



International Code Council

ICC IS-3DACT Committee Minutes – Meeting #7

April 19, 2024 – 10:00 AM PDT

1. Welcome and opening remarks

Staff Secretariat, Melissa Sanchez called the meeting to order at 10:02 am PDT and welcomed all committee members, invited parties, and ICC staff.

Ms. Sanchez then went on to note the committee must adhere to the ICC Code of Ethics, which states that those participating in ICC activity must adhere to the highest ethical conduct, with the purpose of the protection of the health, safety and welfare of the public by creating safe buildings and communities. In addition, Section 5.1.10 in Council Policy #7 is in effect and any committee member with a conflict of interest must withdraw from participating in discussion or vote on the matter in which they have an undisclosed interest. Lastly, Council Policy #50 outlines ICC Antitrust guidelines, which indicates the committee meetings are not intended for discussion of pricing and marketing topics.

2. Quorum and Attendance

Ms. Sanchez called the roll of the IS-3DACT with the following members registering attendance. Ms. Sanchez noted there was enough for a quorum.

NAME	2024 IS-3DACT COMMITTEE MEETING					
	#3 12/15/23	#4 1/12/24	#5 2/9/24	#6 3/15/24	#7 4/19/24	#8 TBD
Jared Brewe [A]	X	X	-	X	X	
Gabriel Carrera [D]	X	-	X	X	X	
Bora Gencturk [C]	X	X	X	X	X	
Rory Hamaoka [H]		X	X	X	-	
Werner Hellmer[H]	X	-	X	X	X	
Maryam Hojati [D]		-	X	X	X	
Berok Khoshnevis [D]	X	X	-	-	X	
Jeff Martin [A]	X	X	-	X	X	
Doug Mayer [H]	X	X	X	-	X	
Paul Messplay [H]	X	-	X	X	X	
Adil Tamimi [D]		X	-	X	X	
Bing Tian [A]	X	X	X	X	X	
TOTAL	10/13	9/13	8/12	10/12	11/12	

Interested parties in attendance included Abdul Peerzada (Quikcrete), Daniel Galvez Moreno (ICON), David Langefeld (ICON), Don Ajamian (Emergent 3D), Robert Devine (Wiss, Janney, Elstner Associates), Steve S. Szoke (ACI), Christopher Kaufmann (Parsons), Stephan Mansour (ASTM), Josh Gebelein (Parsons), Rex Donahey (ACI), Michael D Smith (Cemex), Sean Monkman (ICON)

3. Approval of Agenda

Chair Mr. Bora Gencturk asked if there was any opposition to the agenda. There were no objections. The agenda was unanimously approved.

4. Approval of Previous Meeting Minutes

Mr. Gencturk asked if there was any opposition to the previous meeting minutes. There were no objections. The previous meeting minutes were unanimously approved.

5. Update on Work Groups

Mr. Gencturk started the discussion by suggesting that the committee ballot chapter by chapter. The first chapter would be Chapter 3 on materials. Chapters 1 and 2 can be balloted later, as they are editorial and easily fixed.

Mr. Gencturk asked Ms. Sanchez if there was a resolution for new committee members. Ms. Sanchez said they had a couple new applications, but the next board meeting is not until May 31, 2024. She has requested to see if the board members could vote earlier.

a. Materials Work Group (Bing Tian)

Mr. Bing Tian started the conversation on Chapter 3 by emphasizing that it is based on laboratory tests for prequalification. Mr. Gencturk commented that the definitions in this chapter should be moved to Chapter 2. Chapter 3 should focus on conformity requirements, but not definitions. He suggested to eliminate Section 301 entirely. He then brought up that some ambiguity exists in Section 303. For example, in Section 303.1 the phrase “all the supporting documents shall be submitted simultaneously” is unclear. He suggested instead to phrase it “shall be prepared and (shall) be readily available”. Mr. Tian agreed that there is ambiguity in how this Section is worded. Both Mr. Adil Tamimi and Mr. Abdul Peerzada commented that documents are important to have in order to know what was tested at the time of submission. Mr. Gencturk agreed but stressed for more clarity in the written language.

Mr. Jared Brewe had a question on the difference between Chapter 3 and Chapter 5. He summarized that mixture development was Chapter 3 and field development was Chapter 5. Mr. Tian confirmed that this was correct.

Mr. Gencturk then brought up the topic of consistency of the document – both in terminology and formatting. He noted that subsections should only exist if there is more than one subsection, referencing Section 304.5 titled Other Requirements having only one subsection, 304.5.1 Fire Safety. He also noted that each section should have a title in bold, referencing Section 303.3 as a section without a title. Ms. Sanchez affirmed that all sections and subsections should have a title.

Mr. Brewe asked if there was a plan for an editorial process before balloting. He noted that the terminology at the moment is inconsistent (e.g. printed concrete, or printed mortar or printed materials). Mr. Tian agreed that this would be a good idea. Mr. Gencturk said terminology can be established in the definitions, but committee members should read the document to ensure that terminology is consistent with the definitions because there is no formal editorial review. Ms. Sanchez confirmed that there is no formal editorial review but offered to also review the document for consistency. She

requested all changes be tracked to aid transfer of revisions to the master draft. Mr. Gencturk requested Ms. Sanchez keep the master draft and that members send their versions to her.

Mr. Tian suggested voting on Chapter 2 definitions first to formalize the terminology so that it could be used consistently throughout the draft. Mr. Gencturk disagreed with voting on Chapter 2 first because the other chapters are still being written. He reasoned as long as terminology is used consistently, it would be simple to vote on Chapter 2 at the end, and editorially adjust the terminology as needed, after all the chapters are written.

Moving on, Mr. David Langefeld requested any mention of reinforcement materials in Chapter 3 be moved to Chapter 4 as it is more consistent with the title of Chapter 4. Mr. Gencturk and Mr. Tian agree to this change.

Mr. Langefeld then asked about the difference between concrete and mortar. Mr. Tian said he would put these definitions in Chapter 2. Mr. Daniel Galvez Moreno also brought up the term polymer binder. Mr. Tian stressed that that this standard is for hydraulic mortar and not polymer binder. Mr. Gencturk said to define the material in Chapter 2.

Mr. Langefeld asked about the criteria for the lab and whether it meets the qualifications mentioned in AC509. Mr. Gencturk responded that this is a standard and thus does not specify types of labs to be used, just how the material is tested. The burden of doing the standard and convincing the code officials what is being done is left to another entity.

Mr. Galvez Moreno asked why ASTM standards were excluded on Alkali Silica Reaction (ASR) testing requirement. Mr. Abdul Peerzada replied that the AASHTO standard is the most realistic in terms of time and accuracy. Mr. Gencturk suggested including a statement that states the conditions when ASTM standards can be used and when AASHTO can be used. Mr. Galvez Moreno expressed concern about the acceptability of AASHTO around the world. Mr. Gencturk was unsure how much AASHTO was used in Europe. Mr. Tian responded that at the recent ACI Convention the AASHTO method was being used by more people because of its reliability and time. The test is a compromise between the short 14-day test (ASTM C1260) and the year long test (ASTM C1293). He added that it was up to the committee to ultimately decide how conservative they want the standard to be.

Mr. Langefeld asked about the definition of equilibrium density. Both Mr. Peerzada and Mr. Galvez Moreno said this term is not used in materials. Mr. Langefeld shared in the chat that the definition is new for ACI 318-19 and Mr. Galvez Moreno shared in the chat an excerpt from ASTM C567 on it.

b. Structural Work Group (Jared Brewe)

Mr. Brewe started the conversation on the structural requirements (Chapter 4) by presenting several pathways a designer could take in the chapter. He highlighted Sections 403, 404, or 406 as potential pathways. He also said the working group is still working on the details, and suggested the possibility that a separate chapter be created for durability as it did not fit well under the existing chapter heading. Mr. Gencturk commented that the draft should have balance between chapters and that a separate durability chapter would not be consistent

with the other chapter headings. Rather, he suggested, the titles of Chapter 3 and 4 be revised or expanded to allow for durability. Mr. Brewe suggested dropping the word “Structural” from the title of Chapter 4 and just labeling it as “Design Criteria”.

Mr. Brewe moved on to Section 404 Engineer Provisions (no testing involved). He said the working group added the terms – non-dimensionally controlled and dimensionally controlled sections to Chapter 2. Mr. Gencturk asked what the difference was between the 70% and 90% values. Mr. Brewe responded that was related to contact width. Mr. Gencturk did not know where the values came from. Mr. Brewe said they were provided by ICON. Mr. Doug Mayer asked if there was data from different sources to substantiate the values. Mr. Gabriel Carrera said the numbers were not based off of ICON data, but were what ICON thought were conservative based on their experience, but they did not have measurements or industry wide averages. Mr. Brewe requested that anyone with additional information help refine the values. He stressed that the importance of being conservative, but not overly conservative and that these values are to be used as a starting point. Mr. Don Ajamian said these values were conservative from their experience at Emergent. Mr. Gencturk asked if the standard provided allowance of alternative values if substantiated by testing. Mr. Brewe confirmed that this was possible.

Mr. Brewe then addressed design material properties. He said they were still unsure whether to reference Chapter 3 or Chapter 5 for this section. He said there is not a maximum design strength in those chapters but are open to including it. He pointed out that for the Modulus of Elasticity, they referred to TMS rather than ACI for a more applicable equation. He then presented interlayer bond numbers. Mr. Gencturk asked how these numbers were verified. Mr. Brewe said there is test data. Mr. Tian confirmed the test data supports a interlayer bond strength between 50 – 75 psi, but a decision has not yet been made on the required interlayer bond strength. Mr. Adil Tamimi asked if there was a standard test for interlayer bond strength. Mr. Peerzada responded that there is and it is referenced in Chapter 5. Mr. Gencturk requested that anyone with test data help contribute to this section. He was not opposed to the suggested 75 psi. Mr. Robert Devine said that 75 psi was suggested by WJE and this value was based on data for masonry wythe veneer. Mr. Gencturk suggested inclusion of language in the draft to explain from the basis of the interlayer bond strength requirement.

For the design methodology Mr. Gencturk asked if additional reduction factors were going to be added or is this method was primarily relying on ACI equations. In addition, Mr. Peerzada asked if Chapter 4 assumed isotropic behavior in all the printed elements. Mr. Brewe responded the working group assumed it to be a hybrid between an isotropic wall in ACI 318 and a masonry concrete wall. He said the intent was to not create new design approaches but to rely on established systems. Mr. Carrera said the design should be as general as possible and not specific to one configuration. Mr. Brewe agreed and referred Mr. Carrera to Section 403.

Mr. Brewe went over the minimum cover reinforcement requirements and stressed that they are for Section 404. He then described that Section 406 was the structural testing criteria as given in AC509 and Section 407 was for construction acceptance testing. Mr. Devine commented that while he wrote the section on reinforcement, he does not think the minimum vertical reinforcement is possible as they would be placing vertical reinforcement in horizontally placed material. He said there were some issues with the language and said

he intended the section to be similar to TMS provisions. He said he would like to review it more. Mr. Mayer asked a question about the horizontal reinforcement. Mr. Devine responded that they intend that horizontal reinforcement be placed in the beads for non-composite walls and in the middle for composite walls. He also mentioned that the reinforcement size was meant to be smaller. Mr. Mayer asked about splicing reinforcement for continuity, but as time was short Mr. Gencturk suggested to move forward with Chapter 5.

c. Materials Work Group (Bing Tian)

Mr. Tian then started the discussion on Chapter 5. He asked whether shrinkage and freeze-thaw should be a field prequalification test. Mr. Brewe said no, and Mr. Galvez Moreno said it was already part of Chapter 3. Mr. Tian then agreed to remove this requirement.

Mr. Tian said that slump testing and air content should be tested at the start of the day and at the middle of the day. Mr. Werner Hellmer asked if this was required. Mr. Tian said it was required.

Mr. Christopher Kauffman wrote in the chat why the term “halfway” was being used. He suggested a more quantitative term more in line with ACI.

Mr. Tian then mentioned that in the field a flow table is not feasible. He suggested in the field people use a penetrometer for mortar and for concrete the slump test.

Mr. Rex Donahey said that ACI does not use the term 3D printing but instead “additive manufacturing” and they have developed a portable test for this.

Mr. Devine asked about ASTM C109 mortar cubes. Mr. Tian said C109 would be for mortar and C39 would be for concrete. Mr. Devine suggested that it would make more sense if the test was based on aggregate size. He also asked about the inclusion of 1-day and 7-day strength checks. Mr. Tian said it was because they have this requirement in Chapter 3, but acknowledged that for field testing this was a lot and suggested making the 7-day optional and only the 28-day mandatory. Mr. Donahey asked about non-destructive testing. Mr. Gencturk said those tests require a lot of calibration and thus make them less feasible to use.

Mr. Tian then initiated a discussion regarding whether a mock up wall in field should be. Mr. Galvez Moreno thought a mock up wall was unnecessary. Mr. Tian disagreed and brought up the question about who is responsible for printing in field. Mr. Hellmer supported the including requirements for a mock up wall in field. Mr. Peerzada suggested a mock up wall was not necessary if both the material and printing company are the same. Mr. Sean Monkman asked the question, if one builds a 100 homes, do they need to build 100 mock up walls? Mr. Devine suggested a mock up wall be included as part of the lab prequalification tests. Mr. Stephen Mansour suggested drilling out a specimen from the printed wall to check its properties instead. Mr. Langefeld wrote that if a contractor did an alternative design then they have already tested at least 15 full-scale members and should be exempt from a mock up wall. Mr. Peerzada said that a clause could be added to make the printing company liable if a structural failure occurs. Mr. Gencturk suggested moving the mock up wall to the laboratory. Mr. Tian disagreed as many labs do not have a printer.

In the interest of time, Mr. Gencturk suggested a separate meeting for further discussion.

6. Next Meeting

The next meeting is set for May 10, 2024, at 10am PDT.

7. New Business

There were no additional items.

8. Action Items & Summary

The action items from the meeting were summarized as follows:

<i>Schedule a meeting on the mock-up wall.</i>	<i>Ms. Sanchez</i>
<i>Work on Chapter 3 balloting.</i>	<i>Everyone</i>
<i>Send the latest draft to Ms. Sanchez</i>	<i>Mr. Brewe</i>

With no other questions or comments before the committee Mr. Gencturk moved to adjourn the meeting. Mr. Brewe motioned for adjourning and Mr. Hellmer seconded the motion. The meeting adjourned at 11:57 am PDT.