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# Committee 544
## Fiber Reinforced Concrete

# Agenda ACI 376-C
## Analysis Sub-Committee Meeting,

Sunday, October 26, 2014, 3 PM - 5 PM

Hilton Washington,
Washington DC

Room: Columbia 10

1. CALL TO ORDER and APPROVAL OF AGENDA
2. INTRODUCTIONS
3. ANNOUNCEMENTS
4. TN on Design and Analysis of the TCP Embedment Zone
   - Resolution of remaining negative votes and comments
5. OTHER BUSINESS / INFORMAL DISCUSSION OF PROJECTS
6. ADJOURNMENT

## Technical Note on TCP (TCP – TN)

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| | Approved Sections |
| | Section Approved with Comments to be resolved |
| | Negative Vote |
| | 2013.04.13 376-C Minneapolis |
| | 2014.02.14 376-Webinar |

**UPDATE NOTES (2013.01.08)**
a) 2013.10.21 Phoenix discussion items are on pg 14 of 15.
b) See the following Ref. no. for NEGATIVES REQUIRING FURTHER DISCUSSION: 1, 18, 32, 37, 41, 44 & 47, 49, 63, 74.
c) Pg. 16 of 16 has Legatos negative that requires further discussion.

**WEBINAR NOTES (2014.02.14) ~ no quorum**
a) Resolved Ref.No. 1, 32, 41, 44 & 47. Ref. No. 63 changed to editorial; RP to propose moving text.
b) Ref. No. 18 and 49 to be discussed further in Reno. Ref. No. 37 and 74 need further discussion – missing notes of resolution.

| Members that Voted | | | Voting Members that did not vote | 2013.04.13 – 376 D Minneapolis | 2014.02.14 – 376 D Webinar |
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| **Voting Members** that voted (79%)<br>1. Hjorteset, Kare<br>2. Brannan, Mike S<br>3. Allen, Junius<br>4. Ballard, Thomas A<br>5. Garrison,Jeffrey<br>6. Hatfield,Alan<br>7. Hoff, George C<br>8. Hoffmann, Richard A | 9. Hoptay,Joseph<br>10. Howe, Thomas R<br>11. Jiang,Dajiu<br>12. Khalifa, Jameel U<br>13. Krstulovic-Opara, Neven<br>14. Legatos, Nicholas A<br>15. Malhotra,Praveen<br>16. Mash,Keith<br>17. Moncarz, Piotr D | 18. Nussmeier, Robert W<br>19. Oliver, William H<br>20. Pawski, Rolf P<br>21. Rushing, William E<br>22. Wu,Sheng-Chi<br><br>**Associate Members**<br>▪ Roetzer, Josef<br>▪ Widianto, Widianto | 23. Hanskat, Charles S<br>24. Douglas,Hamish<br>25. Hashmi, Humayun<br>26. Rajan, Ramanujam S<br>27. Sward,Robert<br>28. Thompson,Eric | Members Attending:<br>1. Brannan, Mike<br>2. Hjorteset, Kare<br>3. Ballard, Thomas<br>4. Garrison. Jeffrey<br>5. Hoff, George<br>6. Hoptay, Joseph<br>7. Howe, Thomas<br>8. Khalifa, Jameel<br>9. Pawski, Rolf<br>10. Hanskat, Charles<br>11. Roetzer, Josef | Participating:<br>1. Allen, Junius<br>2. Brannan, Mike<br>3. Douglas, Hamish<br>4. Garrison. Jeffrey<br>5. Hjorteset, Kare<br>6. Hoptay, Joseph<br>7. Howe, Thomas<br>8. Jiang,Dajiu<br>9. Legatos, Nick<br>10. Krstulovic-Opara, Neven<br>11. Mash, Keith<br>12. Mehta, Sanjay<br>13. Oliver, Billy<br>14. Pawski, Rolf<br>15. Roetzer, Josef<br>16. Vossoughi, Fariborz |

| 1st Ballot Results (Approved w. Comment) | | | | 2nd Ballot Results | | |
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| **Ref No.** | **Text** | **Author** | **Comments** | **2ND BALLOT: RESPONSE being BALLOTED** | **Voting Member's VOTE & COMMENTS** | **Suggested Change** |
| 1 | | Brannan | I am not sure the TCP can be constructed as detailed because it would be impossible to weld both sides of the TCP plate to the embedment plate. It would also be better to radius the sharp corner shown on the TCP plate.<br>Would it be possible to simply lap weld the TCP plate to the embedment plate?<br>Should the embedment zone also extend 2X the wall thickness below the embedment plate? | The comment found partially persuasive. It is not intended that the TN covers TCP construction details. Furthermore, welding requirements should be as per API 620. Address the comment by revising text on page 1 lines 11-14:<br><br>***INTRODUCTION***<br>*ACI 376 provides requirements and some basic recommendations for the design of the Thermal Corner Protection (TCP) embedment zone. The purpose of this Technical Note ~~document~~ is to provide further guidance for ~~on~~ (a) design and analysis of the TCP embedment anchorage ~~detailing~~ and (b) ~~TCP~~ liquid-tightness analysis ~~(i.e., crack width calculations)~~ in the TCP embedment zone (i.e., crack width calculations).* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Humayum, Howe, Wu, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with comment - Hoffman | With Respect to M. Brannan's Comments, it is my opinion this can be welded from both sides, by making this attachment weld first and then going on with the construction. There will be a "fill-in plate that is required to build up the TCP side wall. |

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| | | | | Update title to read:<br>~~*Thermal Corner Protection Design & Crack Analysis*~~<br>*Design and Analysis of the TCP Embedment Zone* | | I have no objection to the proposed changes |
| | | | | | Disagree – Ballard | I believe the embedment zone should extend at least to the bottom of the TCP plate since migration of cracks in this zone would compromise the leak tightness of the detail. |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Agreed and that Tom Ballard to propose wording.<br>From TB email dated 2013.04.15:<br>"*Although the code and this TN do not explicitly define leak tightness criteria for the anchorage and embeddment, the design and construction of these components should be carried out with the clear objective of protecting the corner joint from product temperatures.*" |
| | | | | | | **2014.02.14 Webinar**<br>Ballard wording ok |
| 10 | Page 5 Line 10 | Hoptay | The material selection is temperature dependent and to state that the TCP is 9% Ni infers an LNG tank and not RLG tanks in general. | The comment found persuasive. Change text to read:<br><br>"*Material selection and material requirements used in the design of the ~~9% nickel steel~~ TCP and secondary bottom plates may be performed in accordance with API 620.*" | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Disagree - Douglas | This may still be ambiguous as API 620 does not refer to TCP |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Change last line to read: "… *should be in accordance with API 620*." |

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| 15 | Page 5, line 21, item 10 | Mash | Starting temperatures and conditions should be selected so as to maximise the demand under consideration. For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed. Whereby creating maximum straining across the section. | The comment found persuasive. Add proposed text to line 22:<br><br>***1.2.1 – STEP 1: TCP Load Definition***<br>*Finite element analyses is performed first to determine forces resulting from thermal gradients applied to the TCP, TCP embedment plate and outer concrete wall. Loads should include all loads that the TCP and the embedment will be subjected to including thermal, prestress, creep, concrete shrinkage, internal pressure, hydrostatic pressure and hydrodynamic pressure due to seismic aftershock. Starting temperatures and conditions should be selected so as to maximize the demand under consideration. For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed. Whereby creating maximum straining across the section.* | Agree – Jiang, Moncarz, Khalifa, Rushing, Hoffman, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Legatos, Widianto, Hoptay, Roetzer, Hatfield, Krstulovic | 2013.04.13 – 376-C Minneapolis:<br>To address all comments, replace last three sentences with:<br>*"Initial temperatures and conditions should be selected to obtain the most severe design conditions. For instance the most severe condition for design of the anchors is likely to be a warm wall (summer) with a cold thermal shock to the embedment."* |
| | | | | | Agree with editorial changes - Hoff | *For instance, for the design of the anchors, the critical condition is likely to be a warm wall (summer) and with a cold shocking to the embedment, thereby creating maximum straining across the section.* |
| | | | | | Agree with minor comment - Humayum | last sentence - straining or strain? |
| | | | | | Agree with minor comment - Brannan | consider using "Design" instead of "Starting". |
| | | | | | Agree with editorial changes - Pawski | *Starting temperatures and conditions should be selected so as to maximize the demand under consideration. For instance for ~~the~~ design of ~~the~~ anchors the critical condition is likely to be warm wall (summer) and cold ~~shocking~~ thermal shock to the embed. Whereby creating maximum straining across the section.* |
| | | | | | Agree with editorial changes - Douglas | *Pawski 2013.04.23 – Allen comment below shown incorrectly as Douglas and deleted here.*<br>*Correct comment is:*<br>*"…..... cold shock to the embed which results in the maximum strain across the section "*<br><br>*Douglas additional comment1 at end of Ballot Summary:*<br>*"*1. Page 5, Para 1.2.1 Line 24: Also Comment LE27: What is the advantage of the use of the term "demand" as opposed to load? If a new term is to be introduced then it's use must be defined: When is a load a demand?*"*<br><br>*Pawski 2013.04.23 – this is addressed by 376-C Minneapolis response above.* |
| | | | | | Agree with editorial changes - Allen | *For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed~~. Whereby~~ Thereby creating maximum straining across the section.* |
| | | | | | Agree with changes - Oliver | Agree with suggested grammatical revision:<br><br>*Starting temperatures and conditions should be selected so as to maximize the resulting stresses in the component under consideration. For example for the design of the anchors, the critical condition is likely to be warm wall (summer) and cold shocking to the embed, creating maximum straining across the section.* |

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| | | | | | | Comment: What does demand mean in this context? If not revised, add "demand" to definitions. |
| 18 | Page 5, line 28, item 12 | Mash | Suggest inclusion of the words 'in the absence of a defined leak rate all intermediate levels shall be investigated. In practice this may be achieved by running a number spill levels to so as adequately bound the demands. Typically 5 levels may be used dividing the spill height into 4 equal units. In addition levels in close proximity to the TCP must be investigated. | Agree in principle with comment. Revise as noted and address spill levels in a future edition of the Code.<br>• *"Various spill levels should be considered to determine the most severe effect on the embedment and concrete wall. This should include a spill level~~s~~ located just below the top of the TCP which will place the largest temperature differential between the TCP and the concrete wall. ~~as well as various~~ Also a minimum of three levels should be considered for spill levels above the TCP ~~up to~~, at top of the TCP embedment zone, at mid-height, and full spill height. "* | Agree – Jiang, Moncarz, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Allen, Legatos, Widianto, Roetzer, Hatfield, Brannan, Krstulovic | 2013.04.13 – 376-C Minneapolis:<br>Mash comment non-persuasive.<br>Three is a minimum and does not preclude specifier from requiring or the designer choosing more. |
| | | | | | Agree with suggested change -Khalifa | *This should include a spill level~~s~~ located just below the top of the TCP which will ~~place~~ generate the largest temperature differential between the TCP and the concrete wall.* |
| | | | | | Agree with editorial changes – Hoff, Pawski | *This should include a spill level~~s~~ located just below the top of the TCP ~~which~~ that will place the largest temperature differential between the TCP and the concrete wall ~~Also~~ A minimum of three levels should be considered for spill levels above the TCP ~~up to~~ 1) at top of the TCP embedment zone, 2) at mid-height, and 3) at full spill height.* |
| | | | | | Agree with editorial changes - Douglas | *This should include a spill level~~s~~ located just below the top of the TCP which will ~~place~~ result in the largest temperature differential between the TCP and the concrete wall* |
| | | | | | Agree with editorial changes - Hoptay | *"…at **the** top of the TCP embedment zone, at mid-height, and full spill height"* |
| | | | | | Agree with editorial comment - Oliver | Change "place" to "produce".<br><br>Observation: The proposed text requires four levels, not so far from five. |
| | | | | | Disagree - Mash | Statement of 3 levels does not reflect the significance of the analysis. This is the most important analysis carried out for the outer tank and it is essential that an appropriate amount of levels be considered.<br><br>Suggest that the text is amended to the following:<br><br>*Also a minimum of ~~three~~ five levels should be considered* |
| | | | | | | **2014.02.14 Webinar**<br>Discuss in Reno the issue of safety. Mash insists 5 minimum is a good starting point and contractor must demonstrate they have identified critical condition. |
| | | | | | | **RENO – Sunday 3/23**<br>• *"Sufficent number of ~~Various~~ spill levels should be considered to determine the most severe effect on the embedment and concrete wall. This should* |

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| | | | | | | *include a spill level~~s~~ located just below the top of the TCP which will place the largest temperature differential between the TCP and the concrete wall. ~~as well as various~~ Also a minimum of three levels should be considered for spill levels above the TCP ~~up to~~, at top of the TCP embedment zone, at mid-height, and full spill height.* "<br><br>Ballot: Hoff, Hjorteset, Garrison, Howe, Khalifa, Hoptay, Brannan, Jospeh Ratz., Wu, Pawski<br><br>Widianto |
| 20 | Page 5, line32, item 14 | Mash | Must be achieved through mechanical anchoring! | The comment found persuasive. Revise to read:<br><br>"*The TCP embedment plate should be cast in place and mechanically anchored to the concrete wall ~~or by other suitable means (e.g., ???)~~. Anchor ~~bolts (~~studs~~)~~ should be placed in continuous (circumferential) rows along the concrete wall.*" | Agree – Jiang, Moncarz, Hoff, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Mash, Douglas, Allen, Legatos, Widianto, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with suggested change -Khalifa, Roetzer | Delete second sentence completely as the same is essentially said in the next sentence.<br><br>"*The TCP embedment plate should be cast in place and mechanically anchored to the concrete wall. ~~Anchor studs should be placed in continuous (circumferential) rows along the concrete wall.~~*" |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>After discussion it was agreed delete second sentence as suggested. |
| | | | | | Agree with suggested change -Garrison | Modify last sentence:<br>"Anchor studs should be welded in continuous circumferential rows along the embed plate." |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Withdrawn after discussion on deleting second sentence as per Khalifa, Roetzer, and Hoptay. |
| | | | | | Disagree -Hoptay | Delete second sentence because next sentence covers the same information |

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| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>After discussion it was agreed delete second sentence as suggested. |
| 21 | Page 6, line 1, item 1 | Mash | When? Embedment must be anchored with studs? | The comment found persuasive. Revise to read as noted below. Address questions on spacing and gap size in future:<br>• "~~*When the*~~ *The embedment plate* ~~*is*~~*should be anchored with* ~~*circumferential studs,*~~ *a minimum of two rows of circumferential studs* ~~*should be used to anchor the embedment plate*~~. *The spacing between* ~~*mechanical*~~ *anchor*~~*s*~~ ~~*(*~~*studs*~~*)*~~ *has significant impact on the TCP emebedment performance and thus should be considered in the design.* ~~*should be limited to ensure that the axial, bending and shear stresses in the embedment plate are within the allowable stresses.*~~" | Agree – Jiang, Moncarz, Hoff, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Hatfield, Krstulovic | |
| | | | | | Agree with comments -Pawski | Bullet points 1 & 2 should be combined<br><br>Use "studs" or "bolt studs" consistently |
| | | | | | Agree - Brannan | Note that our Figure 1.1a shows four rows of circumferential studs. Should it show two rows of studs in solid line ink and the other two in shaded or dashed ink to indicate the potential for using more than two rows? |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Agree, annotate sketch to state "2-rows minimum.". |
| | | | | | Agree with editorial changes - Khalifa | Also recommend deleting bolts from first line under section 1.2.3 |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>"Anchors" to be used throughout. Edit TN and replace bolts & studs with "anchors." |
| | | | | | Disagree - Hoptay | Disagree – studs are not always used for consistency suggest the following rewording<br><br>*The embedment plate should be anchored with a minimum of two circumferential rows of anchors. The spacing between anchors has significant impact on the TCP embedment performance and thus should be considered in the design.* |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Persuasive, use proposed wording. |

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| NEW | Page 6 Para 1.2.4 | | This comment inserted by Pawski 2013.04.23 | *Douglas additional comment 2 at end of Ballot Summary:*<br><br>The liquid tightness criteria are specified in Para 2.1, items 1 & 2. Additional tightness criteria on "embedment plates" should not require to be defined by owner. I am not in favour of definitions to be provided by owners. The statement is vague and ultimately provides no guidance.The code is to provide guidance to all, including owners. | Douglas | |
| 28 | Page 7, line ~~1~~ 4, item 1 | Mash | Suggest using nomenclature such as demand as opposed to load. | The comment found persuasive in part. Revise to read.<br><br>*"~~When subjected to~~ During the spill condition~~,~~ the concrete wall will be ~~loaded with~~ subjected to high forces due to mechanical loads and thermal effects ~~and mechanical forces. These forces~~ that will lead to significant wall cracking. ~~During the spill condition, integrity~~ Integrity of the concrete wall must be maintained. As specified in the ACI 376 Code, the wall should remain liquid and substantially vapor tight. More specifically:"* | Agree – Jiang, Moncarz, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with editorial changes - Hoff, Krstulovic | *During the spill condition~~,~~ the concrete wall will be subjected to high forces due to mechanical loads and thermal effects that ~~will~~ can lead to significant wall cracking.* |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Discussed and agree with comment. |
| | | | | | Disagree - Hoptay | Suggest rewording sentence as follows to cover both the transient and steady state condition.<br><br>*The integrity of the concrete wall must be maintained during the entire spill.* |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Withdrawn. |
| 32 | Page 7, line 20, item 6 | Mash | EN only calculates characteristic widths.<br>Historically US codes have cocooned the crack width requirements into the detailing rules, These were based on the Gergely Lutz expressions which used mean widths.<br>Replace 'as per' with 'in accordance with' | The comment found persuasive. Revise page 7 lines 20-21 to read.<br><br>*"3) ACI 376 section 8.1.1.8 - requires that the crack~~s~~ widths should be calculated as characteristic and not mean ~~calculated~~ crack widths. ~~as per EN 1992-1-1."~~* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Ballard, Malhotra, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br><br>Agree with Wu.<br><br>NEW BUSINESS for CODE - JG write the new business item on code change form Q1. |
| | | | | | Disagree - Wu | Suggest that:<br>a) EN 1992-1-1 should stay, as stated in ACI 376 to delete "as characteristic and not mean" |

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| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Persuasive since crack widths calculated by EN 1992-1-1 will be characteristic. Proposed wording to be adopted. |
| | | | | | Disagree - Garrison | b) Committee needs to review the ability of the contractor / designer to meet the requirement of 0.008" max crack width using EN equations for the spill condition (2 cryogenic temperatures). Experience shows that this is a difficult requirement to meet. Instead, perhaps ACI 376 should specify minimum rebar size and spacing within the TCP embedment zone. |
| | | | | | | 2013.04.13 – 376-C Minneapolis:<br>Withdrawn pending future action by main committee. Jeff Garrison to prepare New Business (code change form Q1) proposal to address crack width values and method of calculation. |
| | | | | | Disagree - Mash | By removing the design code there is potential for use of codes that do not generate characteristic levels. In particular Model Code 90 is not prohibited, also Ven der Veen's approach generates mean expectation of crack widths.<br><br>There are some Contractors still purporting to MC90 and reviewer has a concern this will continue if left unchecked. Without guidance the Client is without a Captain and I uninformed.<br><br>Note the NL Analysis is in accordance with EN so there should be no objection to using EN for crack widths. |
| | | | | | | **2014.02.14 Webinar**<br>Mash ok as long as Charcateristic is the basis. Discuss Wu comment in Reno concerning reference to EN 1992-1-1.<br>Webinar consensus was to include reference to EN 1992-1-1 for clarity. |
| 37 | Section 2.2.1<br>Page 8, Line # 2<br>4) Continue analysis until steady state final temperatures are reached | Jiang | Suggest to change to:<br>4) Continue analysis until steady state final temperatures are reached and the temperature distribution is obtained | The comment found persuasive. Revise page 7 lines 20-21 to read.<br><br>4) *"Continue analysis until steady state ~~final temperatures are reached~~ temperature distribution is obtained"* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |

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| | | | | | Disagree - Garrison | Committee needs to define analysis / design requirements. Considering the variability in the possible loading conditions, variability in material properties and variability in modeling techniques it seems that a steady state analysis would be sufficient.<br>2013.04.13 – 376-C Minneapolis:<br>Withdrawn.<br>**2014.02.14 Webinar**<br>?????? |
| 41 | Section 2.2.2<br>Page 8, Line # 8<br>"Apply dead load, prestressing and any other steady state load, iterate to equilibrium" | Jiang | Suggest to change to:<br>"Apply dead, prestressing and any other steady state load" | The comment found persuasive. Revise page 7 lines 20-21 to read.<br>"*To establish initial conditions, ~~a~~Apply dead load, prestressing, normal-operating thermal and any other steady state load, then iterate to equilibrium"* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Disagree - Garrison | Committee needs to define analysis / design requirements. |
| | | | | | Disagree - Garrison | **2014.02.14 Webinar**<br>Mash delete "then iterate to equilibrium" is not losing anything<br>Pg 8 line 11 & 13 delete as suggested. |
| 44 | Page 8, line 10, item 3 | Mash | Determine strains in section, check for Residual Compressive Zone (RCZ), check for max comp stress etc. | The comment found persuasive. Change text to read:<br>**5) "*Beginning with the initial condition defined in step 2, ~~C~~ompute crack widths at time steps ~~times~~ throughout the transient where reinforcing strains are the greatest. ~~and exceed the material yield stress~~ Furthermore, at each time step determine the adequacy of the compression zone."*** | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Disagree - Garrison | Considering the variability in the possible loading conditions, variability in material properties and variability in modeling techniques it seems that a steady state analysis would be sufficient. |
| 47 | Section 2.2.2<br>Page 8, Line # 11<br>5) Computer crack widths at times throughout the transient where reinforcing strains are the greatest and exceed the | Jiang | Suggest to change to:<br>6) Computer crack widths at times throughout the transient where reinforcing strains are the greatest and the stresses exceed the material yield stress | | | **2014.02.14 Webina straw poll**<br>Is Garrison negative persuasive?<br>Yes - 0<br>No - 9<br>Abstain - 1 |

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| | material yield stress | | | | | |
| 49 | Page 8, line 18, item 7 | Mash | What does this mean? | The comment found persuasive. Change Page 8, lines 17-18 to read:<br><br>"*Calculation of cracking and crack widths for the RLG ~~LNG~~ spill condition ~~and/or external fire condition~~ shall be performed using a rational engineering analysis. ~~Both linear~~ Linear or non-linear finite element (FE) analysis should be used as discussed in 2.3.1 and 2.3.2.*"<br><br>2014.02.14 Webinar<br>Mash withdrawn<br>Ballard comment : NKO comment is not relevant & discuss with Ballard in Reno. As written spill condition does not preclude spill + fire as per referenced code. Canadian code. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Malhotra, Garrison, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Disagree - Ballard | CSA Z276 requires that fire and spill be considered concurrently. I believe that this needs to be addressed in this paragraph. |
| | | | | | Disagree - Mash | Rational to one uninformed Engineer could be irrational to informed Engineer. Rational requires defining. |
| | | | | | | **2014.02.14 Webinar straw poll**<br>Mash withdrawn<br>NKO regarding Ballard comment: It is not relevant & discuss with Ballard in Reno. As written spill condition does not preclude spill + fire as per referenced code, Canadian CSA Z276. |
| 63 | Page 9, line 34, item 4 | Mash | Seems out of place in terms of the flow of the document.<br><br>2014.02.14 Webinar<br>Oliver withdraw negative to editorial<br>RP review if moving to another location | The comment found persuasive. Edit text as shown below:<br><br>**"2.3.4 Loading**<br>*The RLG spill case should ……*<br><br>*Nodal temperature transients will typically be computed in a separate heat transfer finite element or finite difference solution. The thermal model used for determining nodal temperatures ~~This thermal model~~ is ~~also~~ a high density model which should include concrete foundation, soil thermal boundary condition, walls, roof and outside or inside ambient temperature boundary conditions. This model should also include the base slab insulation and the thermal corner protection insulation. "* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Disagree - Oliver | This response does not address the basic comment that this whole paragraph doesn't below under "Loading". Suggest moving it to Section 2.3.3 "Mesh Type and Size", or inserting a new section before "Loading" called "Thermal Model". |
| | | | | | | **2014.02.14 Webinar straw poll**<br>Oliver negative withdrawn. Consider editorial. RP to review if another location is more appropriate considering concern. |
| 74 | | Garrison | 1) Code and TN need to define conditions for transient thermal analysis for the spill condition (leak rate).<br><br>2) Why does TN reference withdrawn version of Eurocode 2 (DD ENV 1992-1-1:1992)? Current version is BS EN | The comment found partially persuasive.<br>1) Definition of the spill loading is beyond the scope of the current TN and will thus be addressed in a separate document defining LNG spill conditions. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Malhotra, | |

| 1st Ballot Results (Approved w. Comment) | | | | 2nd Ballot Results | | |
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| **Ref No.** | **Text** | **Author** | **Comments** | **2ND BALLOT: RESPONSE being BALLOTED** | **Voting Member's VOTE & COMMENTS** | **Suggested Change** |
| | | | 1992-1-1:2004. | 2) Update and change the model to the latest 2004 edition of the Eurocode, | Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with comment - Ballard | Garrison was going to forward a copy of EN 1992-1-1:2004 to Ballard for updating the code equations in the TN. |
| | | | | | ???? - Garrison | Agreed, loading and consideration of need for transient analyses needs to be reviewed. |
| | | | | | | **2014.02.14 Webinar** ?????? |

**ADDITIONAL COMMENTS included with the ballots**

| Ref No. | Text | Author | Comments | 2ND BALLOT: RESPONSE being BALLOTED | Voting Member's VOTE & COMMENTS |
|---|---|---|---|---|---|
| | Page 4, line 8; Section 1.1 | Oliver | EDITORIAL: Add "the"<br>*"The primary function of TCP is to protect the already highly…"* | | |
| | Page 6, Lines 28 - 30 | Hoff | Can we provide some guidance to the owner in this section? | 10-21: Hoff comment resolution:<br>~~The crack width requirements in section 6 are provided to for this purpose~~.<br>DELETE 1.2.4 | Hjorteset<br>Wu<br>Biily<br>Brannan<br>Pawski<br>Howe<br>Garrison<br><br>Hoff<br>Hanskat |
| | | Wu | The liquid tightness criteria are specified in Section 2.1, Items 1 & 2. Why do we need additional tightness criteria on "**embedment plates**" to be defined by owner? | | |
| | Page 7, line 8 | Pawski | Referenced section does not match final 376-10<br>*1) ACI 376 section ~~6.3.3~~ 6.3.2"* | | |
| | Page 7, line 14 | Pawski | Referenced section does not match final 376-10<br>*2) ACI 376 section ~~6.3.4~~ 6.3.3"* | | |
| 77 | Page 9, section 2.3.3, lines 19, | Khalifa | Add 'separate' before 'model' for clarity. | | |
| 78 | Page 8, section 2.3.1, line32, 33 | Khalifa | Revise to: Either a proprietary or one of several commercially available FE programs can be used for performing this calculation. | | |
| | Page 9, line 24 | Hoff | Change this sentence to read:<br>*"~~If~~ Liners ~~are considered as structural members, they~~ should be included if they are considered as structural members ~~too~~."* | 10-21-13<br>editorial | |
| | Page 10, line 28 | Pawski | Use "should" in a non-mandatory TN<br>*"Recognized concrete constitutive models ~~shall~~ should be used in the analysis."* | 10-21-13<br>editorial | |
| 79 | Page 10, section 2.4.1, line 30 | Khalifa | Revise to: …account for reduction in tensile stiffness after cracking of concrete including the effects of tension stiffening. | 10-21-13<br>Account for reduction in tensile stiffness after cracking of concrete . | |
| | Page 11, line 7 | Hoff, Widianto | The stress symbols are missing | 10-21-13<br>editorial | |
| | Page 12, lines 10, 11 | Hoff | Change to read:<br>"*~~Since~~ For the RLG spill case, it is critical that cryogenic liquid be prevented from migrating behind the TCP, and conservative assumptions should be used when selecting material properties."* | 10-21-13<br>editorial | |
| | Page 13, Section 2.5 | Wu | The specified Code, EN2 part 1- 4.4.2.4 does not contain the equations for crack width calculation. The crack width calculation is shown in Section 7.3.4 of EN 1992-1-1 (2004 edition). Also, the equations shown here are not the same as the equations shown in EN 1992-1-1 (2004 edition). Please provide clarification. | 10-21-13<br>Modify to address to match code and equations. Same as item 74 | |

**To be addressed as future business:**

| Author | Comments | |
|---|---|---|
| Legatos | Conspicuous by its absence in the TCP-TN write-up is any reference to outer-wall designs that incorporate an impervious, continuous liquid-tight and vapor-tight liner.<br><br>This omission overlooks the crucial role such a liner plays in the formulation of criteria and parameters as they pertain to (a) the serviceability of the outer wall following a spill and/or thermal shock; (b) the specified limits on crack-width, residual wall compression, etc., etc.; and (c) the function, scope and design of the TCP itself.<br><br>Moreover, this omission overlooks the differences between inner-versus-outer, and metallic-versus-non-metallic liners; and the role these differences similarly play in (a) through (c) above.<br><br>If I am not mistaken, the only Code section that fleetingly mentions this subject *with respect to the TCP* is Section 6.3.3. This article provides guidance on what to do if a "leak-tight membrane/liner" is *not* used, but does not say anything about what to do in cases where such a liner *is* in fact used.<br><br>The subject is also covered in 6.3.16.1 1nd 16.3.16.2, but those sections do not relate to the TCP.<br><br>While I have not thoroughly perused the rest of the Code itself to see exactly where else this subject "belongs" and how it should be covered, I believe that TCP-TN coverage might fit in the following sections:<br>Section 1.1 (add a fifth paragraph)<br>Fig. 1.1 (add Fig. 1.1 c)<br>Section 1.2.4<br>Section 2.1 | **2014.02.14 Webinar**<br>Discuss NAL negative in Reno.<br>Note - subsequent to webinar NAL staed he would provide draft wording. |

# RESOLVED VOTES

| 1st Ballot Results (Approved w. Comment) | | | | 2nd Ballot Results | | |
|---|---|---|---|---|---|---|
| **Ref No.** | **Text** | **Author** | **Comments** | **2ND BALLOT: RESPONSE being BALLOTED** | **Voting Member's VOTE & COMMENTS** | **Suggested Change** |
| 8 | Page 5, line 2, item 3 | Mash | Suggest rewording and removing 'substantially' link to definitive acceptance criterion to avoid confusion.<br>Suggest exact acceptance criterion words such as - under the spillage condition the crack widths on the inside face shall be limited to xx, compressive stresses in both the meridional and vertical directions shall be minimum y, max z, | The comment found partially persuasive. Limiting values are covered in the Code (e.g., compressive zone size, crack width limits, etc.) and do not need to be repeated here. Revise text for clarity to read:<br><br>*"The concrete wall above the TCP, directly exposed to spilled product, should remain liquid and substantially vapor tight during the spill condition. This is assured by maintaining a compression zone* ***in the wall exposed to the spill and by*** ~~*and*~~ *limiting the crack width* ~~*cracking*~~ *on the inside face of the wall in* ~~*the vicinity of*~~ *the TCP embedment* ~~*plate*~~ ***zone*** *during a spill."* | Agree – Jiang, Moncarz, Hoff, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Oliver, Pawski, Hatfield, Brannan, Krstulovic<br><br>Agree with editorial changes – Khalifa, Roetzer, Krstulovic | *"The concrete wall above the TCP, directly exposed to spilled product, should remain liquid tight and substantially vapor tight during the spill condition.*<br><br>2013.04.13 – 376-C Minneapolis:<br>Agree with comment. |
| 11 | Page 5, line 4, item 6 | Mash | Assurance is through cracks + compression zones not through cracks alone.<br>Crack width limitation in the vicinity of the embed is to prevent liquid migration behind the TCP area. | No action. Covered in previous response. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 13 | P. 5, Line 15 | Wu | add "seismic Aftershock load". | The comment found persuasive. Change text to read:<br><br>"*The TCP embedment plate should be designed to resist radial and vertical loads and moments resulting from both (a) thermal gradients, as well as (b) mechanical forces that develop during a spill condition including* $SSE_{AFT}$*. The TCP design consists of the following steps:*" | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |

| 1st Ballot Results (Approved w. Comment) | | | | 2nd Ballot Results | | |
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| Ref No. | Text | Author | Comments | 2ND BALLOT: RESPONSE being BALLOTED | Voting Member's VOTE & COMMENTS | Suggested Change |
| 15 | Page 5, line 21, item 10 | Mash | Starting temperatures and conditions should be selected so as to maximise the demand under consideration. For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed. Whereby creating maximum straining across the section. | The comment found persuasive. Add proposed text to line 22:<br><br>***1.2.1 – STEP 1: TCP Load Definition***<br>*Finite element analyses is performed first to determine forces resulting from thermal gradients applied to the TCP, TCP embedment plate and outer concrete wall. Loads should include all loads that the TCP and the embedment will be subjected to including thermal, prestress, creep, concrete shrinkage, internal pressure, hydrostatic pressure and hydrodynamic pressure due to seismic aftershock. Starting temperatures and conditions should be selected so as to maximize the demand under consideration. For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed. Whereby creating maximum straining across the section.* | Agree – Jiang, Moncarz, Khalifa, Rushing, Hoffman, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Legatos, Widianto, Hoptay, Roetzer, Hatfield, Krstulovic | 2013.04.13 – 376-C Minneapolis:<br>To address all comments, replace last three sentences with:<br>*"Initial temperatures and conditions should be selected to obtain the most severe design conditions. For instance the most severe condition for design of the anchors is likely to be a warm wall (summer) with a cold thermal shock to the embedment."* |
| | | | | | Agree with editorial changes - Hoff | *For instance, for the design of the anchors, the critical condition is likely to be a warm wall (summer) and with a cold shocking to the embedment, thereby creating maximum straining across the section.* |
| | | | | | Agree with minor comment - Humayum | last sentence - straining or strain? |
| | | | | | Agree with minor comment - Brannan | consider using "Design" instead of "Starting". |
| | | | | | Agree with editorial changes - Pawski | *Starting temperatures and conditions should be selected so as to maximize the demand under consideration. For instance for ~~the~~ design of ~~the~~ anchors the critical condition is likely to be warm wall (summer) and cold ~~shocking~~ thermal shock to the embed. Whereby creating maximum straining across the section.* |
| | | | | | Agree with editorial changes - Douglas | *Pawski 2013.04.23 – Allen comment below shown incorrectly as Douglas and deleted here.*<br>*Correct comment is:*<br>*"…..... cold shock to the embed which results in the maximum strain across the section "*<br><br>*Douglas additional comment1 at end of Ballot Summary:*<br>*"*1. Page 5, Para 1.2.1 Line 24: Also Comment LE27: What is the advantage of the use of the term "demand" as opposed to load? If a new term is to be introduced then it's use must be defined: When is a load a demand?*"*<br><br>*Pawski 2013.04.23 – this is addressed by 376-C Minneapolis response above.* |
| | | | | | Agree with editorial changes - Allen | *For instance for the design of the anchors the critical condition is likely to be warm wall (summer) and cold shocking to the embed~~. Whereby~~ Thereby creating maximum straining across the section.* |
| | | | | | Agree with changes - Oliver | Agree with suggested grammatical revision:<br><br>*Starting temperatures and conditions should be selected so as to maximize the resulting stresses in the component under consideration. For example for the design of the anchors, the critical condition is likely to be warm wall (summer) and cold shocking to the embed, creating maximum straining across the section.* |

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| | | | | | | Comment: What does demand mean in this context? If not revised, add "demand" to definitions. |
| 16 | P. 5, Line 22, at the end of the paragraph | Wu | Add "and hydrodynamic pressure due to seismic aftershock". | The comment found persuasive. Change text to read:<br>• *"Finite element analyses is performed first to determine forces resulting from thermal gradients applied to the TCP, TCP embedment plate and outer concrete wall. Loads should include all loads that the TCP and the embedment will be subjected to including thermal, prestress, creep, concrete shrinkage, internal pressure, hydrostatic pressure and hydrodynamic pressure due to seismic aftershock ($SSE_{AFT}$)."* | Agree – Jiang, Moncarz, Hoff, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Allen, Legatos, Widianto, Hoptay, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with editorial change – Khalifa, Douglas, Roetzer, Krstulovic | *"Finite element analyses ~~is~~ are performed first to determine forces resulting from thermal gradients applied to the TCP, TCP embedment plate and outer concrete wall.* |
| 26 | Page 6, line 19, item 4 | Mash | Nothing mentioned regarding detailing?<br>Suggest inclusion of words such as.<br>Ideally crack control is best achieved through the introduction of smaller bars at closer spacings as opposed to larger bars at wider spacings. In this regard it is suggested that the bar spacing be selected so as to enable the subsequent introduction of lacer bars to the system. Therefore adoption of bar spacings of between 150 and 200mm is recommended in the vicinity of the TCP whereby allowing additional bars top be slotted in. Anchor spacings should be selected to as to be multiples of the bar spacing to enable a clash free design. | The comment found non-persuasive regarding suggested inclusion of bar detailing because this is normal everyday concrete detailing.<br><br>Add the following after line 7 on page 6.<br>• *"Anchor spacings should be selected to as to be multiples of the bar spacing to enable a clash free design. "*<br><br>Delete lines 6 and 7 on page 6.<br>• ~~*"Allowable stresses i.e., material selection and material requirements used in the design of the embedment plates, may be selected in accordance with API 620."*~~ | Agree – Jiang, Moncarz, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Hoff, Hoptay, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 34 | Section 2.2.1<br>Page 7, Line # 31<br>1) Modeling | Jiang | Suggest to change to:<br>1) Modeling including modeling geometry and material thermal properties | The comment found persuasive. Revise page 7 lines 20-21 to read.<br><br>*1) "Modeling including specific tank geometry and material thermal properties"* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 50 | Section 2.3.1<br>Page 8, Lines # 21 to 23<br>"In this case a non-linear finite element program is used in conjunction with<br>• Non-linear FE | Jiang | Suggest to change to:<br>"In this case a non-linear finite element program is used by:<br>• Implementing the non-linear material constitutive relationship for concrete and steel<br>• Carrying out FE analysis to obtain stress | The comment found persuasive. Change text to read:<br><br>*"In this case, a non-linear finite element program is used ~~in conjunction with~~ by:*<br>• ~~*Non-linear FE material constitutive models*~~ *Implementing the non-linear material constitutive relationship for concrete and steel* ~~*and*~~ | Agree – Jiang, Moncarz, Hoff, Rushing, Hoffman, Humayum, Howe, Wu, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Hoptay, | |

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| | material constitutive models for concrete and steel, and<br>• Crack width calculations as per E | | counters, and<br>• Performing FE analysis post process to calculate crack width as per Eurocode 2 1992-1-1 | • *Carrying out FE analysis to obtain stress/strain contours, and*<br>• *Performing FE analysis post-process to calculate characteristic crack width, ~~calculations~~ following a method, such as ~~as per~~ Eurocode 2 EN 1992-1-1 (see section 2.5 in this TN).”* | Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| | | | | | Agree with minor changes - Khalifa | *Performing ~~FE analysis~~ post-processing to calculate characteristic crack width, following a method, such as Eurocode 2 EN 1992-1-1 (see section 2.5 in this TN).”* |
| | | | | | Agree with minor changes - Ballard | Change word “contours” to “distribution” or change sentence to “Carrying out FE analysis to obtain stresses and strains.” |
| | | | | | Agree with changes - Widianto | To be consistent with Sections 2.3.1 and 2.3.2, suggest the sentence is re-worded as follows:<br><br>"*Non-linear or simplified finite element (FE) analysis should be used as discussed in 2.3.1 and 2.3.2*"<br><br>To be consistent with the last sentence in Section 2.3, I suggest that we switch the order between the current Sections 2.3.1 and 2.3.2 (i.e., present Simplified FE analysis in Section 2.3.1 and present non-linear FE analysis in Section 2.3.2.<br>This will also be consistent with the progression of the actual design, where Simplified FE analysis is done in the preliminary design, before non-linear FE analysis. |
| 53 | Section 2.3.2<br>Page 9, Lines # 2 & 3<br>“However, it should be noted that this is a very time consuming process and is thus usually used in the preliminary design.” | Jiang | Suggest to change to:<br>“However, it should be noted that this is a very time consuming process and is thus usually used for focusing on more critical load cases after a preliminary screen for load cases has been performed in the preliminary design.” | The comment found persuasive. Remove the whole sentence.<br><br>“~~*However, it should be noted that this is a very time consuming process and is thus usually used for focusing on more critical load cases after a preliminary screen for load cases has been performed in the preliminary design*~~.” | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |

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| Ref No. | Text | Author | Comments | 2ND BALLOT: RESPONSE being BALLOTED | Voting Member's VOTE & COMMENTS | Suggested Change |
| 56 | Section 2.3.2<br>Page 9, Lines # 4 & 5<br>"Moment-Curvature Approach: The moment curvature response is obtained using a concrete section analysis program in conjunction with:" | Jiang | Suggest to change to:<br>"Moment-Curvature Approach: The moment curvature response is obtained using a concrete section analysis program by implementing:"<br><br>Comment:<br>Weather should this approach be considered as "Linear Analysis" or "Non-linear Analysis"? May be this approach could be considered as a simplified non-linear analysis approach and should be used for preliminary only. | The comment found persuasive. Change text to read:<br><br>***"2.3.2 Simplified ~~Linear~~ FE Analysis***<br>*Simplified ~~Linear~~ FE analysis is usually used only in the preliminary design.*<br>……<br>*"**Moment-Curvature Approach**: The moment curvature properties are ~~response is~~ obtained using a concrete section analysis ~~program~~ by implementing:"*<br>• *non-linear stress-strain material properties, and*<br>• *a non-linear shell formulation that accounts for the cracking induced stiffness redistribution.*<br>• ~~*This moment-curvature approach would only be suitable for consideration of the steady-state linear thermal gradient case and should also be used only for preliminary design*~~*."* | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 66 A | Page 10 Line 10 | Hoptay | On the code side of ACI 376 ASTM A706 is not referred to as low temperature reinforcing, only in the commentary. Can it be referred to as low temperature reinforcing in the technical note? | The comment found persuasive. Change text to read:<br><br>*"The concrete wall internal temperatures from the thermal model are also typically used for selection and ~~to determine the~~ placement of ~~normal (A615), cold-temperature (A706) and cryogenic~~ reinforcing complying with the requirements of ACI 376."*<br><br>Furthermore, in a future Coed revision, revisit the use of A706 materials in ACI 376 section 4.7.2. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 75 | Appendix A<br>Pages 15-16 | Pawski | It is redundant because it repeats paragraphs 2 through 4 in section 2.1<br>(page 7, lines 9-21) | The comment found non-persuasive. The comment found to be an editorial comment. Appendix A is a "copy" of what is in the Code. It is provided for reader's convenience. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, Hatfield, Brannan, Krstulovic | |
| 76 | Page 16, last paragraph in section R8.1.1.7 | Thompson | Remove the last sentence from the Code Commentary:<br>"~~*Due to the non-homogeneous nature of concrete, calculated crack width values measured in the field will vary from calculated values, and therefore they cannot be directly compared to calculated crack widths."*~~ | Section R8.1.1.7 is text copied over from the Code and provided herein for the user's benefit. Text must remain as-is to properly reflect the Code requirement. Changes to be addressed only if/once the Code has been changed accordingly. | Agree – Jiang, Moncarz, Hoff, Khalifa, Rushing, Hoffman, Humayum, Howe, Wu, Ballard, Malhotra, Garrison, Mash, Douglas, Allen, Legatos, Widianto, Hoptay, Roetzer, Oliver, Pawski, | |

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| | | | | | Hatfield, Brannan, Krstulovic | |