

American Concrete Institute Committee 222 Corrosion

Fall 2010 Meeting Minutes

Tuesday, October 26, 2010

Pittsburgh, PA

Members in Attendance

Mohammad S, Khan, Chair

David Trejo, Secretary

Michael Brown

Randy Poston

Dave Darwin

Andrea Schokker

Tracey Marcott

Jeff West

David McDonald

David Whitmore

Ted Neff

Richard Weyers

Charles Nmai

John Wojakowski

Associate Members in Attendance

Ceki Halmen

Burkan Isgor

Boyd Clark

Chuck Weiss

Matt Drew

Jieying Zhang

Visitors in Attendance

Mike Ahern

Neal Berke

Bill Greers

Barney Heller

Robert Mahan

David Mokarem

Robert Moser

Jan Olek¹

D. V. Reddy

Scott Rice

1. Welcome/Introductions

Chair Khan called the meeting to order at 2:03 pm. This was followed by self-introductions of those in attendance. Chair Khan counted voting members and noted that a quorum was present. Chair Khan noted that there were no changes in the membership of the committee since the last meeting.

2. Approval of Minutes of Spring 2010 Chicago, IL Meeting

Chair Kahn requested comments on the minutes from the Chicago, IL meeting (Spring 2010). Tracey Marcott moved to approved the minutes and John Wojakowski seconded. The meeting minutes from the spring 2010 were approved by unanimous vote.

¹ TAC Contact

3. Task Group Reports

Chair Khan noted that TAC had reviewed several documents and made recommendations to the committee. Chair Khan asked David Trejo to provide an update on the 222R, Corrosion of Metals in Concrete, requested that Jeff West provide an update on 222.2R, Corrosion of Prestressing Steels, and requested that David Trejo provide an update on chloride limits.

Trejo noted that TAC rejected the 222R document during their July 15, 2010 meeting in Stowe, Vermont. The main comments on the document included the need for updated references, the length of the document (want the committee to shorten Chapter 3), and suggested expanding the write-up on corrosion of non-reinforced elements. Trejo agreed to take the lead on the document and indicated that the first few chapters should be out to the committee within a month and the other chapters could be completed before the next meeting.

West reported that he and Marcott met with the TAC in New Orleans. West reported that TAC suggested that the report needed a "broad sweep" and that TAC requested that overlap with other documents be removed. West reported that the "other docs" did not exist when the original 222.2 document was written. West reported that he will try to get the revised document out by the next meeting and Marcott suggested that balloting will be submitted chapter by chapter.

Trejo provided an update on the progress of a paper on chloride limits and critical chloride thresholds. Trejo noted that the paper would likely be written for Concrete International. After discussion on authors, it was suggested that a small group work on the paper.

4. Resolution of Negatives on 222.3R

Chair Khan requested that David McDonald to provide an update on 222.3R, Design and Construction Practices to Mitigate Corrosion of Reinforcement in Concrete Structures. Negatives were addressed by the committee and the attached table (Addendum 1) provides a review of the outcomes. Two negatives were not resolved and it was agreed that these would be balloted soon after the meeting.

5. Report on Sessions

Corrosion Resistant Reinforcement

David McDonald reported that the session on Corrosion Resistant Reinforcement was scheduled for Wednesday morning, October 27, 2010 at 9 am. Six presentations were scheduled. McDonald invited all and recommended that they attend the meetings.

6. Future Sessions

Based on discussions from the past meetings, the committee agreed to organize a session recognizing Brian Hope and Morris Schupack for their contributions to the understanding of corrosion and corrosion mitigation. Khan, Schokker, Trejo will co-chair the meetings and a special publication.

7. Collaboration/Memorandum of Understanding with NACE

Chair Khan reported that he met with Dan Falconer and the idea was well received. Chair Khan reported that the ACI management would handle the collaboration with NACE.

8. New Business

Chair Khan requested attendees to report on any new business. West noted there was a potential to do session on cracking and corrosion that was discussed at the Chicago meeting. It was reported that the Committee 224 (Cracking) is moving forward with session and it is planned for spring 2012.

9. Adjournment

The committee adjourned at approximately 4:40 pm.

Addendum 1

ACI 222.3R - Resolution of TAC negatives

Three ballots were prepared, two of which were sent via web ballot and one was discussed at the fall meeting.

Ballot 1: Closing 10/25/10

Item	TAC #	Negatives	Action Vote Affirm/Negative/Abstain	Text
1		Ok		
2		Ok		
3		Ok		
4		Ok		
5	62	Darwin	Proposed modification to text 12/0/0	It is essential to have concrete with a low w/cm permeability, low potential for plastic and drying shrinkage, low thermal expansion susceptibility and with sufficient cover to protect embedded steel reinforcement.
6	69	Poston: I don't think a comment about adding cover for additional development length is inappropriate. The way this sentence is worded seems odd. Perhaps the sentence as follows: "It may be prudent to add cover to enhance development length when there is risk of corrosion.	3/7/4	???
7	78	Ok		
8	90	Ok		
9	101	Ok		
10	104	Poston	Withdrawn	
11	109	Ok		
12	111	OK		
13	119	Poston	9/4/1	Retain original text as particle size and potential clumping is of particular importance for silica fume.
14	120	Ok		
15	121	Ok		
16	124	Ok		
17	126	Gustaffson, Neff	11/0/3	Change made to Text: <u>As of 1998</u> , there had been are approximately 100,000 structures constructed with containing epoxy-coated reinforcement (Virmani and Clemena 1998). Since that time, epoxy-coated reinforcement has been used on several thousand other bridges built in the last decade.
18	136	OK		
19	137	Ok		
20	138	Ok		
21	142	Ok		
22	154	Ok		
23	170	Ok		
24	171	Ok		
25	172	Ok		
26	181	Ok		

Addendum 1

Ballot 2: Closing 10/29/10 (Ballot still open at time of meeting).

Item	TAC	Negatives	Action Vote Affirm/Negative/Abstain	Text
1	56	Wojakowski	Wojakowski/Brown 13/0/3	2.2.5 Concrete exposed to chemicals— Industrial concrete structures exposed to chemicals, such as acids, that can lead to the disintegration of concrete are at high risk for corrosion. This type of exposure requires <u>may require</u> requires protective measures beyond those required for structures exposed to moisture only. For particularly aggressive chemicals, an impermeable coating on exposed concrete surfaces, polymer concrete, or polymer/sulfur-impregnated concrete concrete surfaces or sulfur-impregnated concrete may be required to ensure long-term corrosion protection (ACI 548.1R and ACI 548.2R).
2	58	Poston I think we need to keep acid rain in. Expand to include that acid rain lowers the ph of the concrete creating an environment conducive to corrosion.	7/3/5	Schokkar to evaluate references and propose text.
3	59	Darwin	Neff/Whitmore 13/0/3	<p><u>In previous documents presented by ACI 222, it was stated that the role of cracks in the corrosion of reinforcing steel was controversial. Following significant field and laboratory studies, it has been concluded by the committee that cracks, especially cracks parallel to reinforcing steel, such as form on bridge decks,</u> can reduce the service life of structures by permitting rapid and deeper localized penetration of carbonation and by providing a direct path for chloride ions, moisture, and oxygen to the reinforcing steel. Thus, cracks can accelerate the onset and rate of active corrosion.</p> <p>Also add references</p> <p>Lindquist, W. D., Darwin, D., Browning, J., and Miller, G. G., "Effect of Cracking on Chloride Content in Concrete Bridge Decks," <i>ACI Materials Journal</i>, Vol. 103, No. 6, Nov.-Dec. 2006, pp. 467-473.</p> <p>Darwin, D., Browning, J., Nguyen, T. V., and Locke, C. E., "Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components," <i>Publication No. FHWA-HRT-07-043</i>, Federal Highway Administration, July 2007, 116 pp.</p>

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4	84	Neff	13/0/1	<p>The following would be a better reference to the minimum slope requirement:</p> <p>ACI 362.1-R-97 Guide for the Design of Durable Parking Structures</p> <p>Also, we need to revise the sentence since we are not giving a range. Suggest the following:</p> <p>As a rule of thumb, the minimum slope should be in the range of 1.5%, with <u>2% being preferred</u>. 1.6% ; that is, 0.9 in. in 5 ft (25 mm in 1.5 m) (ACI 362.1-R-97 Guide for the Design of Durable Parking Structures)</p>
5	94			
6	117			
7	128			
8	129	Gustaffson I vote "Negative", however, on the proposed response in Item #8 to TAC Comment #129. I agree with the TAC comment. And I have reservations with deferring the fixing of the document to the next edition.	Vote Weyers/Hansson 0/13/1	<p>No changes are to be made and TAC is being voted non-persuasive.</p> <p>Considerable discussions occurred and it was determined that consideration of TAC changes would delay the document for several years. This item will be brought up as new business.</p>
9	131	Poston	Withdrawn	
10	139			
11	145			
12	153	Poston		McDonald and Neff are to work and submit text for 4.2.1 and ballot.
13	160			
14	165			
15	176			
16	178			
17	184			
18	190			
19	191			
20	192			

Addendum 1

Ballot 3: Committee Ballot

No.	TAC #	Pg #	Line #	P/G/E/S	TAC Comment	Committee Response
1.	96	17	5	E	Suggest restating as follows: "...water and that protection should be maintained..."	Because the prestressing elements are <u>may</u> not <u>be</u> directly protected by <u>an the</u> alkaline environment of concrete, but instead by <u>some form a combination</u> of <u>either</u> duct <u>and grout, or</u> sheathing <u>or</u> and grease. <u>. p</u> project specifications should clearly indicate <u>that protection be maintained for the full length between anchorages of the tendon and</u> that the duct or sheathing material <u>should be impervious impermeable</u> to penetration of water <u>and that protection be maintained for the full length between anchorages.</u>
2.	97	17	6	P	Need to clarify what is meant by "positive methods".	<u>For unbonded tendons in aggressive environments, t</u> he project specifications should <u>show</u> require that <u>sleeves used to connect the sheathing to the anchorage of encapsulated systems shall</u> <u>should</u> <u>positive</u> <u>methods for attaching the duct to the anchorage to prevent water intrusion have a</u> <u>positive mechanical connection to the anchorage at all stressing, intermediate, and fixed ends.</u> Motion Neff/2 nd Schokker: 11/0/2
3.	98	17	7	P	The PTI specification has been superseded by Section 9 of ACI 301-10 for construction and ACI 423.7 for the material. Please revise.	<u>The Post-Tensioning Institute (PTI) (1985) and ACI Committee 423 (ACI 423.4R) ACI 423.7-07</u> <i>Specification for Unbonded Single-Strand Tendon Materials and Commentary</i> , and ACI 301-10 <i>Specifications for Structural Concrete</i> provide guidance for additional measures, such as corrosion-resistant grease and anchorage protection. Motion Neff/Wojakowski 13/0/0
4.	123	25	7	P	Don't understand how air-entrainment helps reduce permeability. The paragraph reads that if cement content is held constant, water can be reduced while workability is retained due to the presence of entrained air. I agree with that statement. However, isn't the reduced volume of water, at least	Add reference to PCA Design and Control of Concrete Mixtures. Motion Nmai/Weyers 15/0/0

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					<p>partially, offset with the increased volume of air? If so, would the resulting concrete have increased permeability and less resistance to corrosion? Is the argument predicated on the idea that the entrained air will form a non-continuous air-void system?</p> <p>Is there any data on this issue that could be cited?</p>	

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				<p>accelerate the onset and rate of active corrosion.</p> <p>Also add references</p> <p>Lindquist, W. D., Darwin, D., Browning, J., and Miller, G. G., "Effect of Cracking on Chloride Content in Concrete Bridge Decks," <i>ACI Materials Journal</i>, Vol. 103, No. 6, Nov.-Dec. 2006, pp. 467-473.</p> <p>Darwin, D., Browning, J., Nguyen, T. V., and Locke, C. E., "Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components," <i>Publication No. FHWA-HRT-07-043</i>, Federal Highway Administration, July 2007, 116 pp.</p>
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