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2019-11-27

## ICOLD's Kommittéarbete 2019

**Kommitté:** Committee A: Computational aspects of analysis and design of dams

ICOLD's "Committee on computational aspects of analysis and design of dams" har varit aktiv under återkommande tidsperioder sedan många år tillbaka. De två senaste aktiva perioderna är 1993 – 1999 samt den sedan 2005 pågående perioden. Kommittén arbetar med att ta fram bulletiner och ordna Benchmark Workshop.

Kommittén har gett ut 6 bulletiner varav Bulletin 122 "Computational procedures for dam engineering – Reliability and applicability", utgiven 2001 och Bulletin 155 "Guidelines for Use of Numerical Models in Dam Engineering", utgiven 2012 är de senast färdigställda bulletinerna. Bulletin 122 innehåller en kritisk granskning av effektiviteten hos tillgängliga matematiska modeller för olika typer av dammar och problemställningar. Bulletinen visar också några av de referenstillämpningar som presenterades under de fyra första Benchmark workshops före 1999. Bulletin 155 presenterar allmänna rekommendationer för processer inom numeriska analysmetoder tillämpade på dammkonstruktioner vid nybyggnad. Bulletinen behandlar även tillämpning av numeriska analysmetoder på befintliga dammar med särskild hänsyn till uppgifter från mätning och övervakning.

För närvarande håller kommittén på med att sammanställa två bulletiner: 1) "*Non-linear modelling of concrete dams*", 2) "*Capitalization of Benchmarks Results*". Dessutom förbereder kommittén tillsammans med kommitté D (Concrete Dams), arbetet med en ny bulletin om valvdammar med fokus på analysmetoder, konstruktionens uppbyggnad med tillhörande dimensioneringskriterier.

Kommittén har sedan 1991 anordnat 15 Benchmark Workshop. Den 14de Benchmark Workshopen ägde rum september 2017, i Stockholm. Den 15de ägde rum september 2019 i Milano, Italien. Nästa Benchmark Workshopen, 16de, äger rum någon gång under hösten 2021 i Slovenien.

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**Förordnandeperiod:** 2018 - 2021

**Kommitténs ordförande:** Guido Mazzá, Italien

**Svensk delegat:** Manouchehr Hassanzadeh, Sweco Energuide  
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**Kommitténs uppdrag:**

COMPUTATIONAL ASPECTS OF ANALYSIS AND DESIGN OF DAMS (2018-2021)

Kommitténs nya uppdrag reviderades och godkändes ICOLDs *Annual Meeting and Congress, Vienna 2018*.

- 1 Prepare recommendations on the role and capabilities of numerical models to deal with problems relevant to dams throughout their life cycle (design, construction, operation, maintenance, rehabilitation, etc.).
- 2 Organize Benchmark Workshops to compare numerical models between one another and/or with reference solution, including the dissemination and publication of results.
- 3 Prepare recommendations on how computational methods can be used to estimate risks and account for uncertainties inherent to dams.
- 4 Review and consolidate the "state of the art" on new probabilistic approaches to traditionally deterministic inputs and outcomes of numerical modelling.
- 5 Propose lines of research aiming at establishing valid numerical models for the solution of dam problems presently not amenable to reliable numerical treatment.

**Lägesrapport 2019:**

Kommitté A hade ett möte i samband med ICOLD's möte i Ottawa. Vid mötet diskuterades kommitténs mål och arbetsuppgifter under de kommande åren, mötesprotokoll finns i Bilaga 1.

Arbetet fortsatte med bulletinen "*Non-linear modelling of concrete dams NLMCD*". Den svenska delegaten är sammankallande, samt ansvarig och författare för ett avsnitt i bulletinen. Richard Malm, KTH/Sweco som är Co-opted member inom Kommitté A, deltar aktivt i arbetet.

Arbetet fortsatte med bulletinen "*Capitalization of Benchmarks Results*". Arbetet är indelat mellan olika grupper. Den svenska delegaten är sammankallande för en grupp som sammanställer de brottmekaniska frågeställningar som har behandlats vid samtliga Benchmark Workshops som kommittén har ordnat. Richard Malm deltar aktivt i arbetet.

Richard Malm organiserade den Benchmark Workshop som ägde rum i Stockholm. Han har varit aktiv i Benchmark Workshop 15 i Milano och kommer att vara aktiv i den 16nde Benchmark

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Workshop som äger rum 2021 i Slovenien. Nedan sammanfattas Richard Malms aktivitet inom Milanos Benchmark Workshop:

Richard deltog i "formulating team" för Tema A vid ICOLD BW 2019 i Milano. Tema A anordnades av:

- Jerzy Salamon, Bureau of Reclamation, USA
- M. Amin Hariri-Ardebili, University of Colorado at Boulder, USA
- Richard Malm, KTH Royal Institute of Technology, Sweden
- Christopher Wood, Bureau of Reclamation, USA
- Giorgia Faggiani, RSE S.p.A, Italy

Dessutom så hade han och några kollegor skickat in ett eget förslag till lösning på detta problem:

- Enzell J, Malm R, 2 Abbasiverki R, and Ahmed L. (2019) Non-linear behavior of a concrete gravity dam during seismic excitation - A case study of the Pine Flat Dam, In: 15th ICOLD International Benchmark Workshop on Numerical Analysis of Dams, Milano, 9 – 11 Sept 2019.

Tema A handlade om jordbävningsanalyser av betongdammar, där Pine Flat Dam i USA hade valts som fallstudie. Syftet med detta tema var att belysa hur inverkan av att beakta bergets egenskaper påverkar vid jordbävningsanalyser samt hur icke-linjära analyser bör genomföras vid jordbävningsanalyser. Totalt deltog 28 grupper med att analysera detta tema.

Benchmark workshopen hölls i Milano mellan 9 – 11 september, <https://www.eko.polimi.it/index.php/icold-bw2019/2019>

Vid benchmark workshopen så var Richard moderator för delar av tema A (deltagarpresentationer och diskussionen) och höll dels en presentation med det bidrag som Richard och hans kollegor skrivit, men höll även i en presentation där han sammanfattade och jämförde samtliga resultat för två av de olika fallen som skulle studeras.

### **Kommande aktiviteter 2020:**

Kommittén möts vid "ICOLD 2020 Annual Meeting/Symposium April 4-10, New Delhi, India"

Kommittén ordnar "16th International Benchmark Workshop on Numerical Analysis of Dams", 2021, Slovenien. Richard Malm deltar aktiv i organisationskommittén.

Richard är huvudformulator för ett tema som planeras att genomföras vid nästkommande ICOLD BW i Slovenien 2021. Detta tema utvecklas av

- Richard Malm, KTH Royal Institute of Technology (Sweden)
- Mateja Klun, University of Ljubljana, Slovenia
- Alexandre Simon, EDF (France)

- Fernando Salazar, CIMNE (Spain)
- Mahdi Ben Ftima, Polytechnique Montréal, (Canada)

Detta tema handlar om att analysera modeller för att prediktera framtida beteende hos en betongdamm. Tanken är att olika typer av modeller så som teoribaserade (finita elementmodeller, etc.) och databaserade modeller (regression, maskininläring, etc.) kan användas för att prediktera beteendet hos en fransk valvdamm.

Arbetet med bulletinerna fortsätter.

Manouchehr Hassanzadeh

COMMITTEE A COMPUTATIONAL ASPECTS OF ANALYSIS AND DESIGN OF DAMS				88 <sup>th</sup> Annual Meeting. Ottawa, 11 <sup>th</sup> June 2019			
MINUTES							
MEMBERSHIP / LISTE DES MEMBRES							
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**AGENDA OF THE TECHNICAL COMMITTEE A MEETING**

- (i) Examination of the Minutes of 2018 Annual Meeting (Vienna, Austria.1<sup>st</sup> July, 2018).
- (ii) Approval of 2019 Agenda Items.

1. Update of the Committee membership and welcome to new representatives, by **Guido Mazzà**.

- ü *Welcome to new members and co-opted members: Xavier MOLIN (France), Anton TZENKOV (Bulgaria), Phoebe PERCELL (USA), Yi Liu (China), Mariyathas AJANTHINY (Sri Lanka), Graham ROBERTS (South Africa), Ehab A. KHALIL (Egypt), Eugeny VITOKHIN (Russia), Takahide KUROSE (Japan).*
- ü *Request of the Chairman to the ICOLD Secretariat to make corrections of the member list in the ICOLD website.*
- ü *Proposals will be voted by the General Assembly on Friday, 14<sup>th</sup> June.*
- ü *Report of the Chairman on the Committee's activity.*

2. Information about the technical and social organization of the 15<sup>th</sup> Benchmark Workshop to be held in Milan, 9<sup>th</sup> – 12<sup>th</sup> September, 2019.

Presenter: **Antonella Frigerio (Italy)**, member of the Local Organizing Committee of the 15<sup>th</sup> Benchmark Workshop.

3. Examination of the proposals received to host the 16<sup>th</sup> Benchmark Workshop (2 proposals have been received from Bulgaria and Slovenia).
  - ü *Proposals presented by **Anton Tzenkov** (Bulgaria) and **Mateja Klun** (Slovenia).*
  - ü *Open discussion to take a decision.*
  
4. Updating of the status of the Bulletin on “Non-linear modelling of concrete dams”.
  - ü *Topic presented by **Manouchehr Hassanzadeh**, leader of the working group.*
  - ü *Open discussion about objectives and organization of the work.*
  
5. Updating on the status of the Bulletin on “Capitalization of the results of past benchmarks”.
  - ü *Topic presented by each working group leader: **M. Meghella**, **G. Zenz**, **G. Mazzà**, **M. Hassanzadeh**, **C. Marulanda**, **I. Escuder** (Note: Meghella who cannot participate to the meeting will be replaced by Mazzà).*
  - ü *Open discussion about objectives and organization of the work.*
  
6. Preparation of the joint Bulletin on Concrete Arch Dams focusing on analysis, methodologies and associated design criteria.
  - ü ***Russel Gunn** and **Dan Curtis** have been involved in the Joint Workshop preparation. **D. Curtis** will report on this subject during the Committee A meeting (Note. **R. Gunn** cannot participate to the meeting).*
  
7. Miscellaneous aspects, by any Member.
  - ü *ICOLD has started to publish the ICOLD Bulletins with a professional publisher (CRC Press - Balkema). New Templates for ICOLD Bulletins are now available, by **Guido MAZZA**'.*
  - ü *Possible updating of the Terms of Reference of the Committee, by **any Members**.*
  - ü *Others, by **any Member**.*



## MINUTES OF THE MEETING HELD IN OTTAWA DURING THE 87<sup>th</sup> ICOLD ANNUAL MEETING

After having given the welcome to the Committee Members, to the New Representatives and to the Observers, the Chairman Guido Mazzà has called for the approval of the Minutes of the previous meeting held in Vienna and of the present Agenda. Both items have been approved.

1. Update of the Committee membership and welcome to new representatives, by **Guido Mazzà**.

ü *The Chairman has given the welcome to the new members and co-opted members and has presented a report on the Committee's activity. The Chairman has requested to check the ToR that could be updated making a request to the ICOLD Board before March 2020 in order to possibly update them before the next ICOLD Meeting that will be held in India in 2020. The past BWs have been shortly presented as well as the next one that will be held in Milano. Some information about the old and in progress Bulletins have been provided. The Bulletin on Capitalization needs to be discussed to finalize a proper way to present all the data so far collected during the previous BWs. Some activities in collaboration with other TCs are in progress: in Ottawa the outcome of the joint meeting between TC A and D, held on Monday 10<sup>th</sup> June, was to cooperate on the preparation of the Bulletin on concrete arch dam. The Chairman finally outlined the necessity to promote a collaboration with the EURCOLD, in particular on seismic dam assessment.*

2. Information about the technical and social organization of the 15<sup>th</sup> Benchmark Workshop to be held in Milan, 9<sup>th</sup> – 12<sup>th</sup> September, 2019.

ü *Antonella Frigerio (Italy), member of the Local Organizing Committee of the 15<sup>th</sup> ICOLD Benchmark Workshop, has presented the technical and organizational aspects of the event. In particular, she has presented the Themes of the Benchmark proposed by the Formulators, the technical visits at two dam sites, and the short course on seismic analyses applied to concrete dams, held by Prof. Chopra on the 4<sup>th</sup> day of the Workshop.*

3. Examination of the proposals received to host the 16<sup>th</sup> Benchmark Workshop (2 proposals have been received from Bulgaria and Slovenia).

ü *Nina Humar (Slovenia), President of the SLOCOLD, and Anton Tzenkov (Bulgaria), member of TC A, have presented the candidacy respectively of Slovenia and Bulgaria to host the next BW in 2021.*

*After a wide discussion of the TC members, it has been decided to maintain a 2-year basis organization of the BWs and to have a balloting to choose the Country that will host the BW in 2021. Slovenia won the ballot with 14 votes vs 6 votes to Bulgaria. Bulgaria has decided to propose its candidacy for the 17<sup>th</sup> BW.*

*Possible Themes proposed by the Slovenian Committee for the 16<sup>th</sup> BW: a) sediment transport and optimisation of the operation of hydroelectric scheme; b) numerical modelling and proposal of the solution for hydraulic phenomena in the stilling basin on the passage from rectangular to trapezoidal open channel; c) comparison of the response of the model of a dam to the loads and operation in comparison to real dam behavior; d)*

*numerical modelling of heat release in the concrete dam construction phases; e) influence of operational vibration on the construction and behavior of the material.*

*Before the 88<sup>th</sup> Annual Meeting in Delhi, Committee members can propose Themes for the 16<sup>th</sup> BW.*

4. Updating of the status of the Bulletin on “Non-linear modelling of concrete dams”.

ü *Manouchehr Hassanzadeh (Sweden), leader of the working group in charge to prepare the Bulletin has presented an updating of the Bulletin whose aim is to outline when non-linear analyses are needed for concrete dams. He described the contents and updates of each chapter. Manouchehr mentioned in particular the good contribution given by Francisco Lopez (Australia) on the chapter about boundary non-linearity and Russel Gun (Switzerland) on the chapter related to FEM codes for NLMCD. Manouchehr presented a planning for the next steps to try to facilitate and finalize the issue of the Bulletin. Before January 24th, 2020 Manouchehr will make a check of the work done and will provide a feedback to the reference person of each chapter. The first draft will be available on February 28th, 2020. From now on every month Manouchehr will update the version of the Bulletin on the ICOLD share space.*

*An open discussion about the objectives and the preparation of the Bulletin has taken place that will be taken into account by the coordinator Manouchehr Hassanzadeh.*

ü *The Chairman discussed about the time schedule of the issue of Bulletins: draft Bulletins must be circulated among the National Committees for gathering observations at least 4 months before the publication to get the approval. To prepare the French version of Bulletins, the TC A needs a support by the French mother tongue members. Gerald Zenz, vice Chair, provided information about the template of Bulletins that the ICOLD Board has defined in the frame of an agreement with Balkema editor. The Template is already available on the share space of the ICOLD website. This template has to be used to issue the new Bulletins.*

5. Updating on the status of the Bulletin on “Capitalization of the results of past benchmarks”.

ü *The Chairman summarized the objectives of the Bulletin and the sharing of the activities to prepare it. The reference person of each chapter has presented the activities in progress.*

Dam type	Problems analysed in the 14 BW					
	Static analysis & interpretation of measurements	Seismic analysis	Thermal analysis Fracture mechanics Swelling	Seepage analysis Settlement evaluation	Probabilistic analysis & risk assessment	Open themes
Concrete	1, 5, 5, 6, 7, 9, 10	2, 4, 12, 13, 14	3, 3, 4, 6, 8, 11, 14		11, 14	9 <sup>th</sup> St. Petersburg 13 <sup>th</sup> Lausanne 14 <sup>th</sup> Stockholm
Embankment	1, 4, 5, 11, 14	2, 3		3, 4, 7	13	
RCC			7, 8			
Rockfill & CFRD	5, 6, 8, 9, 10, 12					
Others		10			12	

Camilo Marulanda (Colombia) presented the activated related to embankment, rockfill and CFRD dams: a table with the main topics has been defined. The advancement of the work is about 70% and as soon as it will be completed, it will be circulated among the members and people that have expressed interest in supporting the initiative. The correlated papers presented in the BWs' Open Themes will be included as well. This aspect will also be followed by the other chapter coordinators.

Manouchehr Hassanzadeh presented the work in progress related to thermal, fracture and swelling analyses: in September the short description of the Themes will be completed as well as the synthesis of each related BWs; the critical assessment of the topics will make reference to three phenomena (mechanical, physical and chemical) and the draft version of the chapter will be available on November; finally, the chapter about the main shortcoming of this type of analyses will be defined.

Mateja Klun (Slovenia) on behalf of Massimo Meghella (Italy), presented a table that will summarize the BWs content related to static analyses and measurement interpretation. The table will be filled in next months within the end of 2019.

Gerald Zenz will follow the Camilo and Manouchehr approach and he has committed to prepare a draft that synthetize the BWs papers related to seismic analyses before the end of 2019.

The chapter related to risk assessment has been completed yet under the supervision of Ignacio Escuder Bueno (Spain).

ü The expectation of the Chairman is to have a draft version of the Bulletin ready for the ICOLD Annual Meeting that will be held in Delhi.

6. Preparation of the joint Bulletin on Concrete Arch Dams focusing on analysis, methodologies and associated design criteria.

ü Russel Gunn and Dan Curtis (Canada) have been involved in the Joint Workshop between TC A and TC D, held on Monday 10<sup>th</sup> June. During the joint meeting, Dan Curtis has reported on seismic analyses related to arch dams.

- ü *The Chairman shortly presented in which BWs of TC A concrete arch dams were investigated with reference with different aspects (static, seismic, thermal problems, abutment stability, etc.). Dun Curtis summarized what has been presented in the Joint Workshop with TC D. It could be taken into account that also several ICOLD Bulletin, issued so far, contain information about concrete arch modelling as well. Other members of TC A have expressed their interest to contribute to the activities of the joint working group.*
7. Miscellaneous aspects, by any Member.
- ü *ICOLD has started to publish the ICOLD Bulletins with a professional publisher (CRC Press - Balkema). New Templates for ICOLD Bulletins are now available on the share space of the ICOLD website.*
  - ü *The TC A ToR will expire in 2020 and they could be postponed or changed providing information to the ICOLD Board 4 months before the ICOLD Annual Meeting in India. The Chairman will send an email to all Members to ask a feedback.*
  - ü *According to the number of the TC A members that will participate to the 15<sup>th</sup> ICOLD Benchmark Workshop in Milan, the Chairman will organize a Committee meeting to discuss about the activities in progress.*