

**ACI COMMITTEE 444
Structural Health Monitoring (SHM) and Instrumentation**

**MINUTES
ACI Fall 2018 Convention
Rio All-Suites Hotel and Casino
Las Vegas, NV**

**Tuesday, October 16, 2018
8:00 AM - 11:00 AM
Amazon N**

Prepared by: Mohamed ElBatanouny

Attendance

Voting Members

Thomas Schumacher
(Chair)
Hani Nassif
Branko Glisic
Mike Forde
Paul Ziehl

Mohamed ElBatanouny
(Secretary)
John Popovics
Bernard Hertlein
Ming Liu

Michael Brown
(TAC Contact)
Brock Hedegaard
Mohammad Pour-Ghaz
Tulio Bittencourt

Associate Members

John Pearson
Marwa Abdelrahman
Farid Moradi

Jacob Henschen
Joseph Klein
Dan Su

Vafa Soltangharaei
Heather Todak
Ahmet Sanli

Visitors

Rafal Anay
Soundar Balakumaran
Long Phan

Jinying Zhu
Asad Bassam

Hector Guerrero
Rakesh Khan

Excused

Mohamed Mahgoub

Dirk Heidbrink

Matthew Smith

1. Welcome and Introductions

Chair Schumacher called the meeting to order at 8:10 AM and all in attendance were welcomed to the meeting. Introductions were given by all attendees.

Chair Schumacher thanked the previous committee chair Nassif for his leadership over the past years.

2. Approval of Minutes

The meeting minutes for the Spring 2018 Convention were web-balloted and approved (ballot closed on September 10). Two editorial comments were made and will be addressed.

3. Membership Status and Update

Chair Schumacher discussed the status of committee's membership indicating the need for diversity in the committee and also more industry members. The chair contacted two members who have not attended the meetings in about three years. A decision to keep or thank those members will be made based on the correspondence. TAC Contact Brown suggested using the ACI Committee Membership Questionnaire.

Chair Schumacher made two member announcements:

- Nassif was honored by the NJACI and Concrete Aggregate Association receiving their Lifetime Achievement Award
- Forde was elected Honorary Member of ACI

The committee congratulated both members on their awards.

4. Status of Technical Sessions

4.1- Fall 2018 – Las Vegas, NV, October 17, 2018 (Theme: Dream Big, Build Bigger), Session: Analysis and Interpretation of Structural health Monitoring (SHM) Data: Big Data Management and Field Studies

Chair Schumacher thanked the moderators (Mohamed ElBatanouny and Marwa Abdelrahman) for organizing the session titled "Analysis and Interpretation of Structural health Monitoring (SHM) Data: Big Data Management and Field Studies". Moderator ElBatanouny indicated that there are five scheduled presentations. Presenter Mohamed Mahgoub apologized for not being able to attend the session due to a recent knee injury.

4.3- Spring 2019 – Quebec City, March 24-28, 2019 (Theme: Nordique Concrete) Joint session with ACI 342 (Innovative Techniques for Bridge Evaluation).

ElBatanouny discussed the joint session with 342. He indicated that no update was given during the 342 Committee meeting as the moderators did not attend. Chair Schumacher and M. ElBatanouny will contact 342 Chair Harris for an update on the status of the joint session.

4.4- Fall 2019 – Cincinnati, OH, October 20-24, 2019 (Theme: TBA)

Chair Schumacher suggested organizing a mini session to introduce the report ACI 444.1 "Report on Structural Health Monitoring Technologies for Concrete Structures". Mini sessions are held during the first hour of a committee meeting. TAC Contact Brown, B. Hedegaard, and B. Glisic expressed their support of the proposal. Nassif suggested that we request a bigger room.

4.5- Spring 2020 – Rosemont, IL, March 29-April 2, 2020 (Theme: TBA)

The committee agreed on requesting a full session. Topic and moderators will be selected next meeting.

5. Update on Special Publication (SP) for the Symposium on Structural Health Monitoring

Nassif discussed the status of the special publication and suggested that the four accepted papers be included and published in The Dennis Mertz Symposium SP. He suggested adding a note to the papers accepted by this committee indicating that these were contributed by Committee 444. Nassif also suggested to add this committee as a co-sponsor to The Dennis Mertz Symposium papers. He will follow-up with the symposium organizers to ask if the accepted SP papers can be published in it.

6. Update on committee document ACI 444.1: “Report on Structural Health Monitoring Technologies for Concrete Structures”

Chair Schumacher gave an update on the document. The committee had quorum as 12 voting members were present in the meeting. The committee discussed the path to complete and ballot the document before the next deadline for submission to TAC: December 21, 2018. Action items with a deadline of October 31, 2018 are highlighted in yellow. The goal is to ballot the entire document section by section by mid-November.

- Ch. 1 Introduction. Chair Schumacher took responsibility of this chapter. He indicated that he can complete it before the proposed ballot in mid-November.
- Ch.2 Notations and Definitions. Chair Schumacher inquired about the need to have this chapter. M. Brown indicated that this chapter is required by ACI. Schumacher e-mailed ACI staff to ask if they can help with this. B. Glisic suggested that every section author should add the definitions that are particular in his/her section to this chapter. M. Brown and B. Hedegaard suggested that every author compile a table of their notations and symbols so we can scan the information and ensure we do not have duplications. Notations should be consistent across the document.
- Section 3.1 M. Brown compiled some information and will aim to finish this section. Chair Schumacher requested that this be completed by the end of the month.
- Section 3.2 Chair Schumacher and J. Popovics resolved all the comments for this section. J. Popovics added a few more comments and Chair Schumacher will respond to all of them.
- Section 4.1.1 AE Sensors section has been approved.
- Section 4.1.2 DIC section has been approved.

- Section 4.1.3 Displacement Sensors was reviewed by B. Hedegaard and J. Popovics. They indicated that there are a couple of sub-sections that need to be revised and be cited better. Currently most of the citations are based on websites. More citations need to be added. B. Hedegaard and J. Popovics will revise the section themselves instead of sending it to the author in interest of time. B. Hedegaard suggested that we can move a part from the vibration section to the displacement sensor. H. Nassif is the author of the vibration section and he agreed. Deadline to resolve this section is the end of the month.
- Section 4.1.4 GNNS section will not be included in the report, as decided in the previous committee meeting.
- Section 4.1.5 LIDAR section has been approved.
- Section 4.1.6 Radar. The contact information of one of the author's is missing. M. Brown will revise the chapter as needed. Chair will plan to contact the author to follow-up with M. Brown.
- Section 4.1.7 Strain sensors section has been approved.
- Section 4.1.8 Tilt sensors. Authors are not in this meeting. Chair will follow-up with authors to update the photos as this is the only item missing.
- Section 4.1.9 Vibration sensors. B. Hedegaard has revised and edited the section. H. Nassif promised to send it to the Chair by the end of the month.
- Section 4.2.1 Chloride sensors. J. Popovics has been working with M. Basheer on this section to resolve the negatives and they are very close to completing the revisions. J. Popovics will contact Tyler Ley (reviewer) to address some of the comments on text that he added.
- Section 4.2.3 Humidity sensors. M. Brown will coordinate with Chad Anderson (the other author). M. Basheer and M. Smith had comments on the section. M. Basheer added a section of FBGs to measure humidity. M. Brown will send this section to B. Glisic to review.
- Section 4.2.4 Load Cells has been approved.
- Section 4.2.5 pH sensors has been approved.
- Section 4.2.6 Piezometers has been approved.
- Section 4.2.7 Temperature sensors has been completed.

- Section 4.2.8 WIM sensors. H. Nassif edited the section and addressed all the comments. This section is now ready for ballot. M. Brown suggested that some of the photos be revised to avoid copyright and marketing issue. H. Nassif will use a photograph from the system he installed instead of the current figure to avoid this issue. The committee suggested that H. Nassif also revises Figures 2 and 3.
- Section 4.2.9 Weather station has been approved.
- Section 4.3.1 Conductive surface sensors. There is one editorial comment but otherwise this section is finished. Chair Schumacher and M. Pour-Ghaz will do another read through.
- Section 4.3.2 Energy harvesting has been completed.
- Section 4.3.3 Fiber-optic sensors. There are no negatives in this section. There are comments that need to be addressed. B. Glisic agreed to address the comments by the end of the month.
- Section 4.3.4 MEMS section has been approved.
- Section 4.3.5 Wireless sensor networks. There is a negative by J. Popovics on this section. The author, M. Mahgoub, apologized for being absent due to a recent injury. Chair Schumacher will follow-up with the author of this section to resolve the negatives.

The follow-up on the items identified above should be completed by the authors by the end of the month. Chair Schumacher is planning to submit a ballot by mid-November for the entire document. If the document is approved by the committee, we can submit the document to TAC by December 21, 2018. If there are negative comments we may need to do a shortened ballot (pending M. Brown's approval as TAC Contact) or do a web meeting.

7. Update on committee document ACI 444.2: "Report on Analysis, Interpretation, and Prognosis of Structural Health Monitoring Data for Concrete Structures"

B. Hedegaard gave an update on the document. He prepared a draft section as an example to be followed by other authors. No other progress has been made except for the section previously completed in Chapter 6. Chair Schumacher suggested that we add some examples for the data processing to make the document more useful to the concrete community. A numerical examples section may also be added to the document. J. Popovics indicated that there is an example on linear regression of concrete strength detection in 228.1R that may be useful to the committee to follow.

B. Hedegaard and M. ElBatanouny will plan a web meeting with the authors of Chapters 5 and 6 in January or February of 2019.

8. NEW BUSINESS

- M. Forde announced the Structural Faults + Repair Conference 2020 and European Bridge Conference.
- B. Glisic announced the SHMII-9 conference organized by Genda Chen of Missouri S&T. There is also an open call for IWSHM 2019 at Stanford University.
- A quick search of conferences of interest to this committee prior to the meetings was suggested by B. Glisic.
- Chair Schumacher suggested that we also do 5-min presentations in future meetings, similar to Nugget presentations at TRB. M. Brown suggested that we ask for volunteers to organize the session. Jacob Henschen and Soundar Balakumaran volunteered to lead this effort for the spring meeting. This will be an informal session, without official announcement by ACI. The presentations should be submitted in advance to the organizers.
- J. Popovics opened the topic on CRC funding letter of endorsement reviews. M. Brown gave an example of another committee that had put a process in place for reviewing such letters. In that committee they make an announcement four weeks prior to a convention and ask the proposer to present in the committee meeting before submitting a letter. The committee drafted a similar announcement and Chair Schumacher will work with ACI staff to add it to the committee webpage.
- Chair Schumacher will contact the durability and service life modeling committees to discuss their upcoming documents and how their work might be related to this committee's efforts.

9. Adjournment

Meeting was moved to adjourn at 10:40 am.