

ACI Committee 209 –CREEP AND SHRINKAGE IN CONCRETE

MINUTES

ACI 2011 Fall CONVENTION

Cincinnati, OH, October 17, 2011

1. Opening of the Meeting and Welcome

The meeting was called to order by Chairman Chiorino at 8:40 AM and all in attendance were welcomed to the meeting.

2. Welcome and Introduction of Members

Attendees:

VOTING MEMBERS

Mario Chiorino (Chair)
Domingo J. Carreira (Secretary)
Sergio Alcocer (TAC Contact)
Gianluca Cusatis
Matthew D'Ambrosia
Raymond Gilbert
Will Hansen
Carlos Videla

ASSOCIATE MEMBERS

Sungjin Bae
Benjamin Byard
Mauricio Lopez

VISITORS

Paul Bracegirdalis
Erika Holt
Matthew Offenbergl
Gurdeep Singh

Meeting attendees introduced themselves. Chair noted that there is not quorum.

Apologies

Voting members Zdenek P. Bazant, Marwan A. Daye, Noel J. Gardner, Akthem Al-Manaseer, Lawrence Novak, Ian Robertson, Mario Sassone and Walter Dilger offered apologies for not being able to attend the meeting.

3. Announcements

Next meeting will be on Monday, March 19, 2011 from 8:30 to 11:30 AM at Hyatt Regency Dallas, Dallas, TX

Changes in membership:

- No changes
- The Committee Roster Committee dated 10/17/2011 is shown in Attachment A.

Chair Chiorino mentioned that the International Advanced Course "Analysis of Creep and Shrinkage Effects in Concrete Structures" was held under the patronage of ACI at CISM International Center for Mechanical Sciences in Udine, Italy, May 23-27, 2011 (flyer with program is shown in Attachment B). The Course was attended by 35 scholars, research assistants and associate professors from Europe, Asia and North America. The lecturers were ACI 209 members Mario Chiorino and Domingo Carreira (Coordinators), Ian Robertson, Mario Sassone

and Carlos Videla, and Mamdouh El Badry from the University of Calgary. The main reference for the Course was the final draft of ACI 209 3R document. A Textbook volume of the Course is under editing by Chiorino and Carreira for Springer-Verlag, the official distributor of CISM lecture notes.

As a complement to the Pittsburgh Minutes where it was announced, the present Minutes contain in Attachment C also the flyer of SEWC 2011 Structural Engineers World Congress held in Villa Erba, Como, Italy, from April 4th to 6th, 2011, which contained a Special Session entitled “Time-dependent behaviour of concrete: prediction models and methods of analysis”. As reported by mail by Chair Chiorino to the Committee members prior to the meeting, in this Session he delivered the lecture: “Analysis of structural effects of time-dependent behavior of concrete: an internationally harmonized format”, in which he illustrated the format of ACI 209.3R document “Analysis of Creep and Shrinkage Effects in Concrete Structures” developed by the corresponding sub-committee. In his lecture, Chiorino evidenced that this document represents at the date the compendium and the most advanced and updated version of previous formats developed at pre-standard level within international associations like CEB and *fib* and adopted, at standard level, by CEN-Eurocode.

Copies of the following documents were distributed at the meeting:

- Agenda for this meeting.
- Minutes of the Spring 2011 meeting in Tampa, FL.
- Committee Roster dated 04/08/2011.

These documents were previously distributed via the ACI 209 web site and email.

4. Approval of Minutes from the Spring Meeting in Tampa, FL.

Chairman Chiorino asked for review and approval of the minutes. There were no comments. Due to the lack of quorum the minutes will be submitted to approval via website.

5. Status of reports:

- ACI 209.1R-05 “Report on Factors Affecting Shrinkage and Creep of Hardened Concrete”
Resolution of TAC Negatives: Chair informed that Akthem Al-Manaseer will finish the revision to respond to TAC comments and that the revised document will be submitted for voting. Chair reminded the need to complete this task by the end of 2011/early 2012 to meet TAC deadline. In fact, TAC approved the revised report 209.1R during the 2010 spring convention subject to satisfactory response to TAC comments within two years.
- ACI 209.3R-XX. “Analysis of Creep and Shrinkage Effects in Concrete Structures”
Chiorino, as chair of the Editorial Committee reminded that the whole document was approved through three subsequent ballots ending respectively September 26, 2008, November 6, 2009 and April 1st, 2011, with the exception of Appendix I and of Appendix L NOTATION (to be transformed into Chapter 2-NOTATION to meet TAC requirements). All negatives expressed in the ballots were solved and withdrawn and voted as non-persuasive in two cases, as documented in the Minutes of previous Committee meetings. The summary of the situation was presented on the screen by Chiorino and is reproduced in the tables of Attachment D. Chiorino will draft the two remaining items and submit them to web ballot before the Dallas meeting. In parallel, he will perform the editorial revision of the entire document required by

the transformation of Appendix L into Chapter 2, with the consequent needed changes in the numbering of chapters, sections, figures and equations and of all related cross references.

- Other Documents: ACI 209.4R-XX “Test Methods for Creep and Shrinkage”. Hani Nassif being absent, no report on the status of the document was available.

6 Other Business

Appointment of the subcommittee for the report “Creep, and Shrinkage Models, Applicability and related Uncertainties.”

A discussion of the mission and scopes of the subcommittee took place. Evidence was given to the need to provide proper guidance to profession and practitioners concerning the selection of prediction models adapted to the problems under consideration’. D’Ambrosia, Gilbert and Hanson volunteered to be members of this subcommittee. Any member, including associate members, is invited to serve in the subcommittee. The chair will be appointed before the Dallas meeting.

Appointment of the subcommittee for the report “Guidelines for 3D Time-dependent Numerical Analyses of Concrete Structures Based on Rate-type Creep Laws”. A discussion of the mission and scopes of the subcommittee took place. It was evidenced that the report of the subcommittee should expand and detail, and be consistent with, the guidance rules on these items already incorporated in the final draft of ACI 209 3R (namely in present Section 2.7–Numerical solutions for structural analysis based on rate-type creep laws, and Appendix B.3–Rate-type approach). Evidence was given also to the need of addressing the domains of activities of both designers and authors of structural analysis computational softwares. Cusatis and D’Ambrosia volunteered to serve in the subcommittee. Chair Chiorino informed that Sassone and Aslani are willing to volunteer and Cusatis informed that Beghini is willing also. Chair Chiorino informed of the appointment of Cusatis as Chair of this subcommittee.

7 New Business

Erika Holt suggested that ACI 209 prepares presentations in power point to be used as educational tools to help faculty members to introduce this subject to the students.

Chair Chiorino suggested that courses or seminars in a format similar to the successful CISM International Course mentioned at point 3 (with flyer and program in Attachment B) be proposed in the Americas, with the patronage of ACI.

8. Presentations

There were no presentations.

8. Adjournment

A motion to adjourn was submitted by Videla and seconded by Hansen. All members present voted to adjourn. The meeting adjourned at 10.24 AM.

Attachments:

- A. Committee Roster dated 10/17/2011.

- B. Flyer and program of CISM International Advanced Course “Analysis of Creep and Shrinkage Effects in Concrete Structures”.
- C. Flyer of SEWC 2011 Structural Engineers World Congress.
- D. ACI 209.3R-XX “Analysis of Creep and Shrinkage Effects in Concrete Structures”:
Approved items and Remaining items to be completed and balloted.

Respectfully submitted by D. J. Carreira, Secretary.

ATTACHMENT A

Committee Roster Creep and Shrinkage in Concrete (10/17/2011)

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TIME TABLE
(Registration on Monday at 8:30)

TIME	Monday May 23	Tuesday May 24	Wednesday May 25	Thursday May 26	Friday May 27
9.00 - 9.45	Opening Lecture	Chiorino	Sassone	Carreira	Carreira
9.45 - 10.30	Chiorino	Chiorino	El Badry	Carreira	Sassone
11.00 - 11.45	Chiorino	Chiorino	El Badry	Carreira	Sassone
11.45 - 12.30	Chiorino	Chiorino	El Badry	Carreira	Sassone
14.30 - 15.15	Videla	Sassone	El Badry	El Badry	
15.15 - 16.00	Videla	Sassone	El Badry	El Badry	
16.30 - 17.15	Videla	Sassone	Robertson	Robertson	
17.15 - 18.00	Videla	Sassone	Robertson	Robertson	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: <http://www.cism.it> or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by March 23, 2011 along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

The Deutscher Akademischer Austausch Dienst (DAAD) and the Deutsche Forschungsgemeinschaft (DFG) offer support to German students. Please contact:

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Information about travel and accommodation is available on our web site, or can be mailed upon request.

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Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences
ACADEMIC YEAR 2011
The German Session

ANALYSIS OF CREEP AND SHRINKAGE EFFECTS IN CONCRETE STRUCTURES




Advanced Professional Training
coordinated by

Mario A. Chiorino
Politecnico di Torino
Italy

Domingo J. Carreira
Illinois Institute of Technology
Chicago, IL
USA

Udine, May 23 - 27, 2011

with the patronage of



American Concrete Institute®
Advancing concrete knowledge

ANALYSIS OF CREEP AND SHRINKAGE EFFECTS IN CONCRETE STRUCTURES

Modern concrete structures are becoming more and more complex as a result of elaborate conceptual design and intricate construction techniques combining cast-in-place and prefabricated elements, structural steel components, prestressing and segmental erection, tensioning of stays and ties, jacking, and so on. Typical examples are large span cantilever and cable-stayed bridges, cast-on-form or cantilever built arches prestressed by jacking, composite steel-concrete structures, concrete or steel-concrete high-rise and supertall buildings. Some of these examples represent extreme recent applications of structural concrete. In general, we may speak of structures characterized by sequential applications of external actions (loads and imposed deformations) and by progressive variation in the restraint conditions during construction and early life. For these reasons, these structures are very sensitive, from the construction stage until the end of their service life, to time-dependent effects caused by delayed deformations of concrete (creep and shrinkage). If proper attention is not devoted to these effects, structural reliability in

terms of serviceability and, in some instances, of ultimate safety may be adversely affected. An appropriate evaluation of such effects for designing durable and safe structures requires the establishment of reliable methods for predicting creep and shrinkage strains (a material properties problem), and for determining the consequent time-dependent structural response with an adequate degree of accuracy (a structural analysis problem). The first part of the course briefly addresses the problem of selecting realistic prediction models, focusing on factors affecting rheology of hardened concrete, criteria for construction of a comprehensive database of creep and shrinkage tests and validation/calibration of prediction models with respect to it, comparison and statistical evaluation of different models, with a discussion on adequate statistical indicators. The second and main part of course deals with analysis of structural effects. Fundamentals of the theory of aging linear viscoelasticity are reviewed and basic theorems and general solutions illustrated for the

cases of effective homogeneous structures with rigid or elastic (steel) restraints and of heterogeneous structures and sections. Numerical methods for the solution of hereditary integral equations in terms of incremental forms based on a sum or on conversion to rate-type laws with internal variables are illustrated, as well as algebraic simplifications like the age-adjusted-effective-modulus method. Guidelines are indicated for selecting the appropriate computational approaches, with attention to the design stages and sensitivity of the structure. Advanced problem like hygrothermal effects and cracking, interaction of creep with shear-lag and with flexible shear-connections in composite beams, effects of creep and shrinkage in complex structures such as tied arches, cable-stayed bridges and high-rise buildings are discussed in the last part of the course, together with techniques for long-term structural monitoring and interpretation of results. The course is modeled after the harmonized formats of the following technical guidance documents: the CEB Manual on the same subject (1984), the corresponding sections

of CEB-FIP Model Code 1990 and of fib Textbook on Structural Concrete (2010), and, especially, the recent advanced ACI Guide "Analysis of Creep and Shrinkage Effects in Concrete Structures" (2010, under final approval). The whole set of these documents was edited by the first coordinator, with the cooperation, for the ACI Guide, of the second coordinator and most of other lecturers. Emphasis will be given within the course to this favorable scenario of internationally agreed, although progressively evolving, fundamentals and basic rules of application for codes and technical guidance documents on a subject of significant relevance for the long-term reliability assessment of modern concrete structures, highlighting areas of well established consensus and open problems. The course is addressed to doctoral and postdoctoral researchers, teaching and research assistants in structural mechanics, civil and structural engineering, specialists and practicing engineers in the field of advanced structural analysis and design.

INVITED LECTURERS

Mario A. Chiorino - Politecnico di Torino, Italy
7 lectures on: Fundamentals of aging linear viscoelasticity. Effective homogeneous concrete structures with rigid or plastic yielding restraints. Basic theorems: imposed loads and deformations; single and multiple changes of structural system. Effective homogeneous concrete structures with elastic restraints. Heterogeneous structures. Computational methods for the numerical solution of hereditary integral equations. Algebraic simplifications: AEM method. Guidelines for time dependent analysis of structures.

Carlos C. Videla - Pontificia Universidad Católica de Chile, Santiago
4 lectures on: Creep and shrinkage prediction models and related uncertainty aspects. Factors affecting creep and shrinkage of hardened concrete. Comprehensive database on creep and shrinkage. Guide for modeling and calculating shrinkage and creep in hardened concrete. Statistical evaluation of available prediction models. Discussion of statistical indicators. Influence on the reliability assessment of structures: random scatter, uncertainty of prediction and confidence limits.

Mario Sassone - Politecnico di Torino, Italy
8 lectures on: General numerical incremental solutions for heterogeneous and sequential structures in the aging linear viscoelastic domain. Solutions by AEM method. Solutions for effective homogeneous concrete structures with elastic restraints. Discussion of case studies: segmental concrete bridges and constructions, tied concrete arches, cable-stayed bridges, high-rise concrete or steel concrete buildings. Analysis of beams and framed structures with account for cross section heterogeneities.

Mamdouh M. El-Badry - University of Calgary, Canada
7 lectures on: Cross section analysis. Prestress losses in members with one layer of prestressing steel. Time dependent analysis of prestressed concrete members with multiple layers of prestressing and reinforcing steel using creep-transformed section method. Time dependent analysis of composite members: influence of different thickness of concrete; steel-concrete composite members. Members subjected to sustained temperature gradient.

Domingo J. Carreira - Illinois Institute of Technology, Chicago, USA
5 lectures on: Advanced problems. Hygrothermal effects and cracking. Interaction of creep with shear lag effects in box girders and in wide flanged concrete or steel-concrete composite beams and additional influence of flexible shear connections. Effects of creep and shrinkage in high-rise concrete or steel-concrete buildings.

Ian N. Robertson - University of Hawaii, Manoa, USA
4 lectures on: Monitoring of time dependent effects in large structures. Design of instrumentation system for long-term structural monitoring. Instrument installation and monitoring challenges. Short-term loading and thermal effects. Long-term shrinkage and creep effects. Comparison with shrinkage and creep prediction models.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.

PRELIMINARY SUGGESTED READINGS

BOOKS

- Gross B., *Mathematical Structure of the Theories of Viscoelasticity*. Hermann, 1953.
- Lovitt W., *Linear Integral Equations*. Dover, 1950.
- Salençon, J., *Viscoélasticité pour le Calcul des Structures*. Editions Ecole Polytechnique, 2009.
- Ghali A., Favre R., Elbadry M., *Concrete Structures - Stresses and Deformations*. Spon, 2002.
- Jirásek M., Bazant Z.P., *Inelastic Analysis of Structures*. Wiley, 2002.

- Chiorino M.A., Gardner J. (Eds), *Structural Implications of Shrinkage and Creep of Concrete*, ACI SP-246, 2007.

GUIDES, MANUALS AND PRE-STANDARD DOCUMENTS:

- ACI 209.1R-05, ACI 209.2R-08, ACI 209.3R-XX, *Analysis of Creep and Shrinkage Effects in Concrete Structures*, M. A. Chiorino (Ed), 2010, final draft from Editor.
- Chiorino M.A., Sassone M., *Further considerations and updates on time dependent analysis of*

concrete structures, in "Structural Concrete", V. 2, fib Bull. 52, 2010, p. 43-69.

PAPERS

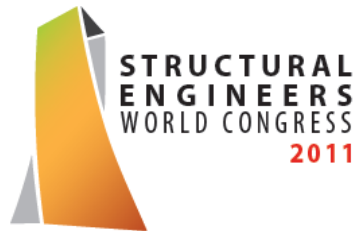
- Chiorino M.A., et al., Effects of creep and shrinkage on serviceability limit state, fib Symp. Dubrovnik, 2007, p. 623-632.
- Chiorino M.A., An Internationally Harmonized Format for Time Dependent Analysis of Concrete Structures, IABSE-fib Conf., Dubrovnik, 2010, pp. 473-480.
- Casalegno C., et al., Time depen-

dent effects in cable-stayed bridges built by segmental construction, fib Congress, Washington, 2010.

- Robertson I. N., Prediction of vertical deflections for a long-span prestressed concrete bridge structure, Eng. Structures, V. 27, 2005, p. 1820-1827.

WEB SITES

- Creep Analysis Research Group: www.polito.it/creepanalysis
- Papers by Z.P. Bazant may be downloaded from: www.civil.northwestern.edu/people/bazant.html



**STRUCTURAL
ENGINEERS
WORLD CONGRESS
2011**

**APRIL 4th to 6th
Villa Erba
COMO - ITALY**

Founding associations:
**ACI - ASCE - IASS
JSCA - NCSEA - SEAOC**

THE AIMS OF SEWC 2011

The Structural Engineers World Congress [SEWC] is an international conference with worldwide participation by structural engineers.

The primary purpose of SEWC2011 is to focus on the overall practice of structural engineering, emphasizing the ethic, technical and theoretical aspects.

The conference will focus on a world-wide exchange of structural engineering experiences, and on the cooperation with the architects, under the common effort towards holistic and sustainable constructions.

The main aspects for the planning, the design and the construction of large structures and infrastructures will be illustrated.

The use of current and new materials, the correct definition of the actions, problems of design and construction, state of the art of research and testing techniques will be also discussed.

THE ORGANIZING COMMITTEE

R. Sundaram:

President SEWC-WORLDWIDE – Honorary member.

Gian Carlo Giuliani dr. eng:

Structural professional engineer in Milano (Italy), Alberta (CAN) and Cyprus - Advisory member IASS Fellow member ASCE, IABSE - Member ACI, fib, PCI, GLIS, ASSISI - President organizing committee IASS Symposium 1995 in Milano.

Riccardo De Col dr. eng:

Structural professional engineer in Milano Secretary of ATE (Association of Building Technologists) Member ACI, ASCE, AISC, IABSE fib.

Fabio Capsoni dr. eng:

Structural consulting engineer in Como

Enzo Siviero prof. eng:

Structural professional engineer - Teacher of Theory and Design of Bridges and construction Techniques at IUAV University in Venezia Vice President of the National Universities Council - Civil Engineering and Architecture area.

THE PATRONAGES AND THE SPONSORS

Patronage to the Congress was given by International Universities and Professional Associations.

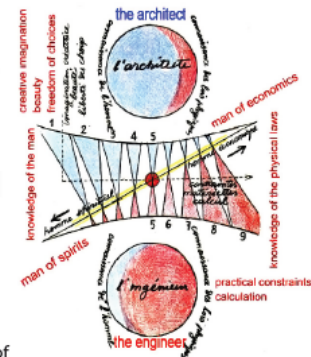
Sponsors are financially supporting the organization, thus allowing keeping the participation fees at a reasonable level.

THE SCIENTIFIC COMMITTEE

Eminent professors and professional engineers, specialized in the Congress themes, and resident in a wide number of Countries, were appointed to evaluate the submitted abstracts, to revise the final papers, and to chair the sessions.

THE THEMES

The themes are assigned according to the following table with an explicit recall to the thought of Le Corbusier which correctly represents the synergy we need for the development of structural engineering.



ANALYSIS-DESIGN CONSTRUCTION	
STRUCTURAL AND ARCHITECTURAL DESIGN	"ARCHINEERING"
CONSTRUCTION IN LABORATORY AND ON SITE TESTS	STRUCTURAL REHABILITATION
STATIC AND DYNAMIC ANALYSIS	HISTORY OF CONSTRUCTIONS
INVERSE ANALYSIS AND DIAGNOSTICS	NEW STRUCTURAL PROBLEMS RESEARCHES
ACTIONS and ENVIRONMENT	
FIRE	CORROSION
WIND	DURABILITY
EARTHQUAKE	SUSTAINABILITY
ABNORMAL LOADS	RESISTANCE
PROBLEMS AND SOLUTIONS	GREEN STRUCTURES
MATERIALS and COMPONENTS	
CONCRETE	BEARINGS
STEEL	JOINTS
WOOD	ISOLATORS
ALUMINIUM	DAMPERS
GLASS	CABLES AND STAYS
COMPOSITES	
DEVELOPMENT AND USE OF MATERIALS	DEVELOPMENT AND USE OF DEVICES
INTRODUCING INVITED LECTURES	MINI SIMPOSIA

THE INVITED LECTURERS

J. Martinez Calzón	Forms, structures and energy.
M. A. Chiorino	Analysis of structural effects of time dependent behaviour of concrete: an internationally harmonized format
M. A. Chiorino	Pier Luigi Nervi: Architecture as challenge
M.E. Giuliani	About structural details
K. Goepfert	New stadium structures
W.B. Kraetzig	Solar chimneys
G. Maier	Inverse analysis methods
M. Majowiecki	Structures in architecture
F. Mola	Conceptual approach and analysis in the structural design of rc tall buildings
R. Motro	Art and structural engineering
P. Samyn	Rhythms in steel structures
E. Siviero	Bridges and architecture
R. Sundaram	Shell structures
M. Virlogeux	Bridges in historical sites

LARGE INFRASTRUCTURES

TBD	The Messina Strait Crossing
TBD	The 2015 EXPO in Milano

SPECIAL PARALLEL SESSIONS

L. Binda	Assessment and repair of Historic masonry buildings
M.A. Chiorino	Time dependent behaviour of concrete: prediction models and methods of analysis.
A. Martelli	Seismic protection techniques
R. Motro	Actuality of tensegrity
A. Murthy	Prestressed and Precast Concrete
A. Palermo	Design of innovative solutions for timber structures
E. Siviero	Engineering versus architecture
K. Soetens	Aluminum structures
TBD	Fire engineering for steel and concrete structures
TBD	Super tall buildings.

Other ones expected

CALL FOR PAPERS

The abstracts should be e-mailed up to November 30th 2010; the acceptance of the abstracts will be confirmed by the Scientific Committee before December 30th, 2010. The authors will be kindly requested to e-mail the final papers before January 31st, 2011 and to pay by this date the reduced participation fee.

THE LANGUAGE

All oral presentations and all written papers will be in English; no simultaneous translation will be provided.

WEB SITE

A web site was implemented to provide more details on the Congress, the status of the submitted abstracts and papers, the registration, and so on. Contact www.sewc-worldwide.org specifying the SEWC2011 - Italy reference. On the web site, links to the sponsors and exhibitors homepages are also given.

THE DATE

The Congress will take place from Monday April 4th to Wednesday April 6th 2011. An optional cultural and technical tour to Milano could possibly be organized on Thursday April 7th.

CLIMATE

At the beginning of April the climate in Como is mild but a little bit cold in the evening; occasional rain can be expected.

THE VENUE

Villa Erba (Como Cernobbio). The recently built Villa Erba convention and exhibition facilities are located in a park on the shore of the well renowned Lario Lake. Very nice hotels can be found in the town of Como or in the villages of Cernobbio and Moltrasio. A fortyfive minute walk or a fifteen minute ride on city buses or ferries is necessary to reach Villa Erba from Como center. The trip from Milano Malpensa Intercontinental airport to Como requires a train change in Saronno and an hour time. Two railway lines, (one regional and one international from Switzerland and Germany) connect Como to Milano in a 45 minute travel time. The exit Como Nord of the A9 highway is convenient for people travelling by car.

THE PARTICIPATION FEE

The normal participation fee is fixed at € 650 if paid before December 31st 2010, or at € 750 for late payments. The fee for the members of the Scientific Committee and for the authors is set at 550€. For the Italian participants only all the fees will be charged with 20% VAT. A reduced fee of 325€ will be applied for students upon the submittal of a specific request from their Teachers.



THE SERVICES

The participation fee will include:

- Lunches from April 4th to April 6th
- Morning and afternoon coffee breaks
- Welcome cocktail on April 4th
- Farewell dinner on April 6th
- A printed copy of the abstracts
- A CD with the complete presented papers
- Free visit to the exhibition (see below)

No accompanying persons' program is planned.

The delegate's eventual guests will be kindly requested to pay for their lunches, welcome cocktail and farewell dinner.

HOTEL AND INDIVIDUAL TRIP BOOKING

The hotel booking, via the local MIZAR agency 22012 Cernobbio (CO) - Via 5 Giornate 2/r ITALY Tel. +39 031 342025 Fax. +39 031 342015 - www.mizarconventions.com - will be directly effected by the participants; reduced rates will be applied for the period of the Congress. Travel agencies will support the delegates in planning their one day or longer trips. Tours to Milano city for visiting monuments, art galleries and shopping areas can be easily and directly effected. taking a train for a 45 minute ride. Individual trips to the close-by Italian and Swiss ski areas located in the Alps can be organized. The view of the glaciers and of the snowy mountains from the top stations of the cable cars is really breathtaking and can be enjoyed by everyone.

PATRONAGING INSTITUTIONS

AIMETA (Associazione Italiana di Meccanica Teorica ed Applicata)
ASSISI (Anti-Seismic Systems International Society) - ATE (Associazione Tecnologi Edilizia) - CISM (International centre for mechanical sciences)
Colegio de ingenieros de caminos, canales y puertos
CSCE (Canadian society for civil engineering) - ENEA (Agenzia nazionale nuove tecnologie energia e sviluppo sostenibile) - Fondazione Promozione Acciaio - GLIS (Gruppo Lavoro Isolamento Sismico) - IUAV (Istituto Universitario Architettura Venezia) - Ordine Ingegneri Architetti di Milano - Ordine Architetti di Como - Ordine Ingegneri di Como Politecnico di Milano - Universidad Politecnica de Madrid - Universidad Politecnica de Valencia - Université Mointpellier 2 - YLDIZ TEKNİK UNIVERSITESI - The Institution of Structural Engineers - CNI (Consiglio Nazionale Degli Ingegneri).

SPONSORING COMPANIES


ArcelorMittal


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EXHIBITORS

ALGA - Canobbio - FIP Industriale - HRC
Interbau - Mapei - Maurer Söhne

ACI 209.3R-XX

Analysis of Creep and Shrinkage Effects in Concrete Structures

- **Approved items**
- **Remaining items to be completed and balloted**

CHAPTER 1 – INTRODUCTION	APPROVED	
CHAPTER 2 – FUNDAMENTALS	APPROVED	
CHAPTER 3 – ANALYSIS OF THE EFFECTS OF CREEP AND SHRINKAGE ON THE OVERALL RESPONSE OF STRUCTURES	APPROVED	
CHAPTER 4 – CROSS-SECTION ANALYSIS	APPROVED	
CHAPTER 5 – ADVANCED PROBLEMS	APPROVED	
CHAPTER 6 – REFERENCES	APPROVED	

APPENDIX A – CREEP AND SHRINKAGE PREDICTION MODELS AND RELATED UNCERTAINTIES	APPROVED	
APPENDIX B – SOLVING THE AGING LINEAR VISCOELASTIC EQUATIONS IN STRUCTURAL ANALYSIS CREEP PROBLEMS AND CONVERSION OF COMPLIANCE INTO RELAXATION: DETAILED ALGORITHMS	APPROVED	
APPENDIX C – APPLICATION OF THE GENERAL METHOD TO A CASE STUDY OF AN NON-HOMOGENEOUS CONCRETE STRUCTURE COMPOSED OF BEAMS, AND COMPARISONS WITH APPROXIMATE SOLUTIONS	APPROVED	
APPENDIX D – AAEM METHOD: APPLICATIONS TO NON-HOMOGENEOUS CONCRETE STRUCTURES	APPROVED	
APPENDIX E – AGING LINEAR VISCOELASTIC SOLUTIONS FOR EFFECTIVE HOMOGENEOUS CONCRETE STRUCTURES OF AVERAGED RHEOLOGICAL PROPERTIES WITH RIGID OR PLASTIC YIELDING RESTRAINTS	APPROVED	
APPENDIX F – EFFECTIVE HOMOGENEOUS CONCRETE STRUCTURES OF AVERAGED RHEOLOGICAL PROPERTIES: EFFECTS OF SHRINKAGE AND YIELDING OF RESTRAINTS	APPROVED	
APPENDIX G – AGING LINEAR VISCOELASTIC SOLUTIONS FOR EFFECTIVE HOMOGENEOUS CONCRETE STRUCTURES OF AVERAGED RHEOLOGICAL PROPERTIES WITH REDUNDANT ELASTIC RESTRAINTS, AND COMPARISONS WITH OTHER APPROACHES	APPROVED	
APPENDIX H – TIME DEPENDENT ANALYSIS OF CONCRETE-CONCRETE COMPOSITE STRUCTURE USING CREEP-TRANSFORMED SECTION METHOD. EXAMPLES OF APPLICATION	APPROVED	
APPENDIX I – VALUES OF $E_c(t')$ AND LONG-TERM NUMERICAL VALUES OF THE FUNCTIONS $J, \Phi, \Phi_{28}, R, \xi, \chi$	TO BE COMPLETED AND BALLOTTED	
APPENDIX L – NOTATION	TO BE COMPLETED AND BALLOTTED	TO BECOME CHAPTER 2