and hands-on exercises in the laboratory and in the class-room. In addition, the doctoral course involved a professional tour to the in-situ cast 45 story "Torre Loma Larga". Construction site representatives from Holcim informed the course participants about the concrete technology involved. Social activities included a down-town dinner and realized the aim of stimulating a friendly study atmosphere. Each course module involved preparatory readings (typically two scientific papers). In order to receive course credits (5 ECTS credits) participants needed to make a scientific poster, give a group "conference presentation" and pass a quiz which evaluated the learning outcomes from all course modules and readings. All teaching activities were in English. The overview program follows at the end of this report.

Financial and scientific support

The RILEM Doctoral Course was supported financially by HOLCIM Mexico and Germann Instruments, whereas scientific sponsorship was granted by RILEM, ACI International and the ACI Northeast Mexico Chapter. The course was also co-sponsored by the Instituto de Ingenieria Civil at the Universidad Autónoma de Nuevo León. Information about RILEM was presented to the participants during the course and in course material. Sign-up for a free 3-years RILEM membership was offered to the participating PhD-students.



Pictures from left to right, top to bottom: 1) Course participants attentively listening to a presentation given by Konstantin Kovler, 2) Dimitri Feys instructing course participants during the lab exercise in fresh properties of concrete, 3) Course participants registering results from NDT on a concrete beam, 4) Course participants studying posters, 5) Construction site study tour to the 45 story "Torre Loma Larga", 6) Down-town, Mexican style galla dinner for course participants and lecturers.

Lecturers

The following persons lectured at the course:

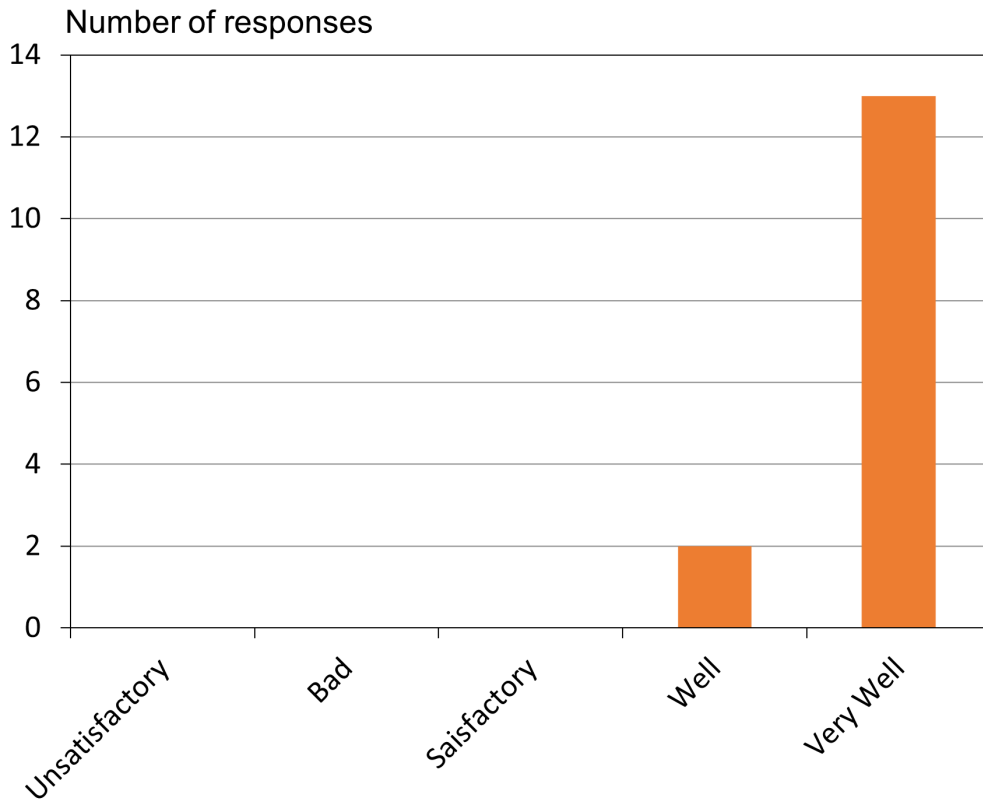
- Pedro Castro Borges, CINVESTAV-IPN Unidad Merida, Mexico
- Alejandro Durán-Herrera, Universidad Autónoma de Nuevo León, Mexico
- Dimitri Feys, Missouri University of Science and Technology, USA
- R. Douglas Hooton, University of Toronto, Canada
- Ole Mejlhede Jensen, Technical University of Denmark, Denmark
- Konstantin Kovler, Technion - Israel Institute of Technology, Haifa, Israel
- Daman K. Panesar, University of Toronto, Canada
- Jason Weiss, Oregon State University, USA

Workload, ECTS and learning outcomes

The workload of the full course was approximately 140 hours corresponding to 5 ECTS points, including the teaching period during the course, readings before the course and preparation of an individual poster. The learning outcomes of the participants were evaluated mainly through a quiz and the plenum presentations finalizing the course. A certificate of attendance was issued to the participants completing the course. Seven participants were awarded poster competition prizes based on teacher's evaluation of the "Technical content" and "Technical Format". Additionally, course participants were involved in the selection of an overall poster competition winner.

Course evaluation

At the end of the course an evaluation was conducted. A total of 15 participants completed the questionnaire. On the scale "unsatisfactory, bad, satisfactory, well and very well", all the responses were well or very well. Many participants expressed spontaneously their satisfaction with the course, such as "An excellent course with international personalities who are authorities in their fields; the knowledge gained is invaluable."



Based on the responses received through the questionnaires and personal contacts during and after the course it is concluded that the event was very successful.

Organizers of the doctorate course: O.M.Jensen, K.Kovler, A.Durán-Herrera and P.Castro-Borges, November 2024.

Appendix: Overview program

Concrete Life Cycle – From cradle to grave

Mon 14 – Fri 18, October 2024, Doctoral Course, 5 ECTS Monterrey, Mexico

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
8 ⁰⁰						
9 ⁰⁰		1. Course intro & personal presentat.	6. Lecture OMJ Curing and hydration	9. Lecture WJW Shrinkage and Cracking	13. Lecture RDH Durability	17. Quiz
10 ⁰⁰		Coffee - poster	Coffee - poster	Coffee - poster	Coffee	Coffee
11 ⁰⁰		2. Lecture DFE Fresh properties	7. Lecture KKO, ADH Industrial by-products	10. Lecture RDH Standards and specifications	14. Lecture PCB Service life evolution	18. Prep. of student presentations
12 ⁰⁰		Lunch	Lunch	Lunch	Lunch	Lunch
13 ⁰⁰						
14 ⁰⁰		3. Lecture KKO, ADH NDT	8. Lecture WJW Property development	11. Lecture DKP Life Cycle Assessment	15. Lecture NN Study tour preparation	19. Student presentations
15 ⁰⁰						
16 ⁰⁰		Coffee - poster	Coffee - poster	Coffee - poster	Coffee	Coffee
17 ⁰⁰		4A. Tutorial DFE Fresh prop. (experim.)	4B. Tutorial DFE Fresh prop. (experim.)	12. Tutorial DKP Life Cycle Assessment (exercise)	16. Study tour	19. Student presentations
		5A. Tutorial KKO, ADH NDT (experim.)	5B. Tutorial KKO NDT (experim.)	Poster - vote		20. Closure
18 ⁰⁰	Barbecue					
19 ⁰⁰		Dinner	Dinner	Dinner	Downtown Dinner	

Participant preparations before event:

- (2 weeks of work)
- Paper readings
- Personal presentation
- Scientific poster

Lecturers:

ADH: Alejandro Durán-Herrera
 DKP: Daman Panesar
 DFE: Dimitri Feys
 RDH: Doug Hooton
 WJW: Jason Weiss
 KKO: Konstantin Kovler
 OMJ: Ole Mejlhede Jensen
 PCB: Pedro Castro Borges