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To: ICC-ES Evaluation Committee

From: J. David Musselwhite, P.E.

Date: January 25, 2010

Subject: Proposed Revisions to Acceptance Criteria for Steel Deck Roof and Floor Systems, Subject AC43-0210-R1 (DM/WM)

MEMO

In response to staff's December 29, 2009, letter proposing changes to AC43, we received correspondence from six interested parties: two consultants (C.W. Pinkham with S.B. Barnes Associates; and Satish Matani with John A. Martin & Associates, Inc), three deck manufacturers (Brian Meyer with Metal Dek Group, a unit of CSi; Patrick Bodwell with ASC Profiles Inc.; and Jeffrey Martin with Verco Decking, Inc.), and one fastener manufacturer (William G. Gould with Hilti, Inc.). The two consultants only commented on Item 9 of the staff letter. The other four interested parties commented on most of the items in the staff letter. Attached is a spreadsheet with the comments from each party in a side-by-side comparison for ease of review. The comments on the spreadsheet are direct quotes from the writers' letters.

The staff comments below will be an attempt to summarize each item in the staff letter and either suggest a resolution to concerns or indicate where there are still outstanding issues.

Items 1, 2, 3.a, 3.b, 3.c.i, 3.c.ii, 3.c.iii, 3.c.vi, 3.d, 3.e, 3.f, 4.h, 6.f, 10.a, 10.c, 11, 12 and 15 were not questioned. Therefore, these items are assumed to be accepted by industry or will be addressed by staff only if there are any questions remaining.

Item 3.c.iv: It appears there is a need for AC43 to clarify Section 8.2.2.3 of AISI S905-08. AC43 will state that this requirement is for narrow lower flute sidelap edge conditions that exist when certain steel deck profiles are manufactured and not for full sidelap panel edges.

Item 3.c.v: One writer indicated that Sections 10.5 and 10.6 of AISI S905-08 appear to have an error in the N-value used in the equations. The intent of staff is to get confirmation of this with AISI prior to developing any necessary changes to AC43 to give the correct information.

Item 3.c.vii: Staff believes that AC43 should be revised to clarify Section 9.1.2 of AISI S905-08 by requiring the rate of loading for manual loading of the test sample to be limited to a maximum of 500 lbs/minute.

Item 3.c.viii.1: The writers vary in their comments to this item. The intent of staff is to get information from AISI prior to developing necessary changes to AC43.

Item 3.c.viii.2: The written comments vary in their interpretation of Section D5 of AISI S100. Staff is open to discussion on this item, but at this time staff's position is that AC43 needs to be revised to provide a consistent interpretation.

Item 3.c.viii.3: The writers vary in their comments on this item and may be misinterpreting the staff comment. Section 7.2 of AISI S905-08 indicates that for evaluation of connections with more than one nominal thickness and/or nominal steel tensile strength the differences should be considered. Section 7.2 indicates the parameters that define distinct nominal thickness and tensile strength. Section 7.2 also provides guidance as to connection testing necessary when multiple nominal thickness and/or steel strengths are to be evaluated. The reference to S905 in the proposed revisions would result in utilizing Section 7.2 of S905, if the report applicant is requesting evaluation of diaphragms with more than one steel thickness and/or steel strength

Item 4.a: The response received indicates a misunderstanding of the staff comment. This item in the staff letter was about fastener type, not fastener spacing.

Item 4.b: The response received indicates that the 15% variance in the diaphragm test results, as stated in Section F1 of AISI S100, is to be used for the comparison of the diaphragm test results to the calculated values. Staff does not agree with this interpretation of F1. The staff suggestion is to revise AC43 to indicate that the 15% variance limitation in Section F1 is not applicable to diaphragm test results.

Item 4.c: Testing of concrete strength samples within 48 hours appears to be acceptable to everyone. Staff agrees and proposes that the criteria be revised.

Item 4.d: There was only one response concerning the testing of the insulating concrete. The writer suggested using the same time frame in testing the strength sample as was used for structural concrete strength samples (48 hours). Staff agrees, and proposes that the criteria be revised.

Item 4.e: All four of the commenters agree that Equation (2) in AISI-S907-08 is correct. If this is the case, staff will have to review the impact of the change on existing evaluation reports and make a recommendation.

Item 4.f: All four of the commenters agree that Equation (1a) in AISI-S907-08 standard is correct. If this is the case, staff will have to review the impact of the change on existing evaluation reports and make a recommendation.

Item 4.g: The writers vary in their positions on whether diaphragm tests are needed of decks for each panel nominal steel strength being evaluated. Staff is open to discussion of this item. Additional revisions to AC43 appear necessary.

Item 5: One writer requested that ASTM E 72 be removed from AC43 since AISI S909-08 is now being used for web crippling test. Although AISI S909 will be the primary test standard, it is staff's opinion that ASTM E 72 should remain in the criteria as an alternate, to cover testing that may already be completed for existing reports or reports under review at this time.

Item 6: The writers vary in their positions on this item. Staff is open to discussion of this item. Further revisions to the criteria may be necessary.

Item 6.a: The writers vary in their positions on this item. Staff is open to discussion of this item. Further revisions to the criteria may be necessary.

Item 6.b: The writers vary in their position on this item. Staff is open to discussion of this item. Further revisions to the criteria may be necessary.

Item 6.c: Item 6.c of the December 29, 2009, staff letter incorrectly referenced Section 3.1.4 of AC43. The correct reference is Section 3.3.1.2 of AC43. The responses received indicate agreement that adjustment of connection strength due to steel over strength should be based on steel ultimate strength instead of steel yield strength. Therefore, staff proposes that the criteria be revised to reflect this.

Item 6.d: The writers vary in their comments to this item. Staff is open to discussion of this item. Further revisions to the criteria may be necessary.

Item 6.e: This item is under review by staff and will be clarified at the hearing.

Item 7: Staff seeks industry consensus on this item. If industry wants AC43 to address roof panel-to-steel connections for wind uplift as a requirement or option, staff requests that industry provide proposed revisions to the criteria for future consideration by the Evaluation Committee.

Item 8: The one comment received supports what is in AC43. Inclusion of vertical load tables in reports on steel deck panels is optional.

Item 9: All six writers commented on the requested removal of the Tri-Services Design Manual, TM 5-809-10 (1982). The writers vary in their opinions on this item. Staff is open to discussion of this item. Further revisions to the criteria may be necessary.

Item 10.b: There was only one response to this item. The writer asked if the change was based on profiles similar to the boundaries defined in Section 3.4 of AISI S100. With the information provided to the staff, the revision to require additional web crippling tests is necessary since waiving interior reaction tests has been shown not to be conservative. Also, the proposed change is based on information on panels at the boundaries, in Section 3.4 of AISI S100.

Item 13: Hilti questions removal of the test frame figures. Their concern is that the figures in AC43 all indicate that an endlap must be part of the test configuration. In response, staff proposes that the criteria be further revised with a requirement that the assemblies for diaphragm testing under AISI S907 include representative panel endlaps..

Item 14.a: The three responses received indicate that it may be appropriate to add provisions for evaluation of panel-to-support connections for combined shear and tension. The correspondence indicates support for the use of the provisions in SDI DDM03. In order for ICC-ES to adopt use of the combined load equation in SDI DDM03, test data supporting the provisions in SDI DDM03 should be submitted. For fasteners not specified in SDI DDM03, proposed revisions to the criteria will be needed to specify the appropriate test methods and conditions of acceptance.

Item 14.b: The submitted correspondence indicated that more than one possible approach may be available for criteria to address fastener pull-out and pull-over. Additional revisions to the criteria will be presented at a future Evaluation Committee hearing.

Enclosure: (Spreadsheet)

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1		Hilti agrees with this change.				
2		Hilti agrees with this change, however there are still some references to the UBC in the AC43 draft that need to be removed. Please see Section 4.4.4.				
3.c.iv	It appears that the S905 should be revised as suggested by ICC and noted above in 3.c.iv.	Hilti's position and the intent of the statement "no greater than 2d" in the AISI S905-08 test method is that this applies to cases where the geometry of the specific cold-formed steel product being evaluated has a narrow lower flute edge distance at the sidelap panel edge. This is intended to conservatively accommodate for the narrow lower flute sidelap edge condition that exists when certain steel deck profiles are manufactured. It may be confusing as worded and would be "greater than 2d" for the case of a steel deck product with a full sidelap panel edge. Nevertheless, the dimensions shown in AISI S905-08 Table 1 would apply for typical steel deck products and have been historically used for the small element lap-joint shear connection tests.	The referenced language in Section 8.2.2.3 of S905-08 is intended to address testing of screws for sidelap applications with deck panel profiles or configurations which necessitate fastener placements with narrow edge distance.	We do not understand the requirement as written in section 8.2.2.3 as referenced. We suggest ICC-Es consult with AISI regarding the intent or to determine if a typographical error is causing the confusion.		
3.c.v	Verify the figure notation in Section 10.5 and 10.6 of S905. It appears there are errors not only in referencing the figures but also in the use of fasteners (N-value) in the equations. Refer to attached markup of S905.					
3.c.vii	the manual & computerized modes described in the S905-08 are not the same. The loading rate will affect the results. It is recommended that the manual mode use at least the maximum loading rate of 500lb/min.	Hilti's position is that the spirit of the load rates is the same for both the manual and computerized methods described in AISI S905-08, which is to not load the system so quickly such that a shock loading occurs, and to have adequate time for data acquisition. The load holds accomplish this with the manual approach and the rate of loading limits accomplish this with the computerized approach. This test system option was reviewed and agreed upon by the AISI committee during writing of the AISI S905-08 test method.	The intent with the loading rates listed in Section 9.1.2 of S905-08 is to allow adequate time for data collection and to prevent shock loading. The loading rates listed for both manual and computerized loading are slow enough to insure these criteria are met, and either can be expected to produce acceptable results. (Now if we can only get the earthquakes to follow that criteria.)	When manually applying loads to a specimen the rate of loading is usually slow, to allow the operator to stop at the appropriate points to take readings. The one minute period will be enough time for the assembly to reach equilibrium if the rate of loading is in excess of the machine controlled rate of loading of 500 lbs per minute. Both are accepted methods in the standard and no additional requirements need to be added in AC43.		
3.c.viii.1	Fig 1 represents support fasteners, Fig 2a and 2b represent side-lap fasteners. Verbiage should be included to allow a manufacturer to modify a test assembly (with ICC approval) to match the end use conditions and ensure the correct failure mode i.e., if perforated material is tested then a wider specimen may be required to accurately evaluate the fastener.	Hilti's position is that this section is self-explanatory and not confusing. Selection of the appropriate AISI S905-08 alternative test setups in Figure 2(a) and 2(b) is dependent on the specific profile geometry of the cold-formed steel product being evaluated. These alternative test setups were included in the test method based on previous research that has been done.	Please note that the language in Section 8.2.2 of S905-08 refers to Figures 1(a) and 1(b), but due to a misprint, only Figure 1 {which will be 1(a)} was included. This is being corrected in an upcoming AISI errata sheet. The test setup in Figure 1 (a or b) has historically been used for testing both light gage to structure connections and light gage to light gage (sidelap) connections. Figure 2, both (a) and (b), are offered as alternatives to Figure 1 for testing sidelap profiles where the load can not be applied directly in the plane of the connection.	ASIS S905-08 states in section 8.2.2.3 that the test setups in figures 1(a) and 1(b) are both acceptable for determining the strength and flexibility of both structural and stitch (side lap) connections used in diaphragms. Section 8.1.1 states, that the standard test shall be performed unless the standard test is unsuitable for evaluating connection properties. Since the alternate tests are for deck side lap geometry then the standard test would be appropriate for deck to support member connections.		
3.c.viii.2	This would evaluate the variance in the fastener being tested to ensure the Ω (φ) used in the calculations is more conservative than the variability in the fastener performance.	Hilti's position is that this section is self-explanatory and not confusing. The AISI S100 Table D5 safety and resistance factors should be used, but confirmed through small element connection tests per AISI S905-08 and full-scale diaphragm system tests per AISI S907-08.	This statement in Section 10.3 of S905-08 is saying that when the results of the fastener testing is to be used for the determination of diaphragm system values, the safety factor or resistance factor for diaphragm systems can not be less critical than those listed in Table D5, even if the safety or resistance factors	We agree with section S905-08 section 10.3. If a fastening system has variability less conservative than in section D5 then if the factors in D5 are to be used the system must be justified through full scale testing. Alternately, we believe that the higher factor of safety or lower safety factor generated for the		

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			determined for the individual connections is less critical than is listed in D5 for diaphragm systems. In other words the intent of S905-08 was that the most critical value, either Table D5 or the small element fastener test results, will govern the diaphragm system design.	connection study should be used to develop diaphragm values without the need to run full scale tests.		
3.c.viii.3	This should only be required when the steel grade is expected to affect fastener performance. Also, Section 7.2 of the S905 includes tolerances for the applicability of deviations in thickness and material strength. So Section 7.2 should cover the steel grade issue.	Hilti's position is that if two different steel deck grades are tested, then a mathematical relationship should be allowed to be developed for recognition in other steel deck strengths.	If the intention is to recognize differing steel strengths in the resulting individual fastener or diaphragm system strength values, then that is a variable that the test program should include and account for in the predictive equations and test reconciliation. Otherwise the report should stipulate the minimum strength for which the fastener/system values are applicable and the test data analysis should account for differences between tested and specified strengths. Steel strength would not be expected to affect displacement results, and thus would not need to be included in an adjustment for stiffness determination.	The analysis of the test results in accordance with section F of S100 requires adjustment of the test results for the actual yield and tensile of the specimen independent of grade or mill certifications therefore S905-08 does not need to address the yield and tensile strength of the steel, which relates to the grade of the steel.		
4.a				We do not believe that the same side laps spacing should be required for running a series of diaphragm tests. By limiting the side laps to one spacing important knowledge about the diaphragm may be missed in testing resulting in possibly non-conservative testing.		
4.b	This tolerance (% from average) is only required if identical test specimens are being evaluated, which is not required for either S907 as stated above or AC43. Otherwise, the tolerance should be related to the comparison between the calculated and tested strength/stiffness/flexibility of the specimens (Ref S907-08, Section 12.3)					
4.c	No concern, 48 hours is more reasonable due to handling and shipping of test specimens to offsite testing facilities.		No	Tests cylinders should be tested with in the 48 hours per the standard.		
4.d				We recommend requiring testing within 48 hours similar to structural concrete.		
4.e	Both equations have been analyzed and checked using AutoCAD and the AISI equation is definitely correct. See attached derivations.	Hilti's position is that the equation from AISI S907-08 should be used to calculate diaphragm net deflection. This equation has been reviewed and agreed upon by the AISI committee during writing of the AISI S907-08 test method.	This question was the subject of significant debate within the AISI Diaphragm Subcommittee during the development of S907-08 prior to its adoption. We feel the equation in S907-08 should be used. Please note that the measurement of the diagonals for determination of displacement is included in S907-08 as an acceptable alternative to the historical four corner dial placement.	Follow S907, the test standard		
4.f	The AISI approach is reasonable because in the <0.02 condition it is allowing for up to 2% increase before being penalized. Imagine the situation where you have 2 similar tests (i.e., same fasteners but slightly different S/L spacing) with similar failure loads, but one falls just below the 2% limit and the other is above. The AISI equation creates continuity between the equations at 0.02. See attached derivations.	Hilti's position is that the equation from AISI S907-08 should be used. This equation has been reviewed and agreed upon by the AISI committee during writing of the AISI S907-08 test method.	The intent of Equations (4a) and (4b) in Section 10.2 of S907-08 is that if the bare frame contributes 2% or less of the maximum total system test strength, then the bare frame contribution is ignored, but if the bare frame contribution is greater than 2%, the amount greater than 2% is deducted from the maximum total system test strength. In the case on G' determination, the bare frame load is that load required to produce bare frame displacement equal to the total system displacement measured at 0.4 times the maximum test load on the total system.	Follow S907, the test standard		

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			Equation 4.a in Section 10.2 of S907-08 states that if the bare frame strength is greater than 2% of 0.4Pmax, then the bare frame strength greater than 2% is deducted from Pmax to determine G'. In neither case is Pd greater than 0.4Pmax. The S907-08 approach should be adopted.			
4.g	Additional full-scale tests should NOT be required if the support & S/L fasteners have already been evaluated for individual strength/stiffness characteristics using the steel grades desired. Only one set of full-scale tests should be required for confirmation.	Hilti's position is that if two different steel deck grades are tested, then a mathematical relationship should be allowed to be developed for recognition in other steel deck strengths.		Higher grades of steel may be substituted for the tested grade of steel, using the tested grade of steels lower test results. Performance for a higher grade of steel would otherwise require testing in accordance with the acceptance criteria.		
5				ASTM E72 should be dropped from AC43 because E72 was not intended to be used for web crippling testing.		
6		Hilti's position is that "new" fasteners or connectors that are introduced and that are not specifically listed in the SDI DDM03, should be evaluated through both small element connection tests per AISI S905-08 and full-scale diaphragm system tests per AISI S907-08 to confirm their performance in the steel deck diaphragm application. There are many aspects of the steel deck diaphragm system that are not fully captured by just running the small element connection tests, including the steel deck panel edge details and dimensions, the steel deck endlap condition, etc. Other justifications for keeping the AISI S907-08 full-scale diaphragm system testing requirement are: 1. To investigate the effect of steel deck endlaps. --> Small element lap-joint shear connection testing alone is not sufficient to investigate the effect of the steel deck diaphragm endlap condition. To base the diaphragm design only on a steel sheet failure mode is not sufficient. Doing so, the theoretical diaphragm shear strength would be independent of connection quality at the endlap, which does not correspond with test experience and the actual behavior. --> Tension and shear situation at the endlap location on steel deck diaphragm is very difficult to calculate (a complex combined load state at the steel deck endlap exists). A calculation method is not an option for the practicing engineer. --> Determination the range of validity of the predictive design equations to ensure the accuracy of the equations within the defined parameter scope as implied by AISI S907-08 Section 11.1, which states, "side seam fastener spacing within the common limits so that interpolation of results can be made". Although AISI S907-08 does not currently require an endlap condition on the steel deck diaphragm test specimens, Hilti's position is that the revised AC43 shall include endlaps (as shown in the AC43 test frame layout figures) in the test specimens, as this can be a controlling	AC43 currently recognizes diaphragm values determined in accordance with DDM03 for the full range of fastener types listed in DDM03. DDM03 includes formulas for the determination of both individual connection and diaphragm system strength and stiffness for welds, screws, button punches and numerous power actuated pins. This paragraph seems to be saying that ICC accepts the formulas for welds, screws, and button punches but no longer recognizes the formulas for power actuated fasteners. The proposed approach is inconsistent. What is the basis for this change? It has always been our understanding that SDI requires or at least recommends confirming full scale tests in addition to small scale fastener tests when new fasteners outside of the scope of DDM03 are to be evaluated in accordance with the design equations in DDM03. In this version of AC43 it is proposed that only small scale tests are required for some types of fasteners and both small and full scale tests are required for others. We feel that some full scale tests should be included for all new fasteners in order to confirm the system behavior is consistent with the values determined by the predictive equations based on the small scale tests.	We agree that for fasteners used in combination with standard panels that only fastener strength and flexibility need to be developed in accordance with S905 if they fall outside the scope of DDM03. In accordance with the 2006 IBC that specifies the use of DDM03, through RD1.0 and NC1.0, the safety and resistance factors for all mechanical connections is specified in DDM03 and testing for these connections including pins is not required per the 2006 IBC. The definition of standard panels in section 1.4.11 infers that the only standard panels are wide rib, intermediate rib, narrow rib and hat profiles. SDI does not specify standard panels in DDM03. They have appendices of performance values for common panel configurations in the industry. We believe that this section can be better worded as follows: **1.4.11 Standard Deck Panels:** Standard deck panels are trapezoidal or hat shaped in either single or multi-web configurations. The panel widths range from 12 inches to 36 inches wide, 0.6 inch to 7-1/2" in height, with base steel thicknesses from 0.014 to 0.071 inches thick. Unless all common profiles descriptions are listed naming a partial list may create uncertainty as to which common profiles are standard or non-standard panels.		

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		factor in the overall performance of the diaphragm system. 2. Verification of scatter criterion. --> Demanding only a scatter limit for Qf implies, that the same scatter will be observed in the full scale diaphragm system tests. This cannot be generalized, as different failure chains might occur in the full scale diaphragm system. 3. Verification of borders or boundary conditions under which interpolation using the predictive equations is possible. --> Reference AISI S907-08 Section 12.4. 4. Optimization of performance --> Benefits for the construction industry, design professional, building owner, building official and public safety 5. Motivation for product and application innovation --> Some of the AC43 revisions are confusing and seem to be “watering down” the qualification requirements. This offers little incentive for manufacturers to improve their products and innovation. ICC should ask if these revisions will drive manufacturers to “just calculate according to SDI and be done with it”? Furthermore, “generic screws” should comply with some nationally recognized standard. Either ASTM C1513 or ICC-ES AC118 or both. Allowing for recognition of a “generic screw” as part of a steel deck roof and floor system evaluation creates a loop-hole, whereby the screws would not be confirmed as being representative of standard manufacturing nor produced under any ICC-ES AC10 quality program. They could be not representative of standard manufacturing and “jacked up to give good results”. This is unacceptable from a safety and quality stand-point and ICC-ES is going down a slippery slope with this type of terminology. It is also unfair to report holders and ICC-ES should not be delegating this authority to SDI or any other association of manufacturers to define the product used in the tests or calculations themselves. Sidelap connectors used in steel deck evaluations should be evaluated to nationally recognized standards and produced under an ICC-ES AC10 quality program.				
6.a	The S905 should be used as the basis for testing. Modifications should be allowed (with ICC approval) to the S905 testing apparatus to insure the connection is being evaluated correctly & accurately. Per Table 3 of proposed AC43, a full-scale diaphragm shear test is required for confirmation.	Hilti’s position is that AC43 should require both the AISI S905-08 tests and confirmatory complete diaphragm panel test per AISI S907-08 for proprietary punch or crimping systems that are not specifically listed in the SDI DDM03.	There is no reason why crimped or punched sidelap connections could not be tested in conformance with the intent of S905-08. We feel that crimped or punched sidelap connections should be treated consistently with any other sidelap connection. In other words, either all connections outside the current scope of DDM03 (and its addendums) are permitted to be tested with only small scale tests, or all connections require both small and full scale tests. Singling out a particular type of sidelap connections for full scale testing seems both	The method in DDM03 is a rational method utilizing engineering mechanics and the strength/flexibility of the connectors. The method has been verified through full scale testing across a wide range of panel profiles. The modularity of the method allowing for combining many different panel configurations and connections systems has been proven. Any connection system that is tested for shear and flexibility in accordance with a method such as S905 may be used with the general design method in DDM03 provided the panels are of a		

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			inconsistent and discriminatory.	standard configuration and the strength and flexibility of the connectors are within the range of strength and flexibility of those in DDM03. This range is from: Nominal shear strength 200lbs ≤ Proprietary Connection ≤ 6400lbs button punch in ¾" arc spot weld in 22 ga, grade 33 14 ga, grade 80 Stiffness 0.175 in/kip ≤ Proprietary Connection ≤ .0043 in/kip button punch in ¾" arc spot weld in 22 ga, grade 33 14 ga, grade 80		
6.b	Yes	Hilti's position is that if a proprietary fastener has a different design or dimensions on the washer or head, then the fastener should be evaluated according to AISI S905-08. This would then be confirmed through full-scale diaphragm system tests according to AISI S907-08.	Fasteners which fall outside of the scope of DDM03 should be tested in accordance with the requirements of AC43. This could include fastener tests in accordance with S905-08 and / or full scale diaphragm tests per S907-08 to confirm system behavior.	Larger or smaller fastener heads may be tested in accordance with S905 provided they fall within the range as described above in item 6.a		
6.c	Where is an adjustment factor mentioned in Section 3.1.4?	Hilti's position is that the adjustment factor should be based on ultimate strength.	DDM03 defines screw connection strength based on Fy, while Section E4 of AISI S100 defines screw connection strength based on Fu. Full scale diaphragm tests are typically analyzed based on Fu. We feel the adjustment factor should be based on Fu with the addition of a statement based on Section F1.1(c) of S100 similar to: "A similar adjustment shall be made on the basis of yield strength instead of tensile strength where the yield strength is the critical factor." Connection stiffness should not need to be adjusted based on steel strength. When looked at from a larger perspective, this section does not seem to differentiate between isolated connection tests and diaphragm system tests. There should be further differentiation between tests conducted to develop or confirm design equations for a range of design parameters, and tests to evaluate a specific isolated condition. Results for isolated connection tests or full diaphragm system tests for a specific isolated condition should be adjusted for steel strength and thickness as appropriate based on the scope or variables included in the testing. When tests are conducted to develop or confirm predictive equations for a range of design parameters in order to develop tables for publication, the test reconciliation is based on the properties of the individual test specimens to confirm the predictive equations. Once reconciled, those equations are used to develop tables based on the specified steel strength and thicknesses to be recognized in the report.	Adjustments to the test data to account for different strength of deck than specified should be applied to either the yield or tensile as depending on which is used in the particular fasteners design equation.		
6.d	If by 'non-standard' it is meant to say a profile that does not fit within the limitations of the DDM03, then the S904/S905 should be used based on the failure modes of the full-scale	Hilti's position is that the terminology "finger printing" is confusing. This should be revised or explained what is intended. Of course, it should be verified that the fasteners used in full-scale	Verification of fasteners used during testing should be limited to representative samples from each lot of those used during testing. Testing from every box could be unnecessarily	We agree that the use of S904 may be a good method to determine the shear and tensile strength of proprietary fasteners such as power-driven pins/nails. We have observed		

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	tests. A better definition of 'non-standard' profiles is needed. Reference the profile nominal depth and thickness limitations of the DDM03.	diaphragm system tests are representative of standard manufacturing and that they comply with manufacturing specifications. However, a similar requirement should exist in AC43 for the welding procedures and mechanical crimping procedures to be the same as used in the assembly and in the field. This will help ensure that the connection procedures used in the field match those used in the tests.	burdensome. Testing per S904-09 may establish fastener strengths but those values may not be the limiting factors in the connection or diaphragm system behavior and thus may not necessarily be appropriate for use in modifying full scale diaphragm test results. Clarification of this section is needed.	through full scale diaphragm shear testing of cellular deck profiles with a combined thickness of the pan and beam over 0.1 inches (16/18 gauge) that the dowel shear and a combined rollover/pull out of power driven nails occurs rather than the typical slotting of the steel deck around the fasteners that the SDI equations predict. The SDI equation appears to overestimate the shear strength of the connections in thicker combined thicknesses because there is no requirement to limit the shear to that of the fasteners dowel shear strength or combined rollover/pull-out failure mode.		
6.e		Quality documentation in accordance with AC10 should be required for all connection types (e.g. proprietary fasteners, welds, crimps, "generic screws", etc) used in diaphragm system tests. Why would ICC-ES not want quality documentation on all connection types?	How does the use of "generic" screws for diaphragm designs comply with this requirement? The cover letter question 6 and Proposed AC43 Section 2.1.1.4 permit the inclusion of diaphragm values based on "generic" screws which conform to DDM03 requirements. It appears that "generic" screws do not require ICC recognition. Is this the intent?			
7	Note that uplift requirements should be reviewed based on project requirements, and prescribe the S904 or S905 for fastener testing when design criteria is not published on the desired fasteners.	There should be an option in AC43 to allow for wind uplift tension resistance and combined loading in the ESR based on current, accepted engineering practice (e.g. SDI DDM03). The applicant should either provide AISI S904-08 test data and supporting calculations according to AISI S100 Section E.4 or SDI DDM03 or provide AISI S905-08 tension connection test data for pullover and pullout.	Inclusion of tension capacity of connections should be permitted to be included in reports at the proponent's request. Capacities not currently covered by the provisions of AISI S100, would need to be determined by testing in accordance with S904-08 and/or S905-08.	At a minimum AC43 should remind designers to consider the effects of uplift in their design through a general note. The inclusion of uplift data in AC43 would aid designers and would be beneficial in a deck report. We suggest obtaining an industry consensus on this item.		
8			Inclusion of vertical load tables should be optional.			
9	Remove TM 5 and require tables to be revised upon renewal of reports.	Hilti's position is that the Tri-Services Manual, TM 5-809-10 should remain as a reference in AC43. The Tri-Services Manual is included as a reference in AISI S907-08, and extensive reference is made throughout AC43 to AISI S907-08. Updating the reference title of TM 5-809-10 to the new TI or UFC documents is an editorial issue. Interested parties and industry representatives can still get copies of the Tri-Services Manual on-line at www.wbdg.org or from ICC-ES or the steel deck manufacturers or fastener manufacturers. Furthermore, Table 2 in AC43 should remain as non-mandatory diaphragm flexibility limitations. Many structural engineers still use this table.	We do not feel there is a need or technical basis for eliminating the use of the analytical method of determining diaphragm capacities contained in the Tri-Services Manual, TM 5-809-10. We are aware of no empirical or anecdotal evidence that the values currently published based on that reference are invalid or that the buildings constructed based on those values have failed to perform as expected. In other words, there are no life-safety concerns supporting the ICC suggestion to eliminate the reference. The message which would be sent to the design community is that the values they currently rely upon are not valid, raising questions about their previously designed projects. The issue of the deletion of Table 2 is a separate issue from the use of the analytical formulas of TM 5-809-10. The provisions of Table 2 are currently applied to all report holders regardless of the methodology used to determine the design values, thus its use is not currently dictated by the choice of analysis method. Therefore its deletion should not be dictated by the decision of whether or not to eliminate the use of the TM 5-809-10 analytical method.	Removing the use of the "tri-services" method, Army TM 5-809-10, is keeping in step with the requirements of the 2009 IBC. Evaluation reports are intended to provide for means and methods that are not addressed by the building code. The tri-services method would fall into this category and may therefore be an acceptable alternate method. Many manufactures have generated reports based on this method because the SDI diaphragm design manual does not address end lapped steel deck, top seam welds and side seam welds. We would recommend that an organized phase out of the tri-services method be implemented by ICC-ES. This process may be that no new calculations in accordance with the tri-services method will be accepted and that existing tables would be grandfathered in and allowed until a specified date in the future. It would be reasonable to assume that it may take 1 to 2 years for manufacturers to recalculate and or test products and 2 years to get through ICC review under the new criteria. ICC-ES must develop a process in which all manufacturer's legacy "tri-services" tables expire on the same day to maintain fairness to all manufacturers.	The 2007 California Building Code refers to span-width ratio per AC43 in Section 1604A.3.7.2 (DSA and OSHPD). We have been using Table 2 in AC43 for the design of school and hospital buildings in California. Eliminating Table 2 from AC43 will create uncertainty for limiting diaphragm flexibility limitation. This also make the current California Building Code (CBC) refer to something that no longer exists.	Most of the existing ICC-ES reports are based on TM 5-809-10. These reports are based on diaphragm values developed in TM 5-809-10 or diaphragm testing and the test results were analyzed using TM 5-809-10 methodology. These reports show conservative results as they are based on full scale diaphragm tests and not extrapolated from small scale connection test specimens. The analysis conforms to all the current AISI standards. The Industry has spent significant amount of time and finance in developing these reports. The diaphragm systems based on these performed very well in the past with no life-safety issues. There is no technical basis for eliminating this document from section 3.3.1 of AC43. AC43 in Section 4.2.1 requires Diaphragm Testing in accordance with AISI S907 and S907 recognizes TM 50809-10. The fact TM 5-809-10 was replaced by TI 809-4, which was replaced by UFC 3-310-0 is not an issue since most of the existing reports are based on TM 5-809-10, anyway. The design equations in TM 5-809-10 for diaphragm shear strength and stiffness were developed based on full-scale testing and are valid. The diaphragm tables based on these design equations which are included in current ICC-ES

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			The guidelines included in Table 2 and its footnotes are not consistent with code requirements for diaphragms constructed of other materials, nor are the masonry/concrete wall deflection limitations imposed in the Table 2 footnotes consistent with current design practices, therefore there is no reason to retain Table 2 as a mandatory requirement. Given its past prominence, we would suggest that Table 2 should be allowed to remain (edited to eliminate the wall deflection equation in footnote 2) as an optional guideline which can be used in lieu of a rational analysis. This would prevent the current CBC from referring to something which no longer exists. The proposed AC43 requires the use of AISI S907-08 for diaphragm testing. S907-08 recognizes the TM 5-809-10 method of analysis, and this approach has been used in the analysis of much of the test data to support existing ICC Evaluation Service Reports. We feel TM 5-809-10 should continue to be referenced in Section 3.3 as an acceptable method of determining diaphragm shear strength and shear stiffness. Table 2 should be retained as a non-mandatory alternative to a rational analysis.			Evaluation Service reports are still valid. The current AC43 references in Section 3.3, diaphragm shear strength and shear stiffness. AC43 also references in Section 6.2 Diaphragm Flexibility Limitations (Table 2). The 2007 California Building Code refers to span-width ratio per AC43 in section 1604A.3.7.2 (DSA and OSHPD). For design it has been customary to give an empirical method (Table 2) with an option to use rational analysis. Eliminating Table 2 will invalidate this empirical method for limiting diaphragm flexibility and have the current CBC refers to something that no longer exists. Diaphragm Flexibility Limitation shall be limited per Table 2 or based on rational analysis accepted by the governing agency.
10.b			Is the reason for the considerable increase in the number of tests based on testing of profiles similar to the boundaries defined by Section 3.4 of AISI S100? The new acceptance criteria calls for minimum and maximum gage, minimum and maximum bearing width, end and interior bearing. So for each profile rather than 1 test series, 8 test series are now required. This represents a significant increase in testing expense. Is the added expense justified for all deck/profile types?			
10.d				We do not agree with the mandatory use of linear regression as the only method to adjust the web crippling equations. This method may not be the most appropriate method. The criteria should state that adjustments must be made but not mandate how to do this. That should be up to the engineer responsible for the work and approved by ICC as valid engineering work.		
13		Hilti's position is that if the test frame layout figures are removed from the AC43 draft, then there will be no requirement for deck endlaps in test specimens. This is not conservative and not representative of actual construction practice where steel deck endlaps are used.				
14.a	Only if this load combination is to be published in an ESR. Refer to DDM03 for design criteria.	Hilti's position is that provisions should be included in AC43 for evaluation of panel-to-support connections for combined shear and tension. Since extensive reference is made to the SDI DDM03 throughout this draft, this would be a practical solution to allow the use of the SDI DDM03 combined loading equations.		For diaphragms in which wind load is driving the diaphragm shear, investigation of the combined uplift and shear on connections may be warranted. This is not warranted for seismic events because the uplift load on a diaphragm would be incidental in magnitude compared to the shear demand. For a wind event the uplift may be very large compared to the shear		

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				demand on a connection.		
14.b	Maybe this should be a requirement under the fastener Acceptance Criteria (AC70 - Pins or AC118 - Screws).	Hilti's position is that provisions should be included in AC43 for evaluation of pullout and pullover for all connection types. No separate procedures need to be developed for pins (e.g. power-actuated fasteners) as these exist already within AISI S905-08.	AISI S905-08 provides provisions for evaluation of connection pull-over and pullout. Additional procedures should not be required.	We believe the pull-out of pins should be tested in accordance with S905. This test method is for mechanical connections including power-actuated fasteners which may included nails, pins and clinch connections. All mechanical fasteners should be tested in accordance with the same standard to ensure that both the measure performance is relative to other previously proven methods.		
15				We agree with the inclusion of Dr Luttrell's document.		
Conclusion				In conclusion we recommend that ICC-ES does not take action on AC43 at this meeting. We recommend that ICC-ES staff engage and work with the Steel Deck Institute and AISI to develop this criterion and address it in a future meeting for approval. In general, the revisions are a positive start in updating AC43 to fall in line with current design practices and the 2009 IBC but it has a few shortcomings that need to be addressed. We recommend that ICC-ES engage industry organizations, practicing design professionals, and academia to participate in writing Acceptance Criteria's prior to presenting them before the committee for approval.		