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Meeting Agenda

ACI 117 - Tolerances

Sheraton Hotel Denver , CO / Director's Row I

November 10, 2015 / 8:30AM – 11:30AM

Committee Mission: Collect, coordinate, and report information on the tolerances for concrete construction through liaison with other ACI committees.

Chair: Eric Peterson

Secretary: Scott Anderson

1. Administrative [5 min]

Welcome from the Chair, Introductions of Members and Guests, and complete the sign-in sheet.

1.1. Approval of the Spring 2015 Convention meeting minutes.

The Spring 2015 minutes were posted to the online committee site.

1.2. Intervening actions since last meeting.

Review committee make-up and questionnaire e-mailed.

1.3. Staff ANSI research regarding Committee 117 User/Producer/General Interest definitions

2. Strategic Planning and Discussion [10 min]

2.1 Revisit strategy for producing ACI 117-XX

2.2 Develop list of goals for new document

2.3 Volunteers base upon expertise (e.g. Allen Face; William Phelan, etc.)

3. Subcommittee Group Reports [5 min ea.]

4. Old Business [30 minutes]

4.1. Reapproved and publication status of ACI-117-10

4.2. Joint Committee 117 & 435 Session – Deflections and Construction Tolerances: The Good, The Bad and The Ugly – Governor's Square 15, Wednesday, 11:00 to 1:00.

4.3. Wire mesh placement tolerance listed in Draft ACI 301

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5. New Business [10 min.]

5.1. ADA Question from Bill Klorman

5.2. Proposed Chapter 5 – See Exhibit 1

6. Adjournment

The next meeting will be on Tuesday April 19, 2016 at the Hyatt in Milwaukee, WI.

Exhibits

Exhibit 1 Spring 2015 Meeting Minutes

Exhibit 2 Proposed Chapter 5, Floor Tolerances

Exhibit 3 Question from Mr. Klorman

ACI 117 Meeting Minutes
TUESDAY, April 14th 2015

Kansas City Convention Center
8:30AM – 11:30AM

Attendees (39 total):

Voting Members (17/30 = 57%): Eldon Tipping (TAC), Eric Peterson (Chair), Scott M. Anderson (Secretary), Michael Ahern, Scott Anderson (Keystone), Karl Bakke, Bryan Birdwell, David Buzzelli, Allen Face, Michael Hernandez, Mark Josten, Michael Lee, Peter Ruttura, Mike Schneider, Bruce Suprenant, Brett Szabo, Scott Winkler

Associate / Consulting Members (4): Larry Campbell, Dennis Fontenot, Jum Horst, J. Scott Hosking

Visitors (18): Matt Senecal (Staff), Jeff Cochrane, Chris Forster, Pete Fosnough, Bev Garnett, Heston Hamilton, Kris Hughes, Bob Irwin, Larry Karlson, Lloyd Keller, Lee Knox, Ben Larsen, Sean Lynch, Patrick McCarvey, Kristen Roberts, John Turner, Greg Wagner, Stacia Van Zetten

General:
Old Business:
- New Business:

1) General:

a) Chair Peterson called the meeting to order at 8:30AM.
b) Introductions within the room were held.
c) Chair Peterson noted that the committee has 30 voting members and 30 associate members and that the committee membership is fairly balanced, at 50% contractors, 33% engineers-architects and 17% general interest
d) It was noted that a quorum is present.
e) Chair Peterson asked the committee to confirm that the October, 28th, 2014, meeting minutes were received and if there were any questions or comments.
f) The meeting minutes were approved unanimously.

2) Old Business:

a) It was noted that TAC has approved the re-approval of ACI 117-10
b) TAC Liaison Eldon Tipping noted that the re-approval of ACI 117-10 is recorded in the TAC meeting notes for the Spring '15 Convention.
c) Our main committee business is the next revision of ACI 117-XX
   1. Chair Peterson noted that the task group for the revision of ACI 117-XX is being led by a writing task group of Bruce Suprenant, Eldon Tipping, and Chair Peterson.
   2. He noted that we are struggling to gain momentum at the sub-committee level.
   3. The sub-committees were reminded that we do not create tolerances, we collect and report tolerances for other sources within ACI or recognized Industry Associations.
   4. Sub-committees were encouraged to focus on completing three specific objectives:
      - Identify current issues with their section.

- Compile a list of existing or needed tolerances to be included
- Complete their list of necessary graphics using ITG-7-09 as a guide

5. Chair Peterson reminded the task group leaders to use ITG-7 as the model when considering graphics needed for ACI 117-XX
6. Chair Peterson has uploaded many historical source documents to the Committee web page under the "Work Folders" section in the New Business Section
7. Section 2 Subcommittee, Chair Dennis Hunter could not be present. Dennis provided an email update stating CRSI, has balloted the measuring points document and are working on cleaning up a few things as it pertains to bend tolerances. Dennis also stated that their Subcommittee should be able to give a good update in Denver Chair Peterson noted that Section 2 covers materials other than rebar, such as batching tolerances, and measurement tolerances for fresh concrete properties, which are referenced, and also need to be verified. He stated that some of this Subcommittee's membership should have expertise in these areas because there are some concrete tolerances may need to be added or updated in this Section.
8. Section 3 Subcommittee update was presented by Peter Ruttura. The Committee discussed a number of issues raised as questions from the Subcommittee Chair regarding Section 3 tolerances and figures.
9. Section 4 Subcommittee update by Brett Szabo.
10. Section 5 Subcommittee issued an update to the Chair through Mike West. They have provided their historical / source documents, namely the PCI Design Handbook, and the PCI MNL-135 Tolerances for Precast and Prestressed Concrete Construction.
11. Section 7, 13 Subcommittee issued an update to the Chair through Ron Eldridge. They have provided a list of tolerances to be updated.
12. Section 8 Subcommittee update provided by Mike Hernandez.
    - It was noted that we are having difficult time documenting where the tolerances in this section originated. A discussion also took place regarding whether or not it is still relevant to keep tolerances in the 117 Specification for Heavy Structures such as Dams. Mike noted that he had researched information provided by the Bureau of Reclamation and was also researching specifications produced by the U.S. Army Corps of Engineers to see what tolerances are used for these structures. Bruce Suprenant stated that he had sent several communications to Committee 347, where these tolerances originated, asking about their present relevance, and if they are ever referenced anymore, and has not yet received a specific response. There was also a discussion between Chair Peterson and TAC Representative Tipping regarding how to obtain guidance from TAC as to whether or not this Section could be or should be eliminated from the Guide, and how this should be pursued. TAC Representative Tipping stated that if the Committee determines that this section and any other sections (principally Sections 8, 9 and 10) which are no longer referenced within Industry should be eliminated from the Standard, that they should ballot their removal. At this point (a successful ballot to remove these Sections), TAC would take the matter under consideration.

13. Section 9 Subcommittee led by Ron Eldridge has not reported any progress. Michael Hernandez indicated that he would check in his conversations with the Army Corps to see what they are using.
14. Section 10 Allen Face noted he took this section because nobody else wanted it. Allen has not found any reference to water conveyance or canal linings in current ACI documents. Bruce Suprenant confirmed that these tolerances originated with ACI 347-78, but that the current ACI 347 is not interested in generating or validating these tolerances.
15. Section 12 Subcommittee update was provided by Brett Szabo on behalf of leader Bryan Birdwell. They are using the tolerances provided by Chapter 4 as a guide to create the basis for expanding the content of this section. Chair Peterson noted that the Committee has received a number of questions through ACI Staff regarding the interpretation of tolerance requirements for slip dowels provided in this Section. It was also noted that there did not appear to be a basis for several changes in tolerances which were made in the 117-10 Specification regarding these. Additionally, Chair Peterson let this Subcommittee know that a number of studies on tolerances for slip dowels have been published including ones by the Federal Highway Works Association, the National Concrete Pavement Technology Center and the Federal Highway Administration. Chair Peterson also noted that the new Specification (117) should include tolerances for diamond plates which are now in common use in pavements and slabs.
16. Section 14 updated provided through Chair Peterson by Ron Eldridge is that based upon feedback from the market, and Committee 346, no changes to this section are necessary.
17. Section 15 Subcommittee update provided by David Buzzelli. The update is that TCA is publishing new tolerance standard this May which we would then be able to use as a basis moving forward.
18. The written task group reports & ongoing work products are being archived in the task group folders on the ACI 117 committee website.
19. The question was asked: "What do we do with tolerances in the existing document that cannot be traced as to their origin or verified by a current ACI committee or other industry association?" The advice from TAC liaison Tipping was to decide at the time of balloting if the committee would like to justify deleting a section or any specific tolerances because the origin or basis of the tolerance cannot be verified.
20. Chair Peterson indicated that he would schedule another web meeting for the task group leaders within about a month to continue our progress.
21. The goal for Denver meeting is to have at last three sections ready for the writing group to start writing in the updated format.

3) New Business:

a) Chair Peterson played a Leica promotional video of laser scanning for evaluating Ff & Fl tolerance compliance.

   1. An invitation has been extended to a representative from Leica to participate in the ACI 117 committee moving forward.

2. The goal is to better understand the possibilities for use of scanning to eliminate the "single point" of analysis for acceptance or rejection of an element.

b) Chair Peterson shared with the committee the performance evaluation system he has used to measure quality as an example of a program that eliminates the single point of evaluation.

c) Allen Face agreed that the program presented by Chair Peterson represents a pattern of data collection that with two additional calculations could be the advancement that could be used to convert to a true statistical basis for tolerance evaluation.

d) Allen face continued to offer that data collection has always been the limiting factor and that barrier is breaking down as the scanning equipment becomes more accurate and affordable.

e) Abstracts are currently being submitted for the Joint Session, on tolerances and deflections, which is being sponsored by Committees 435 and 117, for the Fall, 2015 Convention in Denver.

f) The floor was opened up for additional new business from the committee:

1. John Turner of CRSI announced that ACI 301 will be establishing tolerances for welded wire fabric.
2. We are coordinating with ACI 301 Chair Jim Cornell to see if they have any comments to the current ACI 117 tolerances.
3. ACI Staff member Matt Senecal was present to support the committee which is greatly appreciated by the Committee.
4. Chair Peterson suggested that support from ACI staff would be useful in coordinating stair tolerances with ICC and issues in conflict between the NFPA life safety code and the IBC, and a historically inconsistently applied tolerance.
5. Bruce Suprenant offered that ACI 216 is referenced in the IBC relating to fire resistance in concrete assemblies. There is some discussion over coordinating either UL ratings or other fire life safety fire resistance requirements with ACI 216 from a tolerance perspective.

4) **Adjournment —** Meeting was adjourned at approximately 11:40AM.

5) **Next meeting is Tuesday, November 10, 2015 at the Sheraton in Denver, CO!**

NOTE: Add following to Section **1.3-Definitions**:

Defined Traffic Floor – a floor intended to support the operation of mechanically and/or electrically guided lift trucks and their associated storage racks.

…

Elevation – measured parallel to gravity, the distance between a horizontal reference plane and the horizontal plane passing through the point of interest.

Elevation Error – measured parallel to gravity, the distance between the horizontal planes passing through the actual and the intended locations of a point.

…

Minimum Local Floor Section – a sub-division of the random traffic floor bounded either by the column and half-column lines, or by the construction and control joints, whichever sub-division yields the smaller area.

…

Random Traffic Floor – any floor that is not a Defined Traffic Floor.

…

Specified Overall Area – the entire project random traffic floor area specified to conform to a particular surface profile flatness/levelness classification.

…

NOTE: Renumber the current **Section 5** as "Section 6", the current **Section 6** as "Section 7, etc. and insert the following new **Section 5**:

SECTION 5 – SLABS AND SLAB BASES

5.1 — Deviation from elevation

5.1.1 Slab bases

5.1.1.1 *Below suspended slabs*

Average of all elevation samples ……..……….…………………….....………………… ___“ (___mm)

Standard deviation of all elevation samples …....………………..……..………..…..….. ___“ (___mm)

Maximum deviation at any location…...…………………..…….. -___“ (-___mm) / +___“ (+___mm)

5.1.1.2 *Below slabs-on-ground*

Average of all elevation samples ……………………….…..…..………....……...……… ___“ (___mm)

Standard deviation of all elevation samples …....………………...………..… ……….. ___“ (___mm)

Maximum deviation at any location…...…………………..…….. -___“ (-___mm) / +___“ (+___mm)

5.1.1.3 *Slab base elevation sampling*

5.1.1.3.1 Samples may be collected using any instrument capable of measuring point elevations to within ±___” (___mm).

5.1.1.3.2 Randomly locate all samples.

5.1.1.3.3 Collect not less than thirty (30) samples, regardless of the base area tested.

5.1.2 *Slab surfaces*

5.1.2.1 *Suspended slabs*

5.1.2.1.1 *Formed suspended slabs, before removal of supporting shores*

Average of all elevation samples …………………….………………………………… ___" (___mm)

Standard deviation of all elevation samples …...……………….…………………..….. ___" (___mm)

Maximum deviation at any location…...…………………..…….. -___" (-___mm) / +___" (+___mm)

5.1.2.1.2 Formed suspended slabs, after removal of any supporting shores ………… no requirement

5.1.2.1.3 Slabs on structural steel or precast concrete ………………………….…………. no requirement

5.1.2.2 *Slabs-on-ground*

Average of all elevation samples ………………………..…..……………………..…. ___" (___mm)

Standard deviation of all elevation samples …...………………..…………………….. ___" (___mm)

Maximum deviation at any location…...…………………..…….. -___" (-___mm) / +___" (+___mm)

5.1.2.3 *Slab surface elevation sampling*

5.1.2.3.1 Samples may be collected using any means capable of measuring point elevations to within ±___" (___mm).

5.1.2.3.2 Randomly locate all samples.

5.1.2.3.3 Collect not less than thirty (30) samples, regardless of the slab area tested.

5.2 — Local deviation from intended plane

5.2.1 Specify defined traffic floor profile flatness/levelness tolerances using the Fmin defined traffic floor profile numbering system.

5.2.1.1 The lift truck wheel tracks within each storage aisle shall conform to the highest **Fmin** number required by the lift truck manufacturer for the specific equipment to be used.

5.2.1.1.1 Over any 24" (600 mm) length of wheel track, the absolute difference between any two successive point elevation differences measured over 12" (300 mm) shall not exceed

3.24 ÷ **Fmin** (inches per foot)

or

$$80.1 \div \mathbf{Fmin} \quad \text{(mm per 300 mm)}$$

5.2.1.1.2 At any location along the length of the aisle, the absolute elevation difference between corresponding points on the outermost wheel tracks shall not exceed

$$\{ 1.3 \cdot [\mathbf{L} + 2.7]^{0.5} - 1.9 \} \div \mathbf{Fmin} \quad \text{(inches)}$$

or

$$\{ 6.55 \cdot [\mathbf{L} + 68.58]^{0.5} - 48.26 \} \div \mathbf{Fmin} \quad \text{(mm)}$$

where **L** is the distance in inches (mm) between the lift truck's outermost wheel tracks.

5.2.1.1.3 If the lift truck incorporates dual drive wheels, then at any location along the length of the aisle, the absolute elevation difference between corresponding points on the innermost wheel tracks shall not exceed

$$\{ 1.3 \cdot [\mathbf{D} + 2.7]^{0.5} - 1.9 \} \div \mathbf{Fmin} \quad \text{inches}$$

or

$$\{ 6.55 \cdot [\mathbf{D} + 68.58]^{0.5} - 48.26 \} \div \mathbf{Fmin} \quad \text{(mm)}$$

where **D** is the distance in inches (mm) between the lift truck's innermost wheel tracks.

5.2.1.1.4 If the truck incorporates dual drive wheels, then at any location along the length of the aisle, the absolute difference between the average elevation of the outermost wheel tracks at that location and the average elevation of the innermost wheel tracks at a distance **B** inches (mm) in either direction from that location shall not exceed

$$\mathbf{B} \cdot \{ 1.3 [\mathbf{B} + 2.7]^{0.5} - 1.9 \} \div \{ \mathbf{L} \cdot \mathbf{Fmin} \} \quad \text{inches}$$

or

$$\mathbf{B} \cdot \{ 6.55 [\mathbf{B} + 68.58]^{0.5} - 48.26 \} \div \{ \mathbf{L} \cdot \mathbf{Fmin} \} \quad \text{mm}$$

where **B** is the distance in inches (mm) between the lift truck's load and drive axles, and **L** is the distance in inches (mm) between the lift truck's outermost wheel tracks.

5.2.1.1.5 If the truck incorporates a tricycle wheel arrangement, then at any location along the length of the aisle, the absolute difference between the average elevation of the outermost wheel tracks at that location and the elevation of the center wheel track at a distance **B** inches (mm) in either direction from that location shall not exceed

$$\mathbf{B} \cdot \{ 1.3 [\mathbf{B} + 2.7]^{0.5} - 1.9 \} \div \{ \mathbf{L} \cdot \mathbf{Fmin} \} \quad \text{inches}$$

or

$$\mathbf{B} \cdot \{ 6.55 [\mathbf{B} + 68.58]^{0.5} - 48.26 \} \div \{ \mathbf{L} \cdot \mathbf{Fmin} \} \quad \text{mm}$$

where **B** is the distance in inches (mm) between the lift truck's load and drive axles, and **L** is the distance in inches (mm) between the lift truck's outermost wheel tracks.

5.2.1.2 Test relative compliance with Fmin tolerances using an apparatus capable of measuring a series of discreet wheel track point elevations on not greater than 6-inch (150 mm) centers to an accuracy not worse than ± 0.003" (0.076 mm).

5.2.1.2.1 Test compliance with Fmin tolerances on each new defined traffic slab placement within 8 hours following completion of the final troweling operation.

5.2.1.2.2 Report relative compliance with Fmin tolerances for each new defined traffic slab placement within 12 hours following completion of the final troweling operation.

5.2.1.2.3 Ignore Sundays and holidays when computing Fmin testing and reporting deadlines.

5.2.1.3 Correct all wheel track locations that do not comply with all of the Fmin requirements set forth in Sections 5.1.1.1 through 5.1.1.5.

5.2.1.3.1 Correct Fmin wheel track defects only by grinding. Filling of low spots shall not be permitted.

5.2.1.3.2 Re-measure all corrected wheel track locations for compliance with all Fmin tolerances within 4 hours following completion of corrective grinding.

5.2.1.3.3 Report compliance of all corrected wheel track locations with all Fmin tolerances within 8 hours following completion of corrective grinding.

5.2.1.3.4 Iterate corrective grinding, re-testing, and re-reporting of defective wheel track locations until full compliance with all specified Fmin tolerances is achieved.

5.2.1.3.5 Ignore Sundays and holidays when computing the Fmin re-testing and re-reporting deadlines.

5.2.1.4 Within two (2) weeks following the successful completion of all corrective grinding operations, the Fmin testing agency shall issue a final report certifying the full compliance of all wheel tracks on the defined traffic floor with the specified Fmin number.

5.2.2 Specify random traffic floor profile flatness/levelness tolerances using the FF/FL random traffic floor profile numbering system.

5.2.2.1 Divide the project's entire random traffic slab-on-ground floor area into distinct specified overall on-ground F-Number areas.

5.2.2.1.1 Each distinct specified overall on-ground F-Number area shall comprise the entire slab-on-ground random traffic floor area that is specified to conform to a particular SG floor profile code.

5.2.2.1.2 A specified overall on-ground F-Number area may comprise any number of individual slab-on-ground placements.

5.2.2.1.3 No individual slab-on-ground placement may be associated with more than one specified overall on-ground F-Number area.

5.2.2.1.4 The contract documents shall require that each specified overall on-ground F-Number area conform to a different SG random traffic floor profile flatness/levelness classification code given in Table 5.2.2.1.4.

Table 5.2.2.1.4 - Random Traffic Floor Profile Codes for Slabs-on-Ground					
Floor Profile Code	Relative Profile Quality	Specified Overall Flatness (SOFF)	Specified Overall Levelness (SOFL)	Minimum Local Flatness (MLFF)	Minimum Local Levelness (MLFL)
SG-0	Minimum	20	12	12	7
SG-1	Ordinary	25	15	15	9
SG-2	Average	35	21	21	13
SG-3	Good	45	27	27	16
SG-4	Very Good	60	36	36	22
SG-5	High	75	45	45	27
SG-6	Very high	100	60	60	36
SG-7	Extremely High	150	90	90	54

5.2.2.1.4.1 The SOFL and MLFL values shown in Table 5.2.2.1.4 shall not apply to slabs-on-ground that are intended to be inclined.

5.2.2.1.4.2 The SOFL and MLFL values shown in Table 5.2.2.1.4 shall not apply to slabs-on-ground that are intended to be cambered.

5.2.2.2 Divide the project's entire random traffic shored elevated floor area into distinct specified overall shored elevated F-Number areas.

5.2.2.2.1 Each distinct specified overall shored elevated F-Number area shall comprise the entire shored elevated random traffic floor area that is required to conform to a particular ES floor profile code.

5.2.2.2.2 A specified overall shored elevated F-Number area may comprise any number of individual shored elevated slab placements on any number of building levels.

5.2.2.2.3 No individual shored elevated slab placement may be associated with more than one specified overall shored elevated F-Number area.

5.2.2.2.4 The contract documents shall require that each specified overall shored elevated F-Number area conform to a different ES random traffic floor profile flatness/levelness classification code given in Table 5.2.2.2.4.

Table 5.2.2.2.4 - Random Traffic Floor Profile Codes for Shored Elevated Slabs

Floor Profile Code	Relative Profile Quality	Specified Overall Flatness (SOFF)	Specified Overall Levelness (SOFL)	Minimum Local Flatness (MLFF)	Minimum Local Levelness (MLFL)
ES-0	Minimum	15	9	9	5
ES-1	Ordinary	20	12	12	7
ES-2	Average	25	15	15	9
ES-3	Good	30	18	18	11
ES-4	Very Good	35	21	21	13
ES-5	High	45	27	27	16
ES-6	Very high	60	36	36	22
ES-7	Extremely High	75	45	45	27

5.2.2.2.4.1 The SOFL and MLFL values shown in Table 5.2.2.2.4 shall not apply to shored elevated slabs that are intended to be inclined.

5.2.2.2.4.2 The SOFL and MLFL values shown in Table 5.2.2.2.4 shall not apply to shored elevated slabs that are intended to be cambered.

5.2.2.3 Divide the project's entire random traffic un-shored elevated floor into distinct specified overall un-shored elevated F-Number areas.

5.2.2.3.1 Each distinct specified overall un-shored elevated F-Number area shall comprise the entire un-shored elevated random traffic floor area that is required to conform to a particular EU floor profile code.

5.2.2.3.2 A specified overall un-shored elevated F-Number area may comprise any number of individual un-shored elevated slab placements on any number of building levels.

5.2.2.3.3 No individual un-shored elevated slab placement may be associated with more than one specified overall un-shored elevated F-Number area.

5.2.2.3.4 The contract documents shall require that each specified overall un-shored elevated F-Number area conform to a different EU random traffic floor profile flatness/levelness classification code given in Table 5.2.2.3.4.

Table 5.2.2.3.4 - Random Traffic Floor Profile Codes for Un-Shored Elevated Slabs					
Floor Profile Code	Relative Profile Quality	Specified Overall Flatness (SOFF)	Specified Overall Levelness (SOFL)	Minimum Local Flatness (MLFF)	Minimum Local Levelness (MLFL)
EU-0	Minimum	15	n/a	9	n/a
EU-1	Ordinary	20	n/a	12	n/a
EU-2	Average	25	n/a	15	n/a
EU-3	Good	30	n/a	18	n/a
EU-4	Very Good	35	n/a	21	n/a
EU-5	High	45	n/a	27	n/a
EU-6	Very high	60	n/a	36	n/a
EU-7	Extremely High	75	n/a	45	n/a

5.2.2.4 Perform all F-Number testing in accordance with the current revision of ASTM E-1155 (ASTM E-1155M).

5.2.2.4.1 Each new random traffic slab placement shall constitute a separate test section.

5.2.2.4.2 Measure the FF and FL numbers exhibited by each new test section within 8 hours following completion of the final troweling operation.

5.2.2.4.3 On shored elevated slabs, perform F-number testing prior to the removal of any shores.

5.2.2.4.4 On post-tensioned floor slabs, F-number testing may be performed either before or after the cables are tensioned.

5.2.2.4.5 F-number sample measurement lines shall not cross intended changes in the floor surface's slope.

5.2.2.4.6 The 320 ft^2 (29 m^2) minimum test section area requirement set forth in ASTM E-1155 7.2.1 (ASTM E-1155M 7.2.1) shall not apply.

5.2.2.5 Calculate all test section results within 12 hours following completion of the final troweling operation.

5.2.2.5.1 Use the following variables for each test section calculation:

A_{TST}	=	*test section's area in* ft^2 (m^2)
$A_{\neq FF}$	=	*test section's area in* ft^2 (m^2) *not equal to* SOF_F
$A_{\neq FL}$	=	*test section's area in* ft^2 (m^2) *not equal to* SOF_L
MF_F	=	*test section's measured* F_F*-Number*
MF_L	=	*test section's measured* F_L*-Number*
R_{FF}	=	*test section's relative* F_F*-Number ratio*
R_{FL}	=	*test section's relative* F_L*-Number ratio*
$R_{A\neq FF}$	=	*test section's relative un-equal* F_F*-Number area ratio*
$R_{A\neq FL}$	=	*test section's relative un-equal* F_L*-Number area ratio*
SOF_F	=	*specified overall* F_F*-Number*
SOF_L	=	*specified overall* F_L*-Number*

5.2.2.5.2 Calculate the relative F-Number ratios as follows:

If $MF_F > SOF_F$, $R_{FF} = SOF_F \div MF_F$

If $MF_F < SOF_F$, $R_{FF} = MF_F \div SOF_F$

If $MF_F = SOF_F$, $R_{FF} = 1$

If $MF_L > SOF_L$, $R_{FL} = SOF_L \div MF_L$

If $MF_L < SOF_L$, $R_{FL} = MF_L \div SOF_L$

If $MF_L = SOF_L$, $R_{FL} = 1$

5.2.2.5.3 Calculate the relative un-equal F-Number area ratios as follows:

5.2.2.5.3.1 If $R_{FF} \geq 0.50$

If $MF_F > SOF_F$, $R_{A \neq FF} = 0.924 - 0.24 R_{FF}^3 + 0.916 R_{FF}^2 - 1.6 R_{FF}$

If $MF_F < SOF_F$, $R_{A \neq FF} = 0.24 R_{FF}^3 - 0.916 R_{FF}^2 + 1.6 R_{FF} - 0.924$

If $MF_F = SOF_F$, $R_{A \neq FF} = 0$

5.2.2.5.3.2 If $R_{FF} < 0.50$

If $MF_F > SOF_F$, $R_{A \neq FF} = 1 - 1.425 R_{FF}^3 + 2.3675 R_{FF}^2 - 2.1815 R_{FF}$

If $MF_F < SOF_F$, $R_{A \neq FF} = 1.425 R_{FF}^3 - 2.3675 R_{FF}^2 + 2.11815 R_{FF} - 1$

If $MF_F = SOF_F$, $R_{A \neq FF} = 0$

5.2.2.5.3.3 If $R_{FL} \geq 0.50$

If $MF_L > SOF_L$, $R_{A \neq FL} = 0.924 - 0.24 R_{FL}^3 + 0.916 R_{FL}^2 - 1.6 R_{FL}$

If $MF_L < SOF_L$, $R_{A \neq FL} = 0.24 R_{FL}^3 - 0.916 R_{FL}^2 + 1.6 R_{FL} - 0.924$

If $MF_L = SOF_L$, $R_{A \neq FL} = 0$

5.2.2.5.3.4 If $R_{FL} < 0.50$

If $MF_L > SOF_L$, $R_{A \neq FL} = 1 - 1.425 R_{FL}^3 + 2.3675 R_{FL}^2 - 2.1815 R_{FL}$

If $MF_L < SOF_L$, $R_{A \neq FL} = 1.425 R_{FL}^3 - 2.3675 R_{FL}^2 + 2.11815 R_{FL} - 1$

If $MF_L = SOF_L$, $R_{A \neq FL} = 0$

5.2.2.5.4 Calculate the areas not equal to the specified overall F-Numbers as follows:

$$A_{\neq FF} = R_{A \neq FF} \cdot A_{TST} \ ft^2 \ (m^2)$$

$$A_{\neq FL} = R_{A \neq FL} \cdot A_{TST} \ ft^2 \ (m^2)$$

5.2.2.6 Calculate all specified overall F-Number area results within 12 hours following completion of the final troweling operation.

5.2.2.6.1 Calculate and report the results for each specified overall on-ground, shored elevated, and un-shored elevated F-Number area separately.

5.2.2.6.2 Use the following variables for each specified overall F-Number area calculation:

A_{TOT} = *total area in ft^2 (m^2) of the specified overall F-Number area*

$A_{\Sigma TST}$ = *total area in* ft^2 (m^2) *of all test sections tested to date*

$A_{\Sigma \neq FF}$ = *composite area in* ft^2 (m^2) *tested to date not equal to* SOF_F

$A_{\Sigma \neq FL}$ = *composite area in* ft^2 (m^2) *tested to date not equal to* SOF_L

MOF_F = *composite overall* F_F*-Number for all test sections tested to date*

MOF_L = *composite overall* F_L*-Number for all test sections tested to date*

$R_{F \neq FF}$ = *composite un-equal* F_F*-Number ratio for all test sections tested to date*

$R_{F \neq FL}$ = *composite un-equal* F_L*-Number ratio for all test sections tested to date*

5.2.2.6.3 Calculate the total area of all test sections tested to date:

$$A_{\Sigma TST} = \Sigma A_{TST} \qquad ft^2 \ (m^2)$$

5.2.2.6.4 Calculate the composite un-equal F-Number area for all the test sections tested to date:

$$A_{\Sigma \neq FF} = \Sigma A_{\neq FF} \qquad ft^2 \ (m^2)$$

$$A_{\Sigma \neq FL} = \Sigma A_{\neq FL} \qquad ft^2 \ (m^2)$$

5.2.2.6.5 Calculate the composite un-equal F-Number area ratios for all the test sections tested to date:

$$R_{A \neq FF} = A_{\Sigma \neq FF} \div A_{\Sigma TST}$$

$$R_{A \neq FL} = A_{\Sigma \neq FL} \div A_{\Sigma TST}$$

5.2.2.6.6 Calculate the composite un-equal F-Number ratios for all the test sections tested to date:

$$\text{If} \quad R_{A \neq FF} > 0, \quad R_{F \neq FF} = 1 - 0.61626 \, R_{A \neq FF}^{\ 3} + 1.6655 \, R_{A \neq FF}^{\ 2} - 2.0492 \, R_{A \neq FF}$$

If $R_{A\neq FF} < 0$, $R_{F\neq FF} = 0.61626\, R_{A\neq FF}^{3} - 1.6655\, R_{A\neq FF}^{2} + 2.0492\, R_{A\neq FF} - 1$

If $R_{A\neq FF} = 0$, $R_{F\neq FF} = 1$

If $R_{A\neq FL} > 0$, $R_{F\neq FL} = 1 - 0.61626\, R_{A\neq FL}^{3} + 1.6655\, R_{A\neq FL}^{2} - 2.0492\, R_{A\neq FL}$

If $R_{A\neq FL} < 0$, $R_{F\neq FL} = 0.61626\, R_{A\neq FL}^{3} - 1.6655\, R_{A\neq FL}^{2} + 2.0492\, R_{A\neq FL} - 1$

If $R_{A\neq FL} = 0$, $R_{F\neq FL} = 1$

5.2.2.6.7 Calculate the composite overall F-Numbers for all the test sections tested to date:

If $R_{F\neq FF} > 0$, $MOF_F = SOF_F \div R_{F\neq FF}$

If $R_{F\neq FF} < 0$, $MOF_F = -SOF_F \times R_{F\neq FF}$

If $R_{F\neq FF} = 1$, $MOF_F = SOF_F$

If $R_{F\neq FL} > 0$, $MOF_L = SOF_L \div R_{F\neq FL}$

If $R_{F\neq FL} < 0$, $MOF_L = -SOF_L \times R_{F\neq FL}$

If $R_{F\neq FL} = 1$, $MOF_L = SOF_L$

5.2.2.7 Report all test section and specified overall F-Number area results within 12 hours following completion of the final troweling operation.

5.2.2.7.1 Present all calculation results in a “Daily FF/FL Report” similar in format to that shown in Figure 5.2.2.7.1.

Figure 5.2.2.7.1

XYZ Testing Company
123 Accuracy Way
Anywhere USA
(123) 456-7890

DAILY F-NUMBER REPORT
6-Nov-15
© 2011 Allen Face & Company LLC

OAFF	OAFL	MLFF	MLFL	Proj Area

XYZ Warehouse
123 Industrial Parkway
Anywhere USA

DAILY RESULTS					COMPLETED WORK					REMAINING WORK		
Slab ID	Date Placed	Slab Area	Measured FF	Measured FL	Total Area In-Place	Unequal FF Area	Unequal FL Area	Overall FF	Overall FL	Area	Required FF	Required FL
LATEST RESULTS :												

5.2.2.7.2 Distribute FF/FL Daily Reports to the owner, the architect, the general contractor, and the flatwork contractor.

5.2.2.7.3 Retain sufficient information regarding sample measurement line locations to permit the test runs to be replicated.

5.2.2.8 Test all minimum local areas identified as being questionable by the test section results.

5.2.2.8.1 (Minimum local test criteria, timing, etc) …

5.2.2.9 Report all minimum local area test results within 8 hours following data collection.

5.2.2.9.1 (Minimum local area results reporting format) …

5.2.2.10 *Remedies for deficient F-Number test results*

5.2.2.10.1 *If final MOF_F measures below SOF_F and/or final MOF_L measures below SOF_F*

5.2.2.10.1.1 (Liquidated damages calculation) …

5.2.2.10.2 *If minimum local section measures below MLFF and/or MLFL*

5.2.2.10.2.1 (Physical repair requirements) …

5.3 — Deviation from cross-sectional dimensions

5.3.1 Thickness of Slabs

5.3.1.1 *Suspended slabs*

Average of all samples ……………………...……………………………………. ___“ (___mm)

Standard deviation of all samples …...……………………………………….…. ___“ (___mm)

Maximum deviation at any location…...……………….…….. -___“ (-___mm) / +___“ (+___mm)

5.3.1.2 *Slabs-on-ground*

Average of all samples …………………………….……………………......……. ___“ (___mm)

Standard deviation of all samples …...………………………...…………….. ___“ (___mm)

Maximum deviation at any location…...……………….…….. -___“ (-___mm) / +___“ (+___mm)

5.3.1.3 Slab thickness sampling

5.3.1.3.1 Samples shall be randomly located.

5.3.1.3.2 Not less than thirty (30) samples shall be collected, regardless of the slab area tested.

5.3.1.3.3 Samples shall be collected within seven (7) days after placement.

5.3.1.3.4 Sample locations shall be identified, and results shall be recorded in a manner that will allow an independent third party to verify the accuracy of the data.

5.3.1.3.5 Samples shall be taken either by coring of the slab or by using an impact-echo device.

5.3.1.3.5.1 If core samples be taken, then the length of each core sample shall be determined in accordance with ASTM C 174.

5.3.1.3.5.2 If an impact-echo device be used, then on each day of use it shall be calibrated within the area to be tested at not less than three random locations where the actual concrete thickness is known. The test shall then be conducted in accordance with ASTM C 1383

5.2.1.3.6 Samples exhibiting a thickness greater than 3/4 in. (19 mm) above the specified nominal thickness shall be recorded as having a thickness equal to the specified nominal thickness plus 3/4 in. (19 mm).

5.2.1.3.7 When corrective action is required, additional samples shall be taken in the vicinity of the defective area in order to establish its boundaries more precisely.

Eric Peterson

From: Bill Klorman <Bklorman@Klorman.com>
Sent: Monday, October 12, 2015 1:37 PM
To: Eric Peterson
Subject: FW: ADA Tolerances

Hello Eric:
I wanted to see if 117 was interested in establishing tolerances and testing requirements or some flavor of this for verification of handicap slopes at parking stalls and pathways?

Briefly an issue that keeps coming up is how inspectors and ADA advocates are checking the 2% slope in handicap parking stalls and pathways. Currently, based on our experience ADA inspections are often done with 2' smart levels. As you would assume, the change in slope in such a limited distance especially in a sweat swirl trowel finish in two feet can be very misleading. We have documented one particular project where using a 2-foot level a floor is not in tolerance however checking with a 10-foot straight edge and 4' smart level sistered together and used individually pass. We have also analyzed this slab area with 3D laser Scanning and established a topo map, cut and fill map and heat map for elevation changes all which place the area in compliance. Unfortunately, because there is no written standard for this checking methodology, we are held to the results of a 2' level. In my opinion this needs to be addressed as it is becoming more and more a targeted defect claim by among others, Owner's representatives purchasing buildings and ADA advocates actively searching for claims against building owners even though these slabs passed Building Department ADA inspections. Ultimately it is the concrete subcontractor being forced to repair these slabs and exposed to the added consequential damages simply because there is no way to dispute that such a restrictive zero tolerance is required rather than as provided for in ACI 117 checking a floor with a 10' straight edge.

Thanks for your time and consideration

Regards,
Bill

William M. Klorman, FACI
President, CEO

Klorman

KLORMAN CONSTRUCTION
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From: Ron Burg [mailto:Ron.Burg@concrete.org]
Sent: Monday, October 12, 2015 10:00 AM
To: Bill Klorman <Bklorman@Klorman.com>
Cc: Mike Schneider (schneiderm@bakerconcrete.com) <schneiderm@bakerconcrete.com>; swood@utexas.edu
Subject: RE: ADA Tolerances

Bill,

Good to hear from you.

You are correct; it is within the scope of Committee 117 to address this issue. I suggest you contact the 117 Chair, Eric Peterson (ericp@webcor.com). I believe you know Eric and a number of others on the committee, many of whom are contractors and have likely faced the same of similar issues.

Good luck and looking forward to seeing you in a few weeks!

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