

**ACI-ASCE Joint Committee 423 – Prestressed Concrete**

**ACI 2013 Spring Convention**

**April 15, 2013**

**Minneapolis, Minnesota**

**MINUTES**

**1. Welcome Guests and New Members**

The meeting was called to order at 8:31am by Chairman Carin Roberts-Wollmann. The following members were in attendance for all or part of the meeting:

*Voting Member (26)*

Ahlborn, Tess	Michigan Tech
Barnes, Robbie	Auburn University
Baxi, Asit	Baxi Engineering Inc.
Becker, Roger	PCI
Bondy, Ken	
Dolan, Charlie	University of Wyoming
Donnelly, Jim	Wiss Janney Elstner
Gleich, Harry	Metromont Corporation
Gross, Shawn	Villanova
Hale, Micah	University of Arkansas
Hamilton, Trey	University of Florida
Hayek, Carol	CCL
Krauser, Larry	General Technologies
Krohn, Jason	PCI
Neff, Ted	Post-Tensioning Institute
Rizkalla, Sami	NC State
Roberts-Wollmann, Carin	Virginia Tech
Russell, Bruce	Oklahoma State University
Schaeffer, Tom	Structural Design Group
Trygestad, Amy	Chase Engineering, LLC
Vejvoda, Miroslav	Post-Tensioning Institute
Volz, Jeff	Missouri S & T
Walker, Carl	CW Consulting LLC
Xia, Zuming	VStructural LLC

*Associate and Consulting Members (4)*

Ahmed, Rashid	Walker Parking Consultants
Brown, Michael	WDP
Dymond, Ben	University of Minnesota
Fallis, Garth	Vector
McCarthy, Dan	
Myers, John	Missouri S & T

Nehil, Tom  
Ragaby, Amr El  
Ross, Brandon

Clemson

The following visitors were also in attendance for all or part of the meeting:

Mark Chauvin  
Musa Alawneh  
George Miks  
Greg Zeisler  
Yoshiaki Yamamoto  
Royce Floyd  
Brian Mathys  
Meegan Young

Attendees introduced themselves and Chairman Roberts-Wollmann welcomed all members and guests. It was noted that a quorum was present. (37 voting members)

**2. Approval of Agenda**

The agenda was distributed. Gleich moved to accept the agenda; Dolan seconded. The agenda was approved by unanimous voice vote.

**3. Review of Minutes from Fall Meeting in Toronto**

Gleich moved to approve the minutes; Rizkalla seconded. The minutes were approved by unanimous voice vote.

**4. Membership and Administration**

Roberts-Wollman informed the committee about the passing of Mark Moore. A moment of silence was held in his honor. There may be modifications to the voting membership after the opened ballots close.

**5. Task Group Reports**

**a. 423/445 Task Group on Shear – Roberts-Wollman**

Premature shear failure written by Adolfo as a code change proposal. Balloted and failed in 445.

**b. 423F Task Group on Sustainability – Hayek**

TAC accepted proposed document abstract but cannot include return on investment.

1. Benefits of concrete as a whole to sustainability
2. Prestressing contributions to sustainability
3. Boundary conditions for LCA, but not the full LCA
4. The advantages of prestressing when performing an LCA
5. Include case studies with varying spans from PCA, PTI and PCI.

**c. 423 Task Group on Bond – Russell**

Not in favor of waiting for more testing before drafting a document and hosting a session.

Noted ASTM A1081 approved standard test method evaluating the bond for prestressing strand.

Russell motioned for committee to request a timeslot for session at future convention to develop a Special Publication and host a technical session; Rizkalla seconded.

Approved by unanimous voice vote.

**6. Document Status**

**a. *Specification for Unbonded Single Strand Tendon Materials and Commentary (423.7-07)*. Neff**

Negative resolutions – See attached document for detailed commentary and resolutions.

Scope – exclusion of slabs on grade on expansive soils because IBC references PTI standard, not ACI. Russell withdrew negative after language revision. Dolan noted he has concern for not including slabs on ground putting encapsulated tendons

Item 1, Ref 2: Russell negative withdrawn.

Item 1, Ref 3: Gupta negative withdrawn.

Item 1, Ref 5: Gupta negative: wants anchor (replaces metal casting) and anchorage included to definition. Vejvoda motioned to find Gupta persuasive and add definition for “anchor” (replaces metal casting) and “anchorage” along with proposed definitions; Krauser seconded. Vote: 14 Aye, 6 Nay, 1 abstention. Motion passes, but must address negatives due to change in document. Neff moves to find negatives on last vote persuasive and make Gupta’s negative non-persuasive (reversing previous vote) and replaces anchor where it appears with appropriate terminology; Bondy seconded. Vote: 23 Aye, 0 Nay. Motion passes.

Item 1, Ref 5: Russell negative – proposed new definition. Neff made motion to find Russell persuasive, Hamilton seconded. Approved by unanimous voice vote.

Item 1, Ref 8: Donnelly negative on stressing anchorage definition. Neff motioned to find Donnelly negative persuasive; Ahlborn seconded. Approved by unanimous voice vote.

Item 1, Ref 12: Dolan negative on Contract Documents versus Construction Documents. Neff made motion to find Dolan non-persuasive; Roger seconded. Vote: 18 Aye, 5 Nay, 1 Abstention. Motion passes. Applies for Schaeffer negative on Item 1, Ref 12.

Item 1, Ref 14: Baxi negative on installation drawings. Neff moved to find Baxi persuasive; Krauser seconded. Approved by unanimous voice vote.

Item 1, Ref 14: Donnelly negative withdrawn based on revisions to Baxi negative Item 1, Ref 14.

Item 1, Ref 14: Gupta negative withdrawn.

Item 1, Ref 21: Gupta negative withdrawn.

Item 1, Ref 23: Gupta negative on HDPE or polypropylene. Neff motioned to find Gupta persuasive; Krauser seconded. Approved by unanimous voice vote.

Item 1, Ref 25: Gupta negative on encapsulation tendon and generic tendon definitions. Neff moved to find Gupta non-persuasive; Tom Schaeffer seconded. Approved by unanimous voice vote.

Item 1, Ref 26: Gupta negative to include sleeves in definition of encapsulated tendon. Neff made motion to find Gupta persuasive; Krauser seconded. Approved by unanimous voice vote.

Item 1, Ref 31: Donnelly negative withdrawn based on editorial changes.

Item 1, Ref 33: Schaeffer negative withdrawn.

Item 1, Ref 34: Gupta negative on definition for local zone. Neff moved to find Gupta non-persuasive and use balloted definition; Hayek seconded. Approved by unanimous voice vote.

Item 2, Ref 74: Gupta negative on deletion of certification requirements in specification from previous ballot. Neff moved to find Gupta non-persuasive; Becker seconded. Approved by unanimous voice vote.

Item 2, Ref 76: Baxi negative on bursting steel in nonprestressed reinforcement. Neff moved to find Baxi persuasive and accept proposed revision; Russell seconded. Approved by unanimous voice vote. Applies to Roberts-Wollman negative on Item 2, Ref 76.

Item 2, Ref 77: Schaeffer negative withdrawn.

Item 2, Ref 91: Vejvoda negative on storage of fabricated tendons. Neff moved to find Vejvoda persuasive and accept proposed revision; Krauser seconded. Approved with unanimous voice vote and 1 abstention.

Item 2, Ref 92: Gupta negative on UV stabilizers. Neff moved to find Gupta persuasive and add language of 1.4.3 regarding UV stabilizers; Ahlborn seconded. Approved by unanimous voice vote.

Item 3, Ref 110: Donnelly negative withdrawn base on editorial changes.

Item 3, Ref 111: Gupta negative withdrawn.

Item 3, Ref 112: Gupta negative on mill certification (Part 1) and corrosion stress testing negative (Part 2); Gupta withdrew Part 2 of negative. Neff moved to find Gupta persuasive for Part 1 of negative, eliminating submittal items here and move them to Section 1.4.1; Ahlborn seconded. Approved by unanimous voice vote.

Item 3, Ref 113: Gupta negative on manufacturer and producer. Neff moved to find Gupta non-persuasive due to resolution of prior negative; Ahlborn seconded. Approved by unanimous voice vote.

Item 3, Ref 117: Dolan negative on moving reference notes into commentary. Neff moved to find Dolan perserausive. Ahlborn seconded. And add note to 1.1. Approved by unanimous voice vote.

Item 3, Ref 136: Dolan negative withdrawn, based on committee agreeing to take up as new business.

Item 3, Ref 136: Gupta negative on PT coating. Neff moved to find Gupta non-persuasive without proposed solution; Ahlborn seconded. Approved by unanimous voice vote.

Item 3, Ref 144: Donnelly negative on sheathing. Dolan moved to accept as an editorial change; Krasuer seconded. Approved by unanimous voice vote.

Item 3, Ref 152: Becker withdrew negative based on committee agreeing to take up as new business.

Item 4, Ref 157: Donnelly negative withdrawn based on committee agreeing to take up as new business.

Item 4, Ref 160: Baxi negative withdrawn based on committee agreeing to take up as new business.

Item 4, Ref 160: Donnelly negative withdrawn based on committee agreeing to take up as new business.

Item 4, Ref 160: Esselnick negative on encapsulated anchors – requiring in all applications. Neff moved to find Esselnick non-persuasive; Schaeffer seconded. Approved by unanimous voice vote.

Item 4, Ref 160: Gupta negative withdrawn based on committee agreeing to take up as new business.

Item 4, Ref 160: Krauser negative on ACI 318 vs 350 default. Neff motioned to find Krause nonpersuasive; Ahlborn seconded. Approved by unanimous voice vote.

Item 4, Ref 160: Krauser negative to delete encapsulated tendon paragraph. Neff motioned to find Krauser persuasive and delete paragraph; Bondy seconded. Approved by unanimous voice vote.

Item 4, Ref 160: Schaeffer negative withdrawn.

Item 4, Ref 164: Gupta negative on sheathing/coating. Bondy moved to find Gupta non-persuasive; Rogers seconded. Vote: 18 Ayes, 3 Nays, 1 Abstention. Motion passes.

Item 4, Ref 165: Krauser negative on tape withdrawn for editorial change with tape moved to newly numbered section.

Item 4, Ref 168: Krauser negative on assembly. Neff moved to find Krauser persuasive; Rogers seconded.

Item 4, Ref 179: Schaeffer negative withdrawn.

Item 4, Ref 181: Becker negative on testing withdrawn.

Item 4, Ref 182: Donnelly negative withdrawn based on editorial changes.

Item 4, Ref 183: Bondy negative on anchorage testing acceptance developing strain of 2% and stress of 257ksi. To develop 2% strain, it will go up toward 270 ksi to develop that strain level, rendering 257 ksi requirement useless. We are requiring strain testing to be almost 2.5 times higher than will ever be required to develop the maximum strength required by the building code. Strand is delicate at that point of upper stress-strain curve. There is a paper that shows 0.9% is an appropriate strain, yielding almost 257ksi stress. Bondy fearful committee requiring 2% may be grossly conservative for no valid reason. Neff disagrees, citing importance of ductility and imported steels with varying stress-strain properties. Gleich moved to vote Bondy non-persuasive; Russell seconded. Approved by unanimous voice vote; 1 negative.

Item 4, Ref 183: Xia negative on testing procedure language withdrawn based on committee taking up as new business.

Item 4, Ref 185: Baxi negative – match testing level in 318 to be 0.85. Neff moved to find Asit persuasive; Gleich seconded. Approved by unanimous voice vote.

Item 4, Ref 185: Schaeffer negative withdrawn.

Item 4, Ref 188: Gupta negative on anchorage. Neff motioned to find Gupta nonpersuasive; Trygestad seconded. Approved by unanimous voice vote.

Item 4, Ref 188: Krauser negative on watertight testing subject to hydrostatic pressure. Neff moved to find Krauser persuasive; Krauser seconded. Approved by unanimous voice vote.

Item 5, Ref 193: Becker negative withdrawn.

Item 5, Ref 193: Dolan negative withdrawn.

Item 5, Ref 193: Schaeffer negative withdrawn.

Item 5, Ref 200: Krauser negative withdrawn based on editorial change.

Item 5, Ref 209: Schaeffer negative withdrawn.

Item 5, Ref 210: Schaeffer negative withdrawn.

Item 5, Ref 212: Schaeffer negative withdrawn.

Item 5, Ref 213: Schaeffer negative withdrawn.

- b.** *Guide to Estimating Prestress Losses (423.ZR)*. Roberts-Wollmann stated due to time constraints, we will resolve negatives with voting via 2 conference calls. Note that quorum is necessary during conference calls.

***Chapter 1, 5, 6*** – vote via conference call

***Remaining chapters*** – vote via second conference call

- c.** *Corrosion and Repair of Unbonded Single Strand Tendons (423.4R-98)*. Roberts-Wollman. Hamilton and Moore were working on final edits. Xia and Donnelly agreed to help finalize.
- d.** *Recommendations for Concrete Members Prestressed with Unbonded Tendons (423.3R-05)* Subcommittee for review: Baxi, Bondy, Schaeffer, Dolan, Rashid Ahmed. Provide recommendation for change or re-approval as is.

**7.** Presentation on Carbon Fiber Composite Cable – Yoshiaka Yamamoto, Tokyo Rope

**8. Updates from related committees - out of time for reports**

- a. **381 Reorganization** –Dolan
- b. **318G** – Hamilton
- c. **301** – Krauser

**9. Conference Sessions** –Barnes is working on a session for Reno in 2013 on Self Consolidating Concrete with prestressed applications. Joint sponsorship by 237 and 423.

**10. Reports from Related Groups-** No additional reports

- a. **PCI** –
- b. **PTI** –
- c. **PCA** -
- d. **ASBI** -
- e. **Others** -

**11. New Business** –

**12. Adjournment**

Ahlborn moved for adjournment; Krohn seconded. The motion passed with unanimous voice vote and the committee adjourned at 12:28pm.



<b>Name</b>	<b>Item No.</b>	<b>Ref #</b>	<b>N or E</b>	<b>Balloter's Comment</b>	<b>Committee Resolution</b>	<b>Rationale</b>
Dolan	1	2	E	ACI 318-14 will use Licensed Design Professional instead of Architect Engineer. I suggest we make the same change. The LDP definition is:	No change; See Schaffer Item 2, Ref. 77	
Dolan	1	2	E	Licensed design professional — An individual who is licensed to practice structural design as defined by the statutory requirements of the professional licensing laws of the state or jurisdiction in which the project is to be constructed and who is in responsible charge of the structural design; in other documents, also referred to as registered design professional.	No change; See Schaffer Item 2, Ref. 77	
Dolan	1	2	E	I put this in as an E rather than an N but WHY do we allow unprotected tendons in foundations just to make PTI happy and the owners of the building loose money?	No change	
Donnelly	1	2	E	Dash should be slash between "Architect" and "Engineer" at end of 2nd paragraph.	Agree	
Russell	1	2 (3?)	N	The specification reads as if the specification applies to slabs on ground that are NOT on expansive soils. Rewrite, "This specification shall not apply to post-tensioned slab-on-ground, mat or raft foundations."	Negative withdrawn	
Russell	1	2	N	Commentary should not contain demand language. Rewrite the commentary to remove the word "shall."	Negative withdrawn	
Becker	1	3	E	Based on some of the responses to ballot comments there seems to be an expectation that ACI 301 would also be used. I suggest that the scope should include a statement that the provisions of 423.7 are in addition to the requirements of ACI 301-10.	No change	The scope of the two specifications are separate and distinct. There are no ACI 301 requirements that are applicable to fabrication and PT materials
Esselinck	1	3	E	In the last ballot, several negatives were concerned by exclusions (especially SOG) from the scope of the spec. I am disappointed SoG are not included in this spec but I don't want to block it either.  Suggest suppressing "For nonflexural or membrane type structures primarily under tensile forces, the provisions apply where deemed appropriate by the Architect-Engineer" when can it be inappropriate to follow the spec for these applications? Whatever we say, the Architect-Engineer can change the spec as he deems appropriate -> it seems superfluous to me. Editorial: some definitions have capital letters when they shouldn't (Tail, Wedges, Work...). Some spaces are missing too.	No change	The intent is that the A/E should have the option for these type of applications.
Gross	1	3	E	Change "Architect-Engineer" to "Architect/Engineer" to be consistent with definitions in Section 1.2	Agree – change globally "Architect-Engineer" to "Architect/Engineer"	
Gross	1	3	E	Delete second period.	Agree	

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Gupta	1	3	N	<p>Suggest rewording the second paragraph to following:  The Specification shall not apply to post-tensioned slab-on-ground, mat or raft foundations on expansive soils <u>designed according to the PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils</u>. <del>For nonflexural or membrane type structures primarily under tensile forces, the provisions apply where deemed appropriate by the Architect Engineer..</del></p> <p>This provides a clear guidance when the specifications do not apply.  <b>Follow-up Comment:</b>  Looking at the response from other committee members. I think that this is unclear and needs to be clarified. However, if everyone in the committee decides in favor of this I would withdraw my negative.</p>	<p><b>Negative withdrawn</b></p>	<p>The intent was to parallel the language in IBC.</p> <p>The proposed alternative text would work for the majority of PT SOG applications; however, in theory one is permitted to design a PT slab-on-ground on expansive soils using the WRI/CRSI design method.</p> <p>Also, the deletion of the sentence as proposed would include sport courts under this spec, which is not the intent.</p>
Gupta	1	5	N	<p>Two issues:</p> <ol style="list-style-type: none"> <li>We use the term anchor but it has not been defined. I suggest two definitions. anchors and anchors, encapsulated. I would be open to using the term PT anchor instead of Anchor to distinguish it from a regular concrete anchor.  <u>anchor: A metal casting that transfers the force from the prestressing strand to the concrete.</u>  <u>anchor, encapsulated: An anchor that is completely covered by a plastic coating.</u></li> <li>Since the encapsulation cap is only used for encapsulated anchors it would not apply to regular anchors. <ol style="list-style-type: none"> <li>cap, encapsulation – plastic cap filled with PT coating that <u>covers the strand tail and</u> provides a positive watertight connection <u>to the encapsulated anchor</u> <del>to all anchors protecting the wedges and the tendon tail from moisture infiltration.</del></li> </ol> </li> </ol> <p>To me the anchorage is an assembly that includes the anchor, wedges, sleeves, encapsulating caps and local zone reinforcing that is required behind the anchor.</p> <p><b>Follow-up Comment:</b>  I have always been confused with the use of term “anchorage” for</p>	<p><b>Nonpersuasive – use anchorage throughout the spec.</b></p> <p>Editorial note: revise two instances where “anchor” was used as a noun.</p>	<p>In accordance with the CCT, we are presently using the term “anchorage” for the device as a noun. The CCT uses “anchor” as a verb.</p> <p>Believe that the term “anchor” has only been used as a verb in the spec.</p>

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				the anchor. If we have a problem with anchor being a verb, I would suggest that we rename it as "PT anchor". This way it would distinguish us from regular concrete anchors.		
Russell	1	5	N	Change the word "load" to "force"	<b>Persuasive</b> – revise to: <b>anchorage</b> —a device used to maintain elongation in prestressing strand or bar by transferring compression <del>load</del> <u>force</u> to concrete.	
Ahmed	1	6	NV	Consider revising the sentence as "... where <u>field</u> stressing of tendon is not required."	No change	Stressing may not always be in the field
Ahmed	1	7	NV	Consider revising the sentence as "..... application of post-tensioning force <u>without the need to cut the tendon.</u> "	No change	
Donnelly	1	8	N	Similar to Ref. #6, add " <u>(Also known as live-end anchorage)</u> " to end of definition	<b>Persuasive</b> – revise as follows: <b>anchorage, stressing</b> —anchorage at one end or both ends of tendon where stressing of tendon is required. <u>(Also known as live-end anchorage)</u>	
Donnelly	1	10	E	Delete "positive" in 2nd line of definition	No change	
Ahmed	1	11	NV	Consider revising the sentence as "..... stresses resulting from the <u>applied</u> loads."	No change	Word "applied" doesn't add a lot; also might be construed as not including dead load
Becker	1	12	E	I am not sure this is a good definition of Contract Documents. I believe subcontracts are also considered part of Contract Documents and the Owner has nothing to do with those. I would further suggest that the contents of this specification should really focus on drawings and specifications – perhaps Construction Documents as defined by the IBC. This document should really not get into the issues of contracts between parties.	No change; See Dolan Item 1, Ref. 12	
Dolan	1	12	N	I suggest using "construction documents" instead of contract documents. Contract documents include bid bonds and other assignments not appropriate for this condition. 318 made the following changes:  <b>Contract Documents:</b> a set of documents supplied by Owner to Contractor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.  <b>Add a new definition in Chapter 2.</b>	<b>Nonpersuasive</b> - retain the use of "Contract Documents" throughout to maintain consistency with ACI 301 and TCM	ACI 301 uses the term "Contract Documents" but not the term "Construction Documents"  ACI Specification Manual recommends the use of the "Contract Documents"  ACI CCT includes "Contract Documents" but not "Construction Documents"

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				<u>Construction Documents</u> : Written and graphic documents and specifications prepared or assembled for describing the location, design, materials, and physical characteristics of the elements of a project necessary for obtaining a building permit and construction of the project.		The proposed new definition is not appropriate because the spec is applicable to non-building applications
Gupta	1	12	E	Change "Contract Documents" to "contract documents". We are using lower case in all other definitions. <b>Follow-up Comment:</b> OK	No change	In the CCT , ACI 301 and ACI Spec manual, it is capitalized
Schaeffer	1	12	N	IBC and 318 now use the term "Construction Documents" rather than "Contract Documents" as an effort to remove the reference to contracts. I suggest we use the same definition as 318. The definition currently being considered by 318 and almost identical to the IBC definition is:  Construction Documents - Written and graphic documents and specifications prepared or assembled for describing the location, design, materials, and physical characteristics of the elements of a project necessary for obtaining a building permit and construction of the project.	<b>Nonpersuasive</b> - See Dolan Item 1, Ref 12	
Baxi	1	14	N	<b>Drawings showing information about the specifics of the post-tensioning system and tendon placement information such as the number, size, length, marking, location, elongation and tendon profiles.</b>	<b>Persuasive</b> – revise to: <b>drawings, installation</b> -- drawings showing information <a href="#">about the specifics of the post-tensioning system and tendon placement</a> such as the number, size, length, marking, location, elongation and profile. (Also referred to as "shop drawings")	Reads better
Donnelly	1	14	N	Definition makes no sense as revised (number of what?). Revise to "drawings showing information <b>about the specifics of the post-tensioning system</b> such as the number, size, length, marking, location, elongation, and profile <b>of the tendons.</b> "	<b>Negative withdrawn based on revisions made per Baxi Negative Item 1, Ref. 14 above</b>	
Gupta	1	14	N	I would suggest keeping the term "PT supplier" in the specification. Sometimes the design drawings also show the number, size, length and elongation. I think that having the term post-tensioning supplier clarifies that the installation drawings are prepared by the post-tensioning supplier.	<b>Negative Withdrawn</b>	The term "PT Supplier" was removed in response to a number of negatives on the last ballot. The specification is between the owner and the contractor and should not assign responsibility to subs.
Roberts-	1	14	E	Add back in "of each tendon" or else it is not clear what number,	No change needed with the revision per	The definition is not setting

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Wollmann				size, etc is to be shown.	Baxi Item 1, Ref. 14 above	the submittal requirements for Installation Drawings. Therefore, additional detail is not needed here.
Gupta	1	15	E	Suggest change "aggressive" to "deleterious". Using aggressive in the definition of aggressive is redundant.  Follow-up Comment: OK	Agree – revise to: environment, aggressive— an environment in which structures are exposed to direct or indirect applications of deicing salts and other chemicals known to be <b>aggressive deleterious</b> to steel, seawater, brackish water, or spray from these water sources; and salt-laden air as occurs in the vicinity of coastal <b>waterways</b> . Aggressive environments also include <b>conditions of</b> structures where stressing pockets are frequently wetted or are directly in contact with soils during service	Editorial
Krauser	1	15	E	Possibly change "aggressive to steel" to "deleterious to steel"	Agree - See Gupta Item 1, Ref. 15 above	
Zia	1	15	E	change "coastal ways" to "coastal waterways"  Also revise the last sentence to read: "...also include conditions of structures where..." (NOTE: structures are not environment!)	Agree - See Gupta Item 1, Ref. 15 above	
Gross	1	17	E	End definition with period instead of comma.	Agree	
Gross	1	19	E	Change PT to PT (use bold font).	Agree	
Gupta	1	21	N	Suggest keeping the term PT supplier. The PT material is fabricated and furnished by the PT supplier. See comment on Item 1 Ref#14.	<b>Negative Withdrawn</b>	The term "PT Supplier" was removed in response to a number of negatives on the last ballot. The specification is between the owner and the contractor and should not assign responsibility to subs.
Gupta	1	23	N	<b>Suggest modifying as follows:</b> <b>sheathing</b> — <del>a</del> <b>An extruded high density polyethylene or polypropylene covering that encases material encasing</b> prestressing steel to prevent bonding of the prestressing steel with the surrounding concrete, to provide corrosion protection, and to contain the PT coating.  Follow-up Comment:	<b>Persuasive</b> - revise to: <b>sheathing</b> — <del>a</del> <b>An extruded high density polyethylene or polypropylene covering that encases material encasing</b> prestressing steel to prevent bonding of the prestressing steel with the surrounding concrete, to provide corrosion protection, and to contain the PT coating.	Presently, only HDPE or PP are allowed as sheathing material, so the change would be appropriate. The downside: if new sheathing materials are developed, we will need to revise the definition as well as the sheathing requirements.

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				I would encourage the committee to accept the change.		
Gupta	1	25	N	<b>tendon</b> —in post-tensioned applications, the tendon is a complete assembly consisting of anchorages, prestressing steel, PT coating, <a href="#">sleeves</a> , and sheathing <del>and encapsulation cap</del> .  Follow-up Comment: Would it be acceptable if we add the words “if required by these specifications” at the end of the sentence.	<b>Nonpersuasive</b> – no change	For the generic case of a tendon, the addition of the terms: “sleeves” and “encapsulation cap” is confusing. The follow-up definitions of encapsulated and non-encapsulated tendons includes these items, which clarifies the difference
Gross	1	26	E	End definition with period.	Agree	
Gupta	1	26	N	<b>tendon, encapsulated</b> — a tendon that is completely enclosed in a watertight covering from end to end, including anchorages, sheathing with PT coating, <a href="#">sleeves with PT coating</a> and an encapsulation cap over the <del>tendon</del> <a href="#">strand</a> tail at each end.  Follow-up Comment: OK	<b>Persuasive – revise to:</b>  <b>tendon, encapsulated</b> — a tendon that is completely enclosed in a watertight covering from end to end, including anchorages, sheathing, <del>with</del> PT coating, <a href="#">sleeves</a> and an encapsulation cap over the strand tail at each end	We have not defined sleeves as being part of the anchorage.
Gupta	1	27	E	<b>tendon, non-encapsulated</b> —a tendon that has bare metallic <del>anchors</del> <a href="#">anchorages</a> , and sheathing that is continuous between <del>anchors</del> <a href="#">sleeves</a> but not connected to the <del>anchors</del> <a href="#">sleeves</a> .  See comment for Item 1 Ref.#4.  Follow-up Comment: I would encourage the committee to consider this revision.	No change	In accordance with the CCT, we are using the term “anchorage” for the device as a noun. The CCT uses “anchor” as a verb.  See Gupta Item 1, Ref. 5
Gross	1	28	E	1) Use lower-case “t” in “tail”. 2) If we can use “tendon tail”, why can we not use “strand tail” as opposed to “tail, strand”? Can we be consistent? 3) Also, put this definition in the correct location alphabetically (should be between “sleeve” and “tendon”).	Agree – revise tendon tail to tail, tendon	
Krauser	1	28	E	Delete “the” at beginning of definition	Agree	
Gamble	1	30	E	Delete one of the “tendon, unbounded” cases.	Agree	
Gross	1	30	E	Delete “tendon, unbounded - ” after “tendon, unbounded”	Agree	
Roberts-Wollmann	1	30	E	Tendon, unbonded is repeated, delete second appearance	Agree	
Baxi	1	31	E	Delete “ after the period.	Agree	
Donnelly	1	31	N	Wedges do more than just bite into strand while stressing. Revise	<b>Negative withdrawn based on the</b>	<b>Editorial</b>

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				definition to "Pieces of tapered high strength steel with serrations which bite into <b>and grip</b> the prestressing steel <del>during in order to</del> transfer <del>of</del> the prestressing force <b>to the anchorage.</b> "	<b>following editorial change:</b>  Pieces of tapered high strength steel with serrations which bite into <u>and grip</u> the prestressing steel <u>during in order to</u> transfer <del>of</del> the prestressing force <u>to the anchorage.</u>	
Gamble	1	31	E	Delete final "	Agree	
Gross	1	31	E	Do not capitalize "Wedges".	Agree	
Krauser	1	31	E	"lock onto" might sound better than "bite into"	See Donnelly Negative Item 1, Ref. 31	
Roberts-Wollmann	1	31	E	Delete quotation mark at end of definition	Agree	
Volz	1	31	E	Remove quotation at end of definition.	Agree	
Baxi	1	32	E	Delete "of" after housing.	Agree	
Gross	1	32	E	Do not capitalize "Wedge". Also add period at end of definition.	Agree	
Gross	1	33	E	Do not capitalize "Work".	Disagree	Is capitalized in ACI TCM
Schaeffer	1	33	N	Use "Construction Documents" – see comment Ref #12	<b>Negative withdrawn</b>	
Gross	1	34	E	End definition with period.	Agree	
Gupta	1	34	N	The definition is very confusing: Suggest the following <u>zone, local – A zone of concrete surrounding the anchor that is subjected to high localized stresses. The local zone typically extends a distance equal to half the thickness of the member from the face of the anchor.</u>  <b>Follow-up Comment:</b> The definition is really confusing and does not provide any guidance. However, if everyone feels this is adequate. I would withdraw my negative.	<b>Nonpersuasive</b> – no change	Balloted text is definition from 318
Donnelly	1	39	E	Title of ASTM is "Standard Test Methods for Testing Multi-Wire Steel Strand"	Agree	
Donnelly	2	61	E	Dash should be slash between "Architect" and "Engineer" at end of sentence.	Agree	
Gupta	2	61	E	Need to be consistent either use "Architect-Engineer" or "Architect/Engineer".	Agree; See Gross Item 1, Ref. 3	
Donnelly	2	69	E	Insert "a" before "nationally accredited organization ..."	Agree	
Gamble	2	69	E	Restore 1st sentence to original. It seems imperative enough to me, but TAC will not buy this, on the basis of recent experience with the ACI 216 Code.	Agree; revise to: A copy of the tendon fabrication plant certification shall be furnished.	Editorial Balloted text is preferred style of ACI Spec manual and of ACI301.

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
						However, agree that it is better to be consistent throughout spec.
Gupta	2	69	E	Change "If the certification is not from <u>a</u> nationally accredited..."	Agree	
Roberts-Wollmann	2	69	E	Why is this statement worded differently than the two statements before? Be consistent. I like "shall be furnished"	Agree; see Gamble Item 2, Ref. 69	
Gupta	2	74	N	<p><b>Why delete "<del>which shall ensure that the unbonded tendons and components comply with the requirements of this Specification. If the certification body is not accredited, it</del>"</b></p> <p>Are the specific requirements for unbonded tendons included in IAS or ISO IES Guide 65 documents??</p> <p>? Suggest adding the following to the first paragraph:  "<u>.... or equivalent, which shall ensure that all components of the unbonded tendons comply with the requirements of this specifications.</u>"</p> <p><b>Follow-up Comment:</b>  I have some heartburn over this. The only reason we have an externally audited program is to enforce the specifications. Without the last sentence it kind of refers to a program that really does not address the specifications. I would strongly encourage the committee to consider this.  Would it be better if we substitute the word "ensure" with "confirm" or "enforce"</p>	<b>Nonpersuasive</b> – no change	Text was deleted in response to negatives on the previous ballot. Certification programs <u>help</u> to ensure, but do not guarantee compliance with the spec as would be implied by the proposed revision.
Becker	2	74	E	The sentence after the last bullet point can be deleted. The stated requirement is covered in 1.4.5 under Submittals.	Agree	
Donnelly	2	74	E	Dash should be slash between "Architect" and "Engineer" at end of item.	Agree	
Baxi	2	76	N	Delete the words " as bursting steel". The nonprestressed reinforcement in the local zone is confinement reinforcement as stated even in the definition of local zone. I think it is best if we just leave it as: Nonprestressed reinforcement required for the anchorage devices in the local zone ..... (and not specify whether it is bursting or confining because this is interpreted differently depending on who you talk to)	<b>Persuasive</b> - Revise text as follows:  1.5.2.1 Nonprestressed reinforcement required <u>for anchorages devices as bursting steel for anchorage devices</u> in the local zone shall be indicated on installation drawings.	
Gross	2	76	E	If the term "bursting steel" is added here, it should probably be added to the definitions. I would suggest consulting Baxi on	See Baxi Item 2, Ref. 76	



Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				suggested wording for such a definition. One could make the same argument about the term "local zone".		
Donnelly	2	77	E	Dash should be slash between "Architect" and "Engineer" at end of 1st sentence.	Agree	
Gross	2	77	E	Change "Architect-Engineer" to "Architect/Engineer" to be consistent with definitions in Section 1.2	Agree; see Gross Item 1, Ref. 3	
Roberts-Wollmann	2	76	N	Bursting reinforcement is considered part of the general zone and should be presented on the contract drawings. I think what is being referred to should be called "local-zone reinforcement". According to ACI 318 18.14.2.2 must be provided where it is required for proper functioning of the anchorage device. I recommend "Nonprestressed local zone reinforcement required for proper functioning of the anchorage device shall be indicated on the installation drawings."	<b>Persuasive</b> - see Baxi Item 2, Ref. 76 for revisions	
Schaeffer	2	77	N	Use "licensed design professional" in place of Architect/Engineer. This is consistent with 318.	<b>Negative withdrawn</b>	
Baxi	2	81	E	The tendon sheathing shall be protected from damage by banding materials <b>and</b> by using padding material between banding and tendons.	No change	Prefer balloted text
Donnelly	2	91	E	Leaving tendons on ground, paved or not, will still leave them exposed to water running across the ground. They should be elevated above that surface. Suggested re-wording: "Fabricated tendons shall be stored on <del>a paved</del> <b>an elevated</b> surface with proper drainage away from tendons."	See Vejvoda negative Item 2, Ref 91	
Vejvoda	2	91	N	Modify provision as follows: "Fabricated tendons shall be stored on a paved surface with proper drainage away from tendons or on proper dunnage".  Gravel or other surface is acceptable if proper dunnage is used.	<b>Persuasive</b> – revise to: Fabricated tendons shall be stored on a paved surface with proper drainage away from tendons <u>or on proper dunnage</u> .	
Gupta	2	92	N	How can this be enforced! There is no information about the UV stabilizers in any of the requirements that the manufacturer's submits. I would suggest that this requirement be either deleted or the UV stabilizer information included in the submittal from the manufacturer.  <b>Follow-up Comment:</b> <b>OK</b>	<b>Persuasive</b> – Revise Section 1.4.3 as follows:  1.4.3 -- Sheathing A sheathing material report shall be furnished containing type, thickness, and density of material; <u>information about added ultraviolet light stabilizers (if used)</u> and supporting test data demonstrating compliance with all requirements of Section 2.3	

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
Krauser	2	96	E	Last line need a comma after "loading"	Agree	
Donnelly	3	107	E	Last line of item reads oddly, with two "and"s and no commas. Are we trying to say "coil(s) of strand, wire rod heat number, and wire coils(s) ..." ?	<b>Agree; revise to:</b> 2.1.5 Traceability - The strand manufacturing process shall be controlled and documented in a manner providing identification and traceability with regard to coil(s) of strand, <del>and</del> wire rod heat number and wire coil(s) used to produce the strand.	
Donnelly	3	107-116	E	Renumber sections (and text in Ref. Nos. 109 and 113) to account for deleted sections	Agree	Tests are identified in 2.1.6
Volz	3	107-116	E	Renumber 2.1.5. thru 2.1.11 due to elimination of current items 2.1.2 thru 2.1.4.	Agree	
Donnelly	3	109	E	Not clear about which tests we are talking about. Insert phrase "for mechanical properties" after "Tests" at start of sentence.	No change	
Roberts-Wollmann	3	109	E	Remove hyphen in A-416.	Agree	
Ahmed	3	110	NV	Add ASTM E328 along with A416.	No change	ASTM A416 already references E328
Becker	3	110	E	Need to renumber as 2.1.6.3	Agree	
Dolan	3	110	E	Is a mill test satisfactory and if so, we should allow it.	No change	Not sure what a mill test is.
Donnelly	3	110	N	With modifications, section now reads that we have to test all finished strand annually. We don't want some clever lawyer to ask why the strand in a structure wasn't tested every year. Suggest we change "For" at beginning of sentence to "During the production of"  Additionally, what if the source of the raw material changes but not the type? Don't we want that tested too? Suggest we add the phrase "or source" after "... occasion of change in the type"	<b>Negative withdrawn based on the following editorial change:</b>  2.1.6.2 Relaxation Properties:  For low relaxation strand, finished strand shall be tested <u>during production</u> for relaxation at least annually, but also on any occasion of change in the type of raw material or manufacturing process. The relaxation test shall be performed according to the requirements of ASTM A416 and the requirements herein.  The relaxation test shall be performed as a full 1000-hour test at initial production and every third year thereafter. Interim annual relaxation tests may be performed as 200-hour tests with results extrapolated to	Editorial

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
					1000 hours provided that the previous full 1000-hour test exhibits satisfactory results.	
Gupta	3	111	N	<p>Why delete Stress Corrosion Testing: is it covered by ASTM A416??</p> <p><b>Follow-up Comment:</b> Based on the discussion, I withdraw my negative.</p>	<b>Negative withdrawn</b>	The test is not currently in the Spec. It was proposed as part of the PTI Plant Certification Program for Prestressing Steel Suppliers; however, there is a strong consensus of prestressing steel suppliers who feel the test is unwarranted given the prestressing steels used in the U.S.
Gupta	3	112	N	<p>Two items: 1. Why not ask for the complete mill certification that includes all of these properties and is readily available. 2. Also suggest leaving the sentence with stress corrosion.</p> <p><b>Follow-up Comment:</b> OK!</p> <p>Withdraw my negative on item 2</p>	<p><b>Part 2 of Negative withdrawn Persuasive – Part 1 of Negative.</b> Add the relaxation test report submittal to 1.4.1 as follows:</p> <p><u>1.4.1</u> Prestressing Steel</p> <p><u>1.4.1.1</u> — Certified mill test reports and typical load-elongation curves shall be furnished for each coil or pack of strand used in fabrication of the tendons, containing the following information:</p> <p>a) Heat number and identification; b) Tensile strength; c) Yield stress at 1% extension under load; d) Elongation at failure; e) Modulus of elasticity; f) Diameter and net area of strand; and g) Type of material (normal or low-relaxation).</p> <p><u>1.4.1.2</u> — <u>Relaxation test results shall be furnished if requested by the Architect/Engineer.</u></p> <p>1.4.1.<del>4</del><u>3</u> — Samples from each heat (or “manufacturer’s length,” in the case of strands), properly marked, shall be furnished for verification of prestressing steel properties if requested by the</p>	Requirements are redundant with the submittals of 1.4.1

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
					Architect/Engineer.  <b>Delete Section 2.1.7</b>	          See Gupta Item 3, Ref. 111
Gupta	3	113	N	The term manufacturer is confusing. Either we add a definition for manufacturer or change this to "PT supplier"  Follow-up Comment: OK!	<b>Persuasive</b> – Move section to a new subsection under 1.4.1 Prestressing Steel Submittals and revise as follows:  <u>1.4.1.4 -- Strand producer records – If requested by the Architect/Engineer, the following records related to material production shall be furnished:</u>  <ul style="list-style-type: none"> <li>• <u>_____ Purchasing records showing the purchase of appropriate base materials used in production.</u></li> <li>• <u>_____ Product traceability through production and shipping.</u></li> <li>• <u>_____ Testing results for tests required under Section 2.1.6 of this specification, conformities (or non-conformities), and resultant actions.</u></li> <li>• <u>_____ Calibration records for all testing and control devices.</u></li> <li>• <u>_____ Statistical records of quality performance evidencing the occasion, frequency, and percentage of accepted and rejected final product. Records shall include internal and external occurrences such as on-site lab results and customer responses.</u></li> <li>• <u>_____ Suitability and testing of raw materials including quality reports from wire or rod suppliers.</u></li> <li>• <u>_____ Procedure for the quarantine and disposal of non-compliant product and records of same.</u></li> </ul>	It makes sense to include these with the other submittals. The reference to manufacturers has been removed because it is the contractor's responsibility to pass on these requirements to subs/suppliers.

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
					<a href="#">The strand records shall be maintained for a minimum period of five years.</a>	
Dolan	3	117	N	These notes are commentary and do not belong in a specification. If they stay, the preface must say that notes are commentary and not part of the specification. The same is true on 3-133, 134	<b>Persuasive</b> – Add the following to the end of 1.1 <a href="#">The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.</a>	Notes have been incorporated in accordance with ASTM guidelines for material specifications.  The added text is specified by the ASTM Blue Book whenever notes and/or footnotes are used in a spec.
Ahmed	3	120	NV	Add a bullet item as follow: • Provide corrosion protection to the prestressing strand	<b>Persuasive</b> – add bullet to list as follows: • <a href="#">Provide corrosion protection to the prestressing strand</a>	
Ahmed	3	134	NV	3rd line: Revise the sentence as “Test 1 together with Test 2, ....	Agree; revise to: Together, <del>Tests 1 and with Test 2,</del> the <a href="#">minimize</a> bleeding of the lighter components from the coating <del>is minimized.</del>	editorial
Dolan	3	136	N	The specification is all right but the quality control is not. I would like to see a check that says the total amount of PT coating for a full strand pack is met and if not, then the pack should be recoated.	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	
Gross	3	136	E	Begin last sentence with “The” and end it with a period.	Agree	
Gupta	3	136	N	I liked the equation that was provided earlier.  In addition to the amount of grease required in the P/T strand in the extruded sheathing section, this section is also referenced by Section 2.5.3.2 that deals with the P/T coating in the sleeves. The way the current specification reads the P/T strand in the sleeves only needs to have a coverage of 2.5 lb/100 ft (which is the same as on the extruded section). Clearly in the sleeve section the amount of grease required on top of the strands to fill the voids would be significantly more. I think the intent of section 2.5.3.2. is to fill the voids between the sleeves and strands with P/T coating.  Recommend revising this to the following:  <a href="#">The PT coating shall extend over the entire tendon length. The PT</a>	<b>Nonpersuasive</b> – no change	

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				<p><u>coating material shall completely fill the annular space between the strand and sheathing or sleeve.</u></p> <p><del>The internal diameter of extruded sheathing shall be a minimum of 0.030 in. larger than the diameter of the strand. [This can be deleted since it is covered in section 2.3.4 of the specification.]</del> <u>The minimum weight of PT coating shall be determined by calculating the volume required to fill the space between the strand and sheathing or sleeve based on the following equation:</u></p> $\frac{\text{lb of PT Coating}}{\text{ft}} = 0.812[d_s^2 - d^2]$ <p><u>Where <math>d_s</math> = average internal diameter of the sheathing or sleeve (in.)</u>  <u>d = diameter of the strand (in.)</u></p> <p>I have simplified the equation and made it more generic so that it can be applied to sheathing as well as sleeves. It provides the same answers as the more complicated equation. The average internal diameter of the tapered sleeve can be used to calculate the weight of PT coating required in the sleeve.</p> <p><b>Follow-up Comment:</b>  I would strongly urge the committee to consider this. This would significantly strengthen the specifications.</p>		
Zia	3	136	E	Why use mixed units for the equation?	No change	Units are the same as in current spec; will leave to staff to decide if metric is to remain
Donnelly	3	144	N	Sentence makes no sense as is. Insert "sheathing" after "Minimum density of" at beginning of sentence.	<b>Persuasive</b> – revise as follows: Minimum density of <u>sheathing</u> shall be 0.034 lb/in. <sup>3</sup> (941 kg/m <sup>3</sup> ).	Editorial
Donnelly	3	150	E	I thought we had an issue limiting the sheathing to an extrusion process, which the revised text now does. Suggested re-wording: "Sheathing shall be manufactured by a <del>an extrusion</del> process, such as <b>extrusion</b> , that provides watertight encasement of the PT coating."	Disagree – no change	Actually, in the last ballot there were negative votes that wanted to explicitly require the extrusion process.
Becker	3	152	N	I will reiterate a negative from the previous ballot. This provision has conflicting requirements. The sheathing has to be "continuous between anchorages". Yet the following sentence allows unsheathed lengths of strand. At the very least, add "for	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	Sheathing is continuous <u>between</u> anchorages, but not from anchorage to anchorage. This is why the

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				encapsulated applications" after "between anchorages".		ballot change was proposed. The sheathing typically starts up to 12 inches from the fixed end anchorage and is continuous to within 1 in. of the stressing end anchorage.
Roberts-Wollmann	4	155	E	Make ci a subscript in "but not greater than f'ci" and make c a subscript in "but not greater than f'c"	Agree	
Zia	4	155	E	Clean up Eq. (2-1)	Agree	Will be done by staff in production
Donnelly	4	157	N	It seems like this item should contain more than just that castings be free of defects. Do we need to add something regarding strength requirements, material requirements, or performance requirements (i.e., distribute load uniformly, permit uniform seating of the wedges, capable of developing required tension in tendon, etc.)?	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	No proposal given  <b>New Business</b>
Baxi	4	160	N	Question. Are there any requirements for the type of plastic and plastic coating of the anchor? It does not seem sufficient to just say plastic coated anchor.	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	Voter is nonpersuasive because no proposed resolution has been provided. This issue was previously discussed by the committee and agreed to be taken up as <b>new business</b> .
Dolan	4	160	E	I find this allowance inappropriate.	No change	
Donnelly	4	160	E	To improve readability, move the phrase "by encapsulation" to after "anchorage assemblies" in the first sentence. Revised text: "For all tendons used in applications governed by either ACI 318 or ACI 350, protect all anchorage assemblies <b>by encapsulation</b> , including the anchorage, wedges, and prestressing steel, against corrosion <del>by encapsulation</del> ."		
Donnelly	4	160	E	Dash should be slash between "Architect" and "Engineer" in first sentence of second paragraph.	Agree	
Donnelly	4	160	N	Why are we requiring the encapsulation system to be plastic? Revise first sentence to "Encapsulation systems shall employ a <b>coating of plastic coating or other solid inert material</b> to protect the metallic components ..."	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	<b>New Business</b>
Esselink	4	160	N	If ACI423.7 specs are used in project applications or countries	<b>Nonpersuasive</b> – no change	Negatives were received on

<b>Name</b>	<b>Item No.</b>	<b>Ref #</b>	<b>N or E</b>	<b>Balloter's Comment</b>	<b>Committee Resolution</b>	<b>Rationale</b>
				<p>where ACI 318 or 350 are not applicable, we should impose encapsulation. The "Architect-Engineer" will have to take the initiative when writing the specs to allow non-encapsulated systems. I suggest:</p> <p>Suppress "For all tendons used in applications governed by either ACI 318 or ACI 350"</p> <p>Suppress "For all other applications, the use of non-encapsulated systems shall be permitted unless required by the governing standard, or otherwise specified by the Architect-Engineer."</p>		<p>the last ballot from some of the committee's international members objecting to the requirement that encapsulation would be required.</p> <p>As noted in previous committee discussions and in the ballot, the spec is applicable to applications where the tendons are not exposed to corrosive conditions (e.g. a floor inside a building). In these cases, the use of encapsulated tendons may not be warranted and should not be mandated by the spec.</p> <p>The voter's proposed change would make it mandatory for all applications, which is not the current intent.</p>
Gamble	4	160	E	Is "plastic" without qualifiers ok? There is a semi-infinite array of plastics.	See Baxi Item 4, Ref. 160	
Gross	3	160	E	Change "Architect-Engineer" to "Architect/Engineer" to be consistent with definitions in Section 1.2	See Gross Item 1, Ref. 3	
Gupta	4	160	N	As discussed in the meeting in Toronto: I would like the committee to take on the requirements of plastic that is used to coat the anchors.	<b>Negative withdrawn</b> based on committee agreeing to take item up as new business	See Baxi Item 4, Ref. 160
Kline	4	160	E	I think you mean "For all other applications, the use of non-encapsulated systems shall be permitted unless otherwise required by the governing standard, or otherwise specified by the Architect-Engineer."	Agree, revise to: For <b>all</b> other applications, the use of non-encapsulated systems shall be permitted unless <b>otherwise</b> required by the governing standard, or otherwise specified by the Architect-Engineer.	
Krauser	4	160	E	Delete "all" in first line of second paragraph	Agree, see Kline Item 4 Ref. 160 above	



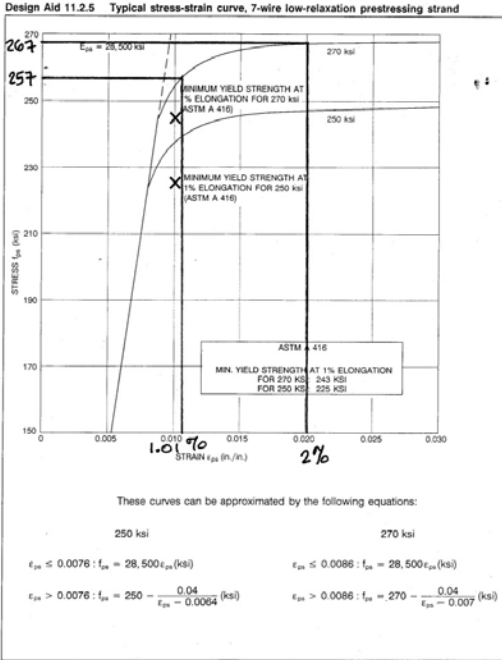
Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
Krauser	4	160	N	The default should be ACI 318 or 350 and encapsulated tendons. I am not sure of the proper wording to use.	<b>Nonpersuasive</b> – no change	Not sure what is being suggested; no proposed resolution has been provided. The default is that encapsulated tendons are required for 318 or 350 apps.
Krauser	4	160	N	Delete the second paragraph. This section is about “encapsulation systems”. The information in this second paragraph is covered in Section 2.6 (items 169 and 170).  <del>“For all other applications, the use of non encapsulated systems shall be permitted unless required by the governing standard, or otherwise specified by the Architect Engineer.”</del>	<b>Persuasive</b> – delete 2 <sup>nd</sup> paragraph	
Schaeffer	4	160	N	Use “licensed design professional” in place of Architect/Engineer. This is consistent with 318.	<b>Negative withdrawn</b>	
Gross	4	162	E	Begin first sentence with “The”.	Agree	
Krauser	4	162	E	“Encapsulation” is misspelled	Agree	
Volz	4	162	E	'Encapsulation' misspelled.	Agree	
Donnelly	4	164	E	Add “and” after “2.5.3.1a and 2.5.3.2;” at end of Item f).	No change	
Gupta	4	164	N	In full contact with PT coating is confusing and not enforceable. Do we mean to fill the void between the strand and sheathing with PT coating or just cover the strand with PT coating. Suggest the section be replaced by the following:  2.5.3.2 Within the <del>sleeve connecting component or enclosure</del> , prestressing steel shall be either covered by sheathing for its full length, or <del>the void space between the sleeve and the prestressing steel be filled</del> <del>be in full contact with P-T PT</del> coating in conformance with 2.2.3 where sheathing is not present.	<b>Nonpersuasive</b> – no change	
Krauser	4	165	N	Tape should only be used for repairs – such as sheathing repairs and when adding couplers to short tendons. Change title:  “2.5.4 – <b>Repair Tape</b> ”	<b>Nonpersuasive</b> – no change	
Krauser	4	166	N	Tape should only be used for repairs – such as sheathing repairs and when adding couplers to short tendons.  “ <b>Repair T</b> ape used as a component for <b>sheathing repairs and when adding enclosing</b> couplers <b>to short tendons</b> shall:”	<b>Nonpersuasive</b> – no change	

**Commented [PG1]:** The sleeve is defined as the device for connecting the sheathing to anchorage.

<b>Name</b>	<b>Item No.</b>	<b>Ref #</b>	<b>N or E</b>	<b>Balloter's Comment</b>	<b>Committee Resolution</b>	<b>Rationale</b>
Krauser	4	168	N	Provide identification of all component parts of the <u>encapsulation</u> system and provide assembly instructions <del>that will be sent</del> to the field.	<b>Persuasive</b> – revise as follows: <del>Provide</del> identification of all component parts of the <u>encapsulation</u> system and <del>provide</del> assembly instructions shall be provided <del>that will be sent</del> to the field.	
Roberts-Wollmann	4	168	E	Again I don't understand why sometimes the wording is "shall be done" and other times an order is given "do this". Be consistent.	Agree; See Krauser Item 4, Ref. 168 above	
Donnelly	4	173	E	The sections referenced have been renumbered. Change "2.7.6 and 2.7.7" to "2.7.4 through 2.7.7" at two locations.	Agree	
Donnelly	4	173	E	Dash should be slash between "Architect" and "Engineer" end of item.	Agree	
Ahmed	4	173, 179, 185	NV	Change "Architect-Engineer" to "Licensed Design Professional"	No change	See Schaffer Item 2, Ref. 77
Donnelly	4	179	E	Dash should be slash between "Architect" and "Engineer" in first sentence.	Agree	
Schaeffer	4	179	N	Use "licensed design professional" in place of Architect/Engineer. This is consistent with 318.	<b>Negative Withdrawn</b>	
Becker	4	181	N	The addition of "when tested in accordance with 2.7.4" is troubling. 2.7.4 requires a test of the tendon assembly. If the anchorages are only good for 95% fpu, how can 2.7.4 require measurement of the tensile strength and elongation (see also 2.7.6) when the anchorages should theoretically limit the load that can be applied to 95% of fpu? I am not sure how to resolve this, but it seems like a terrible inconsistency that has the potential to not develop even fpu or the 2% elongation under the testing of 2.7.4.	<b>Negative withdrawn</b>	This is the testing procedure that is used to evaluate anchorages.  The voter's statement that anchorages are only good for 95% fpu is incorrect. This is a minimum criterion, which most if not all tested anchorages exceed.  Also, do not understand the perceived inconsistency-- tested anchorages must satisfy both the strength and elongation criteria.
Donnelly	4	182	N	Item should not be entitled "Ductility Test". 2.7.6 discusses how ductility is measured during the test in 2.7.4. Suggest change in title to "Ductility Criteria"	<b>Negative withdrawn based on the following editorial changes:</b>  2.7.6 <del>4</del> — Static test  When required by the Architect-Engineer, static tensile tests of tendons shall be	Editorial

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
					<p>performed. The test assembly, consisting of standard production quality components and tendons, shall be at least 3.5 ft (1.1 m) long between anchorages. The test shall provide determination of the yield stress, tensile strength, and percent elongation of the complete tendon.</p> <p>2.7.4.1— Strength test criteria</p> <p>Anchorage and couplers of unbonded tendons shall develop at least 95% <math>f_{pu}</math> when tested in accordance with 2.7.4</p> <p>2.7.4.2 — Ductility <del>test</del> <u>criteria</u></p> <p>Total elongation under breaking load when tested in accordance with 2.7.4 shall not be less than 2%. Elongation shall be measured in a minimum gauge length of 3 ft (915 mm) between two points at least 3 in. (75 mm) from each anchorage. Tendon couplers shall not reduce elongation at rupture below that required for anchorages.</p> <p>2.7.4.5 — Fatigue test</p> <p><b>[Renumber subsequent sections]</b></p>	
Bondy	4	183	N	<p>Ted's response to my negative vote on this issue in the previous ballot was correct. I have always interpreted this specification to require the 2% elongation <u>at</u> the minimum required strength of <math>0.95f_{pu}</math>. It didn't make sense to me that the strength requirement and the ductility requirement were at different points on the stress/strain curve. The current wording makes it clear, however, that the 2% requirement is at breaking strength, which is presumably greater than <math>0.95f_{pu}</math>. So there are still major problems with this specification.</p> <p>First, since the 2% elongation cannot realistically be achieved at <math>0.95f_{pu}=257\text{ksi}</math>, (where the strain is about 1%), the strength</p>	<p><b>Nonpersuasive</b> – no change</p>	

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				<p>requirement of <math>0.95f_{pu}</math> becomes meaningless since it <b>must</b> be exceeded to develop the 2% elongation (see the typical stress/strain curve below from the PCI Design Handbook.) To satisfy the ductility requirement in <b>2.7.6</b> the strand must break at about 267ksi (<math>0.99f_{pu}</math>) rather than 257ksi, so the minimum strength specification of <math>0.95f_{pu}</math> in <b>2.7.5</b> becomes irrelevant. If a tendon breaks at 262ksi (<math>0.97f_{pu}</math>) with a strain of 1.5% it satisfies the strength requirement but fails the ductility requirement, therefore it does not satisfy the specification and must be rejected. If we are going to stick to the 2% strain requirement we should logically remove the strength requirement. It doesn't make sense to specify a requirement that is less stringent than another adjacent requirement.</p> <p>More importantly, the 2% elongation requirement is simply unnecessary. It has been shown<sup>1</sup> that it is impossible to achieve an unbonded tendon strain greater than 1% in a real concrete structure by applied loading. Further, with a commonly used value for effective stress <math>f_{pe}</math> of 176ksi, the maximum stress <math>f_{ps}</math> permitted by ACI 318 at nominal strength is <math>176+60=236</math>ksi (ACI 318-11 Section <b>18.7.2(b)</b>). At this maximum stress of 236ksi the (elastic) strain is only <math>236/28500=0.83\%</math>. Why do we need a breaking strain of 2% in a testing machine when the maximum strain required by ACI 318 in a real structure, <b>under any circumstances</b>, is less than half that value? Surely, with all the other factors of safety (<math>\phi</math> and load factors) built into the ACI Code we don't need that much of a spread between testing machine capabilities and actual demands in real structures.</p> <p>Footnote 2 recommends and justifies a fully appropriate, realistic value for this strain of 0.9% and I encourage the adoption of this, or a similar value, in this specification. This value is achievable, consistent with the required strength of <math>0.95f_{pu}</math>, and exceeds all physical demands which can be imposed on an unbonded tendon in a real structure. I will withdraw my negative vote if the strain requirement in <b>2.7.6</b> is reduced to 0.9%.</p>		

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				<p style="text-align: center;"><b>MATERIAL PROPERTIES PRESTRESSING STEEL</b></p> <p style="text-align: center;">Design Aid 11.2.5 Typical stress-strain curve, 7-wire low-relaxation prestressing strand</p>  <p style="text-align: center;">These curves can be approximated by the following equations:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">250 ksi</td> <td style="width: 50%; text-align: center;">270 ksi</td> </tr> <tr> <td style="text-align: center;"><math>\epsilon_{ps} \leq 0.0076 : f_{ps} = 28,500 \epsilon_{ps} \text{ (ksi)}</math></td> <td style="text-align: center;"><math>\epsilon_{ps} \leq 0.0086 : f_{ps} = 28,500 \epsilon_{ps} \text{ (ksi)}</math></td> </tr> <tr> <td style="text-align: center;"><math>\epsilon_{ps} &gt; 0.0076 : f_{ps} = 250 - \frac{0.04}{\epsilon_{ps} - 0.0064} \text{ (ksi)}</math></td> <td style="text-align: center;"><math>\epsilon_{ps} &gt; 0.0086 : f_{ps} = 270 - \frac{0.04}{\epsilon_{ps} - 0.007} \text{ (ksi)}</math></td> </tr> </table> <p style="text-align: center;">11-22 PCI Design Handbook/Fifth Edition</p> <p><sup>1</sup>Bondy, K. B., "Realistic Requirements for Unbonded Post-Tensioning Tendons", PCI Journal, <b>Precast/Prestressed Concrete Institute</b>, February 1970, pp. 50-59.</p> <p><sup>2</sup>Bondy, K. B., "Requirements for Strength and Ductility of Unbonded Post-Tensioning Tendons", PTI Journal, <b>Post-Tensioning Institute</b>, February 2008, pp. 61-64.</p>	250 ksi	270 ksi	$\epsilon_{ps} \leq 0.0076 : f_{ps} = 28,500 \epsilon_{ps} \text{ (ksi)}$	$\epsilon_{ps} \leq 0.0086 : f_{ps} = 28,500 \epsilon_{ps} \text{ (ksi)}$	$\epsilon_{ps} > 0.0076 : f_{ps} = 250 - \frac{0.04}{\epsilon_{ps} - 0.0064} \text{ (ksi)}$	$\epsilon_{ps} > 0.0086 : f_{ps} = 270 - \frac{0.04}{\epsilon_{ps} - 0.007} \text{ (ksi)}$		
250 ksi	270 ksi											
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$\epsilon_{ps} > 0.0076 : f_{ps} = 250 - \frac{0.04}{\epsilon_{ps} - 0.0064} \text{ (ksi)}$	$\epsilon_{ps} > 0.0086 : f_{ps} = 270 - \frac{0.04}{\epsilon_{ps} - 0.007} \text{ (ksi)}$											
Xia	4	183	N	Suggest change with the following language to accommodate a long testing frame, or other testing condition which may be	<b>Negative Withdrawn based on committee taking up item as new business</b>	<b>New Business</b>						

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				necessary for the bridge application. "Total elongation under breaking load when tested in accordance with 2.7.4 shall not be less than 2%. The free movement such as wedge seating and wire slippage must be excluded when measured from anchorage to anchorage; Or when measured on the strand, the elongation shall be measured with a minimum gauge length of 3 ft (915 mm) between two points at least 3 in. (75 mm) from each anchorage. Tendon couplers shall not reduce elongation at rupture below that required for anchorages.		
Ahmed	4	185	NV	Consider changing the last sentence as "... the upper stress and back to the lower <a href="#">stress level</a> ."	Sentence has been deleted; see Baxi Item 4 Ref. 185 below	
Baxi	4	185	N	Add: In the second test, the tendon shall be subjected to 50 cycles between 40 and 80% of the $f_{pu}$ <del>or 50 cycles between 40 and 85% of <math>f_{pu}</math> if Section 21.5.2.5 of ACI 318 is applicable.</del> One complete cycle involves change from .....	<b>Persuasive</b> – revise to: When required by the Architect-Engineer, fatigue tests shall be performed on tendon specimens with representative samples from production runs and with a minimum length of 3 ft (1 m) between anchorages. In the first test, the tendon shall be subjected to 500,000 cycles between 60 and 66% of the $f_{pu}$ . In the second test, the tendon shall be subjected to 50 cycles between 40 and <del>80</del> <b>85%</b> of the $f_{pu}$ . One complete cycle involves change from the lower stress level to the upper stress level and back to the lower. <del>The period of each cycle involves change from the lower stress level to the upper stress level and back to the lower.</del>	Current ICC Evaluation Service test procedures which are used to evaluate anchorages use a 50-cycle fatigue test "varying the tension stress level in the tendon between 40 and 85 percent of the strand's minimum specified breaking strength."  The proposed change brings the spec requirement in line with the actual test requirements being used in practice.
Becker	4	185	E	I think the last two sentences say the same thing and one or the other should be deleted.	Agree; see Baxi Item 4, Ref. 185	
Donnelly	4	185	E	Dash should be slash between "Architect" and "Engineer" in first sentence.	Agree	
Donnelly	4	185	E	Delete "the" before "Fpu" at two locations.	Agree	
Donnelly	4	185	E	Last two sentences contain nearly identical language, pretty much duplicating one another. Can we combine? Suggested rewording: "One complete cycle and the period of that cycle involves change from the lower stress level to the upper stress level and back to the lower."	See Baxi Item 4, Ref. 185 above	
Roberts-Wollmann	4	185	E	I prefer "60 to 66% $f_{pu}$ " as opposed to "60 to 66% of the $f_{pu}$ " same comment for "40 and 80% $f_{pu}$ "	Agree; see Baxi Item 4, Ref. 185	
Schaeffer	4	185	N	Use "licensed design professional" in place of Architect/Engineer.	<b>Negative Withdrawn</b>	

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				This is consistent with 318.		
Gupta	4	188	N	This is very confusing. The definition of anchorage is only the device that anchors the PT strand. I think that a more appropriate term here is tendon.  Suggest replacing "Anchorages" by "Tendon"	<b>Nonpersuasive</b> – no change	A complete tendon is not tested in this test.  Present language has not caused any confusion to date with testing agencies doing the test.
Krauser	4	188	N	The anchorage does not care if it is in a horizontal position – this should be removed. "Horizontal position" was already removed from 2.5.2 (item 162).  "Anchorages shall remain watertight when <del>arranged in a horizontal position and tested and</del> subjected to a uniform hydrostatic pressure of no less than that specified in 2.5.2 for a period of 24 hours."	<b>Persuasive – revise to:</b>  Anchorages shall remain watertight when <del>arranged in a horizontal position and tested and</del> subjected to a <del>uniform</del> hydrostatic pressure of no less than that specified in 2.5.2 for a period of 24 hours."	
Donnelly	4	189	E	Add comma after "manufacturer"	Agree	
Donnelly	4	190	E	Change "post-tensioning coating" to "PT coating" in items 1) and 2).	Agree	
Krauser	4	190	E	In 1) and 2) change "post-tensioning coating" to "PT coating."	Agree	
Becker	5	193	N	I will reiterate a previous negative. "Responsibilities for project participants must be defined in the Project Specifications" is an incorrect instruction. No assignments of responsibility should be made in specifications. The specifications are written to the Contractor who has the responsibility to see that all provisions are met. In the first line I would suggest that the substitution of "Contract Documents" for "Project Specifications" is not really correct. The reference should either be in the drawings or specs. Contract Documents would also include contracts and subcontracts which are not appropriate places for the reference.	<b>Negative Withdrawn</b>	Text is straight out of the TCM
Dolan	5	193	N	Use "construction documents"	<b>Negative Withdrawn</b>	
Schaeffer	5	193	N	Use "Construction Documents" – see comment Ref #12	<b>Negative Withdrawn</b>	
Donnelly	5	197	E	Checklist should be singular, as there is only one. Change "checklists identify" to "checklist identifies" in Line 1 and Line 2 (two locations).	No change	Text is straight from TCM
Donnelly	5	199	E	Dash should be slash between "Architect" and "Engineer" in heading.	Agree	
Ahmed	5	199, 202	NV	Change "Architect-Engineer" to "Licensed Design Professional"	<b>No change</b>	See
Krauser	5	200	N	The default is ACI 318 or 350 and encapsulated tendons, therefore anything other than the default should be specified. This item may change to "optional" from "mandatory". Similar to item 212.	<b>Negative withdrawn</b> based on the following editorial change:	Editorial

Name	Item No.	Ref #	N or E	Balloter's Comment	Committee Resolution	Rationale
				"Specify in the Contract Documents whether the tendons are to be used for an application <u>not</u> governed by ACI 318 or ACI 350 <u>and not requiring encapsulated tendons.</u> "	Specify in the Contract Documents <del>whether</del> <u>if</u> the tendons are to be used for an application <u>that is not</u> governed by ACI 318 or ACI 350.  Also, revise Item 5, Ref. 212 to:  <del>2.5.4</del> <u>2.6</u> If application is not governed by ACI 318 or ACI 350, specify in the Contract Documents <u>if</u> <del>whether</del> encapsulated systems are required.	
Donnelly	5	202	E	Add "Architect/" before "Engineer" in heading to be consistent.	Agree	
Donnelly	5	203	E	Section referenced is incorrect due to renumbering. Should be 1.4.1, not 1.5.1.	Agree	
Esselinck	5	203, 205	E	Are #203 and #205 desirable optional requirements checkpoints? I would prefer not to remind the reader that he can opt them out of the contract documents.	Disagree – no change	Not all specifiers want to receive this information
Donnelly	5	204	E	Section referenced is incorrect due to renumbering. Should be 1.4.1.1, not 1.5.1.1.	Agree	
Donnelly	5	205	E	Section referenced is incorrect due to renumbering. Should be 1.4.2, not 1.5.2.	Agree	
Donnelly	5	206	E	Section referenced is incorrect due to renumbering. Should be 1.4.3, not 1.5.3.	Agree	
Donnelly	5	207	E	Section referenced is incorrect due to renumbering. Should be 1.4.4, not 1.5.4.	Agree	
Donnelly	5	208	E	Comment in right-hand column is incorrect, presumably because the section referenced is incorrect due to renumbering (should be 1.4.6, not 1.5.6). Section 1.4.6 regarding jack and gauge calibration still exists.	Agree; undelete section  <u>1.5.4</u> . 6 Specify in Contract Documents if calibration certificates for jacks and gauges are not required to be furnished.	Editorial; checklist item was only deleted because it was thought that related spec section was gone.
Donnelly	5	209	E	Section referenced is incorrect due to renumbering. Should be 1.6.3.3, not 1.7.3.	Agree	
Schaeffer	5	209	N	Use "Construction Documents" – see comment Ref #12	Negative Withdrawn	
Schaeffer	5	210	N	Use "Construction Documents" – see comment Ref #12	Negative Withdrawn	
Schaeffer	5	212	N	Use "Construction Documents" – see comment Ref #12	Negative Withdrawn	
Schaeffer	5	213	N	Use "Construction Documents" – see comment Ref #12	Negative Withdrawn	