

First Plenary Meeting of RILEM TC-TDC in Beijing

May, 16th and 17th, 2012

Minutes

Time	9:00-17:30, May 16, 2012, 9:00-12:00, May 17, 2012.
Venue	Shiji Hall, Dongfang Hotel, Beijing, Conference Room No. 1, Dongfang Hotel, Beijing
Main Subjects	Tasks of Group A: 1. Classification of all papers collected. 2. Format of the bibliography to be published. 3. Next steps of Group A. Tasks of Group B: 1. Compilation of standards & recommendations for test. 2. Combination of environmental actions and mechanical load. 3. Selection of the most promising test methods and characterization parameters 4. Next steps.
Participants	19 persons all together attended the meeting, including: 15 members of TC-TDC: Prof. Yan Yao, Prof. F. H. Wittmann, Prof. M. A. Glinicki, Prof. Erik. Schlangen, Prof. R. Pillai, Prof. Tiejun Zhao, Prof. Feng Xing, Prof. Ling Wang, Dr. Juan Li, Prof Fuxiang Jiang, Prof. Xiaomei Wan, Dr. Zhengdi Wang, Dr. Hongzhi Cui, Hao Wu, Jinbo Yang. 4 persons from CBMA: Li Tan, Dr., Chunying Zhou, Peng Du, Yin Cao.
Moderator	
1. Opening of the meeting The chairlady, Prof. Yan Yao, made a warm welcome speech at the beginning of the meeting. She briefly introduced herself and announced that all the participants would be divided into two groups in order to discuss two specific issues separately. The main task of Group A is to compile an annotated bibliography on durability of reinforced concrete under combined mechanical and environmental actions, and the task of Group B is to prepare a list of existing relevant test methods to characterize durability of concrete exposed to combined actions. Professor Yan Yao also suggested that all the members should meet again to discuss results of the two working groups together and to outline next steps next morning. Besides, she took advantage of this occasion to invite all participants to visit CBMA, in particular concrete laboratories next afternoon. Then she invited everyone to present herself or himself, indicating the respective affiliation and specific experiences in the field of RILEM TC-TDC. If everybody knows one another the following discussions will run smoothly. Prof. Ling Wang gave a short overview on the main tasks and prospective work envisaged by TC-TDC. She pointed out that damage of concrete under a combination of mechanical and environmental loads is more severe than that under any single load but the synergetic effects have been neglected so far in research and in practice. The new TC is to develop test methods to characterize the behavior of concrete under combined actions such as mechanical load,	

freeze-thaw cycles, carbonation, and chloride penetration, to check the validity of the recommended test methods by comparative test series, and to publish a RILEM recommendation on the most promising test methods. With the joint efforts of 32 members of TDC, the expected outcome, namely a comprehensive bibliography on this subject and a recommendation for test methods to characterize durability under combined actions, shall be successfully completed. At last Prof. Wang underlined the missions for the first year, which are a comprehensive literature study and publication of a state-of-the-art report (STAR) of TC-TDC and a first draft of a test program for the first comparative test series.

2. Objectives, tasks and the first steps of Group A and Group B

2.1 Group A

Chairman of Group A, Prof. Folker H. Wittmann presented the objectives, and tasks of Group A. The main task of Group A is to publish an annotated bibliography containing complete references and summaries of all papers available in the literature in which results of durability of cement-based materials under combined actions are described.

Prof. Wittmann also underlined the significance of the annotated bibliography to be published. This publication should serve as a common basis for future research. So far, we have collected more than 140 papers from our TC members. An invitation to submit relevant references was distributed among all TC members after the inaugurating meeting in Hong Kong. Group A had to check the relevance of the papers with respect to our main subject and to classify all the papers into different categories to facilitate potential readers to find what has been done so far in this field. It should also help us to determine the most important combinations of actions for the decision of the new test methods. When talking about the combination of actions, he also mentioned that role of cracks for durability and service life should be integrated in the bibliography. He hopes that this annotated bibliography can be published by the end of this year. Finally he encouraged everybody to play an active role in the discussions at this afternoon.

2.2 Group B

Chairman of Group B, Prof. Ling Wang presented the objectives and tasks of Group B. The task of Group B is to finish the compilation of the standards and recommendations for test methods. The final aim of Group B is then to prepare a state-of-the-art report (STAR) on currently available test methods and to develop a test program for the first series of comparative tests.

Prof. Ling Wang planned to finish the tasks with three steps; first participants of Group B are asked to summarize their own test methods of concrete under combined actions such as mechanical load, freeze-thaw cycles, chloride penetration, and carbonation. Then a detailed analysis of all test methods described in the literature shall be carried out. And finally an annotated bibliography on test methods shall be compiled and a critical comparative review of the existing test methods shall be prepared to serve as a basis for the selection of the most appropriate test method of the comparative test series.

Prof. Glinicki said that first we should determine what kind of materials we are going to deal with. Because some other TCs were investigating special concretes, he wanted that it is clarified right at the beginning what we are aiming for. Prof. Wittmann answered this important question that at the moment we just do the literature review and collect papers so we can include all cement-based materials and when it comes to test methods we should focus on specific types of concrete.

Prof. Erik Schlangen thought that it was very important to decide at an early stage what kind of test we are selecting for the comparative test series because we only have four years and we have to prepare these tests for quite some time. He suggested that we should discuss at an early stage in which direction we are going so that we can start to prepare as early as possible. Prof. Wittmann said that this issue would be discussed in detail in the next informal meeting in Cape Town (RILEM week 2012). It is hoped that more members of TC-TDC will be present and by then we should have more or less compiled the annotated bibliography and also the STAR on existing test methods. So he suggested that we leave this question open until September.

Prof. Pillai asked whether we would use reinforcement steel when doing the tests. Prof. Wittmann answered this question. He said that we had no experts in this field before as members of the TC-TDC so far. He was happy that we have now Prof. Pillai as a new member who worked on corrosion of steels in our TC-TDC and he thought that we should take corrosion of steels into consideration. This may enrich the work of this Technical Committee.

Then all participants were subdivided into two groups as follows:

Group A: Folker H. Wittmann, Radhakrishna Pillai, Tiejun Zhao, Zhendi Wang, Hongzhi Cui, Xiaomei Wan, Hao Wu, and Peng Du.

Group B: Erik Schlangen, Michal A. Glinicki, Feng Xing, Ling Wang, Juan Li, Fuxiang Jiang, Yin Cao, and Chunying Zhou.

3. Discussions and conclusions of Group A

First, Prof. Wittmann, the chairman of Group A announced that Group A will discuss the compilation of the Annotated Bibliography and tomorrow morning we will present the results of our work to all members of the TC for further discussion.

Next, Mr. Zhendi Wang made an introduction about the compilation and classification of the relevant literature.

So far, we have collected 151 papers from our TC-TDC members, 43 of which were thought to be directly related to the influence of combined actions. He also mentioned that one can check the input of our members on the website www.rilem.cn. Different emoticons have been placed after the name of the members to distinguish those who have submitted their papers from those who haven't. Mr. Wang also called for more papers from colleagues, students or even friends of TC-TDC members. The references came from different sources such as TC-TDC members, colleagues and from the internet.

Then participants of group A discussed a rational classification of those papers after having gone through all abstracts. The first version prepared by Mr. Wang was as follows: I . Mechanical load combined with leaching, II . Tension and chemical action, III.Flexural loading and chemical action, IV. Mechanical load combined with freeze-thaw cycles, V.Mechanical load and Carbonation, VI.Freeze-thaw cycles and sulphate solution, VII. Mechanical load combined with environmental load and chemical action, VIII. Mechanical load combined with corrosion, IX. Environmental load and chemical action, X.Others.

After a deep discussion a revised version was elaborated in common:

1. Chloride penetration and mechanical load,
2. Carbonation and mechanical load,
3. Chloride penetration and freeze-thaw attack,
4. Carbonation and freeze-thaw attack,

5. Thermal action and mechanical load,
6. Sulfate attack and mechanical load,
7. Cracks and accelerated migration,
8. Corrosion of steel,
9. Leaching and mechanical load,
10. Other load combinations.

During the discussion, all members freely expressed their opinions and reached an agreement. All papers were classified into these ten categories for the annotated bibliography to be published.

As for the next steps, Group A reached a consensus:

1. Adding the relevant papers from JST and the recent conference in Amsterdam (Microstructural-related Durability of Cementitious Composites, April 11-13, 2012) to the annotated bibliography and asking members of TC-TDC to provide more papers,
2. Sending the final classification and the draft of the annotated bibliography (references only) to the participants of the first plenary meeting (within 2 weeks),
3. Collecting feedback and revising the draft accordingly,
4. Sending the revised version to all members of TC-TDC (by the end of July)
5. Preparation of the final version and presenting it at Cape Town (September 2012).
6. Concentrating on two most severe and most frequent combined actions only.

4. Discussions and conclusions of Group B

First, Prof. Ling Wang, the chairlady of Group B briefly introduced the three steps, which have been suggested to achieve the pre-set goals, which were (1) the compilation of standards and recommendations for testing concrete durability, (2) the frequently occurring combination of different actions, and (3) the selection of the most suitable test methods.

Then Dr. Juan Li, the secretary of Group B presented the review and classification of related test methods and allowed all the members to go through all the standards and recommendations, which have been collected, item by item. Prof. Glinicki and Prof. Shlangen suggested some additional methods. Next, members of group B discussed on extension and revision of the compilation of standards and recommendations for test methods. Finally the following conclusions were formulated:

1. Sulphate resistance is regulated by a standard for cements, not for concrete.
2. Some new European standards have not been included in the compilation (such as the revised version of EN206). Prof. Glinicki can provide the TC with new test methods prepared by CEN and technical reports and relevant documents.
3. From the damage inducing actions, AAR and leaching can be ignored but carbonation is important and should be considered.
4. Standards used in USA, South Africa, Australia and Japan have still to be collected later.

Next, the group did a survey on the importance of combinations of actions among all the participants. The results showed that most people chose:

- a. Tensile stress and chloride penetration,
- b. Freeze-thaw cycles, chloride penetration and tensile stress,
- c. Freeze-thaw cycles and chloride penetration.

Then all members of Group B presented their experiences with research on durability of

concrete under combined actions and elaborated which combinations they chose and why they chose them. Considering the importance of carbonation, Group B concluded that the final combination to be considered was the combination of carbonation, tension and chloride penetration.

During the selection process of the most suitable test methods, Group B had a really deep discussion and finally made a draft of detailed test items as follows:

Combined actions	Carbonation, chloride penetration and tension
Materials and mix design for comparative test	Without reinforcement: 1. C40 with OPC without SCM (OPC42.5 350kg, w/c 0.5, fine 800kg, coarse 1050kg, no SP, slump 8~18cm 2. CEM I 52.5R 368kg, water 165.5, fine 840kg, coarse 1027.5kg, SP 5.1, slump 12~15cm, (from RILEM TC-235CTC)
Dimensions of specimens	100mm×100mm×400mm
Curing conditions	Temperature: 20 °C Humidity: under water Age: 28 days
Procedure	Carbonation first, then the combination of chloride penetration and tension simultaneously
Carbonation	2.0 % CO ₂ concentration, 20 °C and 65 % RH for 28 days, 1 % phenolphthalein in 70 % ethyl alcohol as indicator.
Chloride penetration	soaked in 3.0% NaCl solution for 30d, 60d
Tension	Sustained loading, Stress ratio: 0, 0.35, 4 points bending
Test parameters	Carbonation, average depth, Penetration depth of chloride , Strain,

As for the next steps, Group B planned to extend and revise the compilation of standards and recommendations for test methods and to prepare a detailed description of the comparative test method before September 2012.

The following Time Table has been set up by Group B.

NO.	Main Tasks	Participants	Deadline(d/m/y)
1	Standards will be collected further	Members of USA, South Africa, Australia and India	30-6-2012
2	Critical appraisal of existing test methods	Wang ling Li Juan	30-6-2012
3	Preliminary selection of most important load combination	All Members	30-5-2012 If possible
4	Selection of an appropriate test method	All members	2-9-2012
5	Preparation of a detailed description of the test method	Wang ling Li Juan	30-8-2012

6	Selection of the test procedure in September during RILEM meeting		2-9-2012
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5. Final decisions of TC-TDC

On May 17, the second day, all members got together again to further discuss all the items discussed in the subgroup meetings and made final decisions together.

At the end, all members of TC-TDC confirmed the outline and format of the annotated bibliography to be published. Two versions are foreseen. The print version should contain complete references together with the abstracts while full length papers may be provided on a CD. The issue of copyright of the publications needs to be solved by contacting the respective publishers.

Members of TC-TDC, participating in the Beijing meeting, agreed to investigate the triple combination of carbonation, tension and chloride penetration. This test may provide us with an overall information (black box) on durability of the tested type of concrete in aggressive environment. A detailed description of the comparative test method will be finalized by September 2012 at the RILEM Week the latest.

Moreover, results of both groups will have to be revised after the minutes have been sent out to all the TC-TDC members and their feedback has been received. It is planned that this process should be finished within 2 weeks after the meeting.

A preliminary meeting plan was also fixed by the Technical Committee as follows.

NO.	Main Tasks	Date	Venue
1	Informal meeting: discussion and selection of the test program for the first comparative test series	2 September, 2012	Cape Town, South Africa
2	The 2nd plenary meeting: Discussion of the test result of the first comparative test series; Preparation of second comparative test results	May-June 2013	Qingdao Tech. China
3	The 3rd plenary meeting: Discussion on the test result of the second comparative test series	01 – 04 September, 2013	Paris, France
4	Depends on the progress of our work	Late April, 2014	Delft Univ., The Netherlands
5	The 4th plenary meeting	01 - 05 September, 2014	São Paulo, Brazil

6. Closing remarks by Prof. Yan Yao

The meeting was closed on May 17th at noon. In the “wrap-up” presentation, Yan Yao expressed her sincere thanks to Prof. Folker H. Wittmann, who has volunteered to be the

Chairman of Group A and has given us a lot of guidance for our work, and to Prof. Ling Wang for her continuing engagement to make this meeting meaningful and successful. She also thanked all the experts who attended the meeting for their personal efforts and their support of the new RILEM TC-TDC, and those who were unable to attend the meeting but helped a lot in providing papers and recommendations on test methods. She concluded that we had a very promising start of our work. All TC members who could not attend the meeting are kindly asked to contribute to the ongoing work by correspondence.

At last, She suggested having a short informal meeting of RILEM TC-TDC in Cape Town during the first week of September 2012 and that would be a good chance to discuss our first results with other RILEM members.

All members present were confident that the ambitious aim of TC-TDC will be achieved successfully.

Appendix:

List of members of TC-TDC

Member Name	Affiliation		Present/absent
Prof. Yan Yao	China Building Materials Academy	Chairlady	Present
Prof. Ling Wang	State Key Lab of Green Building Materials	Secretary, Chairlady of Group B	Present
Prof. F. H. Wittmann	Aedificat Institute Freiburg	Chairman of Group A	Present
Dr. Zhendi Wang	China Building Materials Academy	Secretary of Group A	Present
Dr. Juan Li	China Building Materials Academy	Secretary of Group B	Present
Prof. M. A. Glinicki	Polish Academy of Sciences	MEMBER	Present
Prof. E. Shlangen	Delft Univ. of Technology	MEMBER	Present
Prof. R. G. Pillai	Indian Inst. of Technology Madras	MEMBER	Present
Prof. Tiejun Zhao	Qingdao Technological University	MEMBER	Present
Prof. Feng Xing	Shenzhen University	MEMBER	Present
Prof. Fuxiang Jiang	Qingdao Technological University	MEMBER	Present
Prof. Xiaomei Wan	Qingdao Technological University	MEMBER	Present
Dr. Hongzhi Cui	Shenzhen University	MEMBER	Present
Dr. Hao Wu	China Building Materials Academy	MEMBER	Present
Dr. Jinbo Yang	Beijing University of Technology	MEMBER	Present
Prof. Max Setzer		MEMBER	Absent
Prof. Christoph Ghelen	Munich Technical University	MEMBER	Absent
Prof. A. Khelidj	Ecole Centrale de Nantes	MEMBER	Absent
Prof. Carmen Andrade	Institute of Construction Science	MEMBER	Absent
Prof. Yoshitaka Kato	University of Tokyo	MEMBER	Absent
Prof. Tamon Ueda	Hokkaido University	MEMBER	Absent
Prof. Klaas van Breugel	Delft University	MEMBER	Absent
Prof. Jason Weiss	Purdue University	MEMBER	Absent
Prof. Jaques Marchand	Université Laval	MEMBER	Absent
Prof. Gideon van Zijl	University of Stellenbosch	MEMBER	Absent
Prof. Shaikh Ahmed	Curtin University	MEMBER	Absent
Prof. Rui Miguel Ferreira	University of Minho	MEMBER	Absent
Prof. Nele De Belie	Ghent University	MEMBER	Absent
Dr. Mathias Maes	Ghent University	MEMBER	Absent
Dr. Wei Liu	Shenzhen University	MEMBER	Absent
Dr. Erika Holt	VTT Technical Research Institute of Finland	MEMBER	Absent
Dr. F. Beltzung		MEMBER	Absent

Li Tan	China Building Materials Academy		Present
Zhunying Zhou	China Building Materials Academy		Present
Peng Du	China Building Materials Academy		Present
Yin Cao	China Building Materials Academy		Present