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To: ICC-ES Evaluation Committee
From: J. David Musselwhite, P.E.
Date: June 10, 2010
Subject: Proposed Revisions to the Acceptance Criteria for Steel Deck
Roof and Floor Systems, Subject AC43-0610-R2 (DM/WM)

MEMO

In response to staff's May 13, 2010, letter proposing changes to AC43, we received correspondence from six interested parties: one consultant (C.W. Pinkham, with S.B. Barnes Associates), 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 two fastener manufacturers (William G. Gould with Hilti, Inc.; Raymond Schwarz with Pneutek, Inc.).

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 four of the writers' letters. The other two writers only have one or two comments each and were not included in the spreadsheet.

The staff comments below are 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.a & 1.e are being corrected to include concrete decks in the calculation method as long as the fasteners are welds as indicated in Section 5-6a(1) of the Tri-Services Manual.

Item 1.b indicates that if the Tri-Services Manual is used, full-scale testing is required if the panels are attached by any means other than welding as described in the Tri-Services Manual. The comment from industry is, why not make this a requirement for DDM03 as well. The reason is that DDM03 does not have this requirement and states in Section 4.8 that if small-scale connection testing is performed, full-scale testing is not required.

Item 1.c is being revised to state that AC43 should include a statement that modifies the Tri-Services Manual requirement to exclude pneumatic and powder actuated fasteners from higher seismic zones (or categories in the IBC). AC43 will state that Tri-Services exclusion is no longer valid and does not apply to AC43.

Item 1.e is being withdrawn.

Item 2 is considered confusing by some. The observation was made that the cover letter and AC43 do not match up on the requirements of generic screws. The letter is correct and AC43 has to be revised to match what Item 2 in the letter describes.

Item 2.a.i: The term “generic screw” is being used in AC43 in order to stay consistent with DDM03. AC43, however, takes it one step further and defines “generic screws” as compliant with ASTM C 1513. What AC43 does not do is better define the separation between generic screws used in side laps and generic screws used in supports. Section 3.1.4.1 requires rewording in order to make this separation clear as well as better define the requirements.

Item 2.a.ii: We are looking for comments from industry on the issue of Qs values in the range of 2 to 3 times the magnitude of the Qs values reported in DDM03. That is, are the equations in DDM03 still valid at higher values of Qs?

Item 2.a.iii: As indicated in Item 2 above, AC43 needs to be reworded to indicate clearly that the evaluation report for the steel deck diaphragm has to state the minimum requirements for generic screws. This requirement has to be stated in Section 6 of AC43.

Item 2.b.i: The different levels of testing refer to what has to be provided in order to be acceptable for use in support connections. If welds are used, small scale testing is not required since DDM03 gives the Qf and is accepted based on AWS procedures and standard weld materials being used. Welds, weld procedures and welding materials, i.e. weld rods, can all be checked or inspected at the job site to insure weld quality. The generic screw must comply with ASTM C 1513 as well as small scale connection test to verify minimum Qf and Sf values for use in the diaphragm calculations in DDM03. However, the testing of the generic screw will be covered by an AC118 evaluation report and not required in AC43 if the diaphragm evaluation is based on calculation only. If the diaphragm assembly is evaluated using a full scale test, the generic screws must be tested in a small scale test in order to see if the screws used in the test are different than the generic screw values used in DDM03 or reported in its AC118 report. Proprietary fasteners are fasteners that are named in the AC43 report and are the only fasteners that can be used with the diaphragm assembly described in the report. If a proprietary fastener is used in an AC43 report, an evaluation report for that fastener must be provided or the applicant for the diaphragm report must provide the fastener testing in order to be included in the report. Here again, if the evaluation of the diaphragm assembly requires full scale testing, the proprietary fastener must be tested in a small scale test in order to see if the fastener used in the test is different than the fastener reported in its AC118 report or the minimum allowed by the fastener’s quality control procedures. Thus, the reason for the different levels of testing.

The criteria has to be reworded to help fully explain the different levels of testing.

Item 2.b.ii: It is our understanding that if a screw is compliant with ASTM C 1513, the connection shear strength and stiffness in the side lap is purely a function of the steel panel thickness and the screw strength itself will not govern. However, the forces in the connection of the panel to the supports are much greater and need to be checked to see if the connection shear strength controls or the screw shear strength controls.

Item 2.b.iii: Section 4.4.4 of AC43 does require fingerprinting of welds used in full scale test assemblies. However, there is not a requirement to include this information in the evaluation report. AC43 needs to state a requirement in Section 6 that weld information is to be given in the evaluation report.

Item 2.b.iv: See our comment in Item 2.a.ii above.

Item 3: One comment received involved the request to require end-laps in all full scale testing. At the present moment, Section 4.2.3 of AC43 only requires end-laps if that is the configuration

of the panels in the field. However, AC43 did not require that a condition of use be stated if the end-laps are allowed or not allowed. Therefore, a statement needs to be added to Section 6 of AC43 requiring the condition of use.

Another comment received indicates that Section 4.2.3 should be removed from AC43 except for the end-lap statement. The commenter believes the extra requirements in Section 4.2.3 are too restrictive. However, the requirements in Section 4.2.3 allow the panels to be tested in either of two directions and not just one as in S907. The number of spans is not indicated or restricted in AC43. The only restriction is that a minimum of five panels wide is to be used.

Item 5: We withdraw our comment.

Item 6: The commenter is correct, SDI/ANSI C1.0 is not referenced in the 2009 International Building Code (IBC) and neither is the Tri-Service Manual (TSM), SDI Diaphragm Design Manual-DDM03 nor SDI Composite Deck Design Handbook-CDD2 but they are the bases AC43 is build upon. SDI/ANSI C1.0 is a standard that SDI has put together that brings DDM03 and CDD2 together as well as set perimeters for minimum material specifications, tolerance and etc. ICC-ES believes that this standard only helps and does not take away from the code requirements.

Item 8: The reason for requiring proprietary fasteners to be tested for uplift is because proprietary fasteners, i.e. pins and non-ASTM C 1513 screws, are not covered by AISI Section E4.

Item 9: The comments on this item need further discussion with industry and staff.

AC43, Section 1.3.3: Renumbering of the section will be part of the final publishing process because of the automatic numbering within the word processor.

AC43, Section 1.3.10: If it is approved to delete the UBC from AC43, Table 1 will be deleted and Section 1.3.10 will be revised to include the year of the editions on each ASTM.

AC43, Section 1.4.11: Section 1.4.10 will be revised to include the corrected material thicknesses as indicated in the comments received.

AC43, Section 1.4.12: Section 1.4.12 will be revised to state that generic side lap screws shall only be required to comply with ASTM C 1513, and generic support screws shall comply with ASTM C 1513 and have a minimum connection shear strength and stiffness as indicated in DDM03, Qf and Sf.

AC43, Section 1.4.14: Section 1.4.14 will be revised to replace word “device” with the word “connection”.

AC43, Section 2.1.2.1: This comment refers to a requirement in AC43 that is not the subject, or scope, of this proposed revision. This would have to be taken up at a future hearing.

AC43, Section 2.3.6: The comment received indicates that any differences reported in Section 2.3.6 should be reported in the evaluation report as well. This is in-line with the statements and comments made in Items 3, 2.b.iii, and 2.a.iii.

AC43, Section 3.1.4.2: The comment received revealed some major gaps in what was written and what was meant. This section of AC43 needs to be rewritten as well as deleting the corrosion test requirements. The corrosion requirements should be covered in AC166, AC118 or AC70.

AC43, Section 3.2.3: In the last sentence, replace the reference to Section 1603.1 with Section 1604.3.

AC43, Section 3.3.1.1: In the last sentence, replace the second “5-6c” with “5-6d”.

AC43, Section 3.3.1.2: The comment received indicates that this section “...should include languages as shown in Section 3.3.3.3(2) of AC70 regarding the option for the applicant to submit test data in more than one steel tensile strength for the development of a mathematical relationship to capture the influence of steel deck thicknesses and/or base steel tensile strength on diaphragm shear strength.” This is a new item to the proposed revised criteria and would have to be taken up at a future hearing.

AC43, Section 3.3.1.2.1: Most comments received on this section of AC43 revolve around the adjustment factor and the equation given to determine the adjustment factor. As pointed in one of the comments, this section only covers the calculated design method and not the testing method. Therefore, the part that concerns the adjustment factor should be removed.

Another comment received on the section involves the requirement that the power driven fasteners shown in DDM03 have connection values that this criteria does not accept. The reason for this is twofold. First, SDI/DDM03 is not a referenced standard in the IBC. Second, since it is not a referenced standard in the IBC, ICC-ES must review the data used to develop the document the same as if it were data for an evaluation report. Therefore, before DDM03 was referenced in AC43, ICC-ES reviewed the data for the generic screws and welds but were not able to do the same for the proprietary pins because of confidentiality issues between the proprietary pin manufacturers and SDI. Therefore, ICC-ES must have the data to backup the proprietary pin values with each steel deck report.

AC43, Section 3.3.1.2.2(4): The comment received indicates this section to be confusing and offers a rewrite for this section. Please review CSI’s comments for the proposed rewrite. Comments for industry are requested.

AC43, Section 3.3.2: One comment received suggests that full-scale testing should always be allowed, even if the diaphragm can be calculated per DDM03 or TSM. Staff has concerns with this approach in that the IBC and its referenced standards do not allow testing of products or assemblies in order to get higher results than what the a calculation method would result in.

Another comment received on this section suggests that the criteria include the term G' , for shear stiffness, as well as the term F , for shear flexibility. ICC-ES does not have an objection to this.

AC43, Section 4.1.2: ICC-ES believes the wording of Section 4.1.2 is correct. Section 4.1.2 does not allow for a modified design approach as indicated in the comment received. Section 4.1.3 is the section that allows for a modified design approach.

AC43, Section 4.1.3: The comment received indicates that the criteria should not mandate only one method or approach to modify the web crippling equations in S100. If there are other ways

to modify the web crippling equations ICC-ES would be open to reviewing them and adjusting the criteria if required.

As far as the method outlined in the commenter's letter, ICC-ES does not see any difference in their "Acceptance of Testing for Cold- Formed Steel Structural Members" and AISI S100 Section F1 except the V_Q in AISI S100 is equal to 0.21 and the method given by the commenter has V_Q equal to 0.25.

AC43, Section 4.2.1: One comment referred to allowing full scale test when the diaphragm can be designed by calculation. Refer to Section 3.3.2 above.

Another comment was to revise the wording of this section to include "...small-scale testing shall be conducted in accordance with AISI S905 and/ or...." and "..., as required by Section 3.3.1." ICC-ES has no problem with this change.

AC43, Section 4.2.2: The comment received indicated that a section on small scale connection tests should be added to Section 4.2.2. ICC-ES agrees but believes Section 4.2.2 may not be the correct location.

AC43, Section 4.2.8: The comments received indicate that an adjustment for steel strength should be handled the same way as it is handled in Section 3.3.3.3 of AC70. Or no adjustment is done to the test results because the development of the equations takes the material properties into account. A discussion is needed among industry on this subject.

AC43, Section 4.4.4: This section is being revised to include a requirement for evaluation reports to list welding information. There are two opposite views on this. One comment indicates that this information is needed to insure the welds are the same as those in the test and to help the Building Official and Inspectors be able to verify the installation. The other two commenter's indicated that welding information in the evaluation reports would shift responsibility from the contractor and possibly affect the quality of the welds due to different welder techniques and welding conditions. More discussions are needed on this item.

AC43, Section 4.4.5: ICC-ES received two comments concerning this section of the criteria. Both comments indicated their desire to use the same adjustments as used in AC70, Section 3.3.3.4.

AC43, Section 5.1.3.5: One comment asked to include ANSI/SDI C1.0-06 to the list of standards in this section. Another comment ask what is applicable. Section 5 of AC43 is about the quality control of the panels in the manufacturer's facility. The parts of Part 2 in these standards that would affect quality of the panels is applicable.

AC43, Section 5.4: The comment asked for clarification of the change in Section 5.4. This is being revised to insure that proprietary fasteners that are being used in the panel's evaluation report, or in an evaluation report on a proprietary fastener using AC43, and does not have an evaluation report to AC118 or AC70 must provide evidence that the fastener is under an approved quality program.

AC43, Section 5.6: ICC-ES removed Section 5.6 because of it being covered in Section 5.4.

AC43, Section 6.2: The proposed change suggested by one comment needs additional review before the change can be made. The question is, is Table 2 an alternate and if so what is the alternative?

AC43, Table 1: If the removal of the UBC is approved, Table 1 will be removed and the edition year of the ASTM standards will be added to Section 1.3.

AC43, Table 2: One comment indicates that Table 2 should be removed and replaced with the following:

The diaphragm length and width shall be limited by; 1) engineering mechanics 2) the applied loads 3) shear capacity of the diaphragm 4) the diaphragm shear deflection limited by the requirements of ASCE 7 in Sections 12.8.6 entitled, "Story Drift Determination" and Section 12.12 entitled, "Drift and Deformation". The shear deflection is based on the stiffness or flexibility factors for the diaphragm and equations of mechanics.

The shear deflection equations of mechanics, diagrams, notations, and symbols in Attachment (attachment showing common equations of engineering mechanics for deflection based on shear stiffness, G , or flexibility factor, f) shall be included in the evaluation report as an aid to designers in determining the diaphragm deflection. The total diaphragm deflection shear web deflection and flexural deflection shall only be considered for diaphragms with aspect ratios large enough to validate slender beam theory. Slender beam theory may be used to determine the flexural deflection and the equations in attachment B may be used to determine the shear web deflection.

This replacement requires discussion with industry.

AC43, Table 3: Footnote 3 of Table 3 says, "...submitted by deck manufacturer". This should be revised to "submitted by the applicant".

Other comments concerning Table 3 require a dialog with industry.

Misc item: The comment that follows needs to be discussed to know how AC43 should treat this issue. *"As proprietary button punch system and generic button punch fastenings do not undergo nearly the level of quality control required by ICC-ES and are essentially similar to arc-spot puddle welds with respect to field quality control, these fastenings should be treated like arc-spot puddle welds and similarly require special inspection."*

Enclosure: (Spreadsheet)

Item No.	CSI	Hilti	Verco	ASC
1.a			<p>This item currently states that if the deck is connected as described in Sections 5-6a(1 thru 4, 6 & 7) of the Tri-Services manual, then no full scale testing is required for standard decks as described in Sections 5-6b (Type A Diaphragms-Decks Having Shear Transfer Elements Directly Attached to Framing) and 5-6c (Type B Diaphragms-Decks Having an Elevated Plane of Shear Transfer). As written, this excludes Section 5-6d (Steel Decks with Concrete Fill). Since Section 3.3.1.1 of the proposed AC43 refers to "Section 5-6 for Bare and Concrete Filled Assemblies" of the Tri-Services Manual, we would request that the intent of Item 1a be clarified to include Section 5-6d. See also Cover Letter Item 1e below.</p>	
1.b		<p>In general, Hilti agrees with this statement, but further believes that the same requirement should be true for steel deck diaphragm systems based upon the SDI design method. The Tri-Services Method and the SDI Method both simply provide calculation methods for evaluating steel deck diaphragm systems and should be held to the same standard. At least some confirmatory, full- scale diaphragm system tests should be required, regardless of the particular design method used in the evaluation. This should especially be true for fastening methods that are not formally included in the design methods, or when the Qf or Qs connection strengths differ substantially from how the design equations for strength and stiffness were originally developed. This would apply to proprietary button punch systems vs. "generic" button punches, for instance.</p>		
1.c		<p>Hilti strongly disagrees with this statement. It is inappropriate for ICC-ES to try and impose this unsubstantiated restriction of trade. Hilti has previously provided ICC-ES with industry research papers documenting the reliable seismic performance of steel deck diaphragms with power-actuated mechanical fasteners. These industry research papers are re-attached as part of this public comment letter for others to see (reference Enclosure B). This industry research has clearly demonstrated that power-actuated mechanical fasteners are actually superior to arc-spot puddle welds in dissipating seismic energy as part of steel deck diaphragm construction. Power-actuated mechanical fasteners demonstrate superior ductility in sheet steel connections and are suitable for seismic resistance. On the other hand, this research has also shown that arc-spot puddle welds provide limited ductility and can fail in a brittle manner. By reading the industry research papers and studying the results of these investigations, if any steel deck attachment method should be restricted or monitored more closely for quality control, it should be arc-spot puddle welds and not power-actuated mechanical fasteners.</p> <p>There are three reasons why this statement should be removed:</p> <p>1.) Industry "state-of-the-art" research (sponsored by SDI, CSSBI and others) into the performance of steel deck diaphragms under seismic loading conditions has proven the superiority of power-actuated mechanical fasteners over arc spot puddle welding. Power actuated mechanical fasteners demonstrate superior ductility and have a greater ability to dissipate seismic energy. The area under the cyclic loops gives a good indication of the energy dissipation capacity. Alternatively, arc-spot puddle welds show less ductility, failing in a brittle manner with less ability to dissipate seismic energy. This seismic performance is not currently reflected in AC43 and should be addressed by ICC-ES.</p> <p>2.) ICC-ES has already reviewed and approved many types of power-actuated mechanical fasteners for steel deck diaphragms previously, and such a restriction would conflict with the current AISI code for these for these types of fasteners and these loading conditions. The SDI DDM03, AISI S100, AISI S907 and AISI S905 test standards do not include any such restriction for power-actuated mechanical fasteners, which have also been proven to be more reliable and more consistent than screw fasteners and arc spot puddle welds for attachment of cold-formed steel deck. The Tri-Services Manual 1992</p>	<p>The proposal to enforce the language of the exception in Section 5-6a(5) of the Tri-Services Manual presents significant technical and commercial implications for both ICC and numerous current (and lapsed) report holders. While there is no denying the language of the exception is in the Tri-Services Manual, it should be considered in its historical context:</p> <p>1) Per Mr. Pinkham with S.B. Barnes Associates, when they wrote the 1982 Tri-Services Manual, power actuated fasteners had just been introduced to the market, and the statement was added simply because the Tri-Services Manual authors had no data regarding the use of power actuated fasteners .</p> <p>2) The 1992 revision of the Tri-Services Manual dropped the exception limiting the use of pins. (The 1992 version of the Tri-Services Manual contains numerous typographical errors in the empirical diaphragm design equations that were carried over from the 1982 version, which is why reference to the 1992 version is problematic.)</p> <p>This proposal would create conflicts within AC43:</p> <p>3) The AISI S907 test standard currently referenced in Item 4 of the cover letter and AC43 Section 4.2.1 as the required test method for conducting full scale diaphragm tests acknowledges the Tri- Services Manual as a recognized concept for the analysis of diaphragm test data. In fact, AISI S907 does not limit the method employed in the analysis of test data, rather it identifies currently recognized references. AISI S907 does not place limits, such as those proposed, on specific fasteners based on the choice of the concepts or theories used to analyze the test data.</p> <p>Looking at this proposal from a technical and commercial perspective:</p> <p>4) This proposal would define that the applicability of test results is dictated by the source of the concepts used to develop predictive equations rather than the test data itself or the correlation of the test data to the predictive equations.</p> <p>5) This proposal would have significant financial impact on numerous ICC-ES report holders. The proposal would also impact the other stakeholders in the design and construction community, including</p>	

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		<p>version removed this restriction, proving that the Tri-ServicesManual was a "living document" that was revised periodically. This is counter to statements from the ICC-ES staff that "no one had maintained the Tri- Services Manual". The fact of the matter is that the ICC-ES staff chose not to include the 1992 version of the Tri-Services Manual for other (editorial) reasons, but revisions since the 1982 version have taken place to reflect the current practice of qualification of steel deck diaphragms and fastening systems through full-scale diaphragm system testing. Full-scale diaphragm system testing should remain as an AC43 qualification requirement.</p> <p>3.) Literally thousands of projects have been completed with power-actuated mechanical fasteners in seismic regions with no documented failures. Such an unsubstantiated restriction ignores the industry research findings mentioned previously, and would cause considerable confusion in the engineering community.</p> <p>Hilti is not recommending the removal of arc-spot puddle welds as an acceptable attachment method for steel deck roof and floor systems. However, Hilti does believe that the attached industry research papers certainly support the addition to AC43 of a seismic test protocol for full-scale steel deck diaphragm systems that would possibly include allowance for enhanced seismic resistance if certain performance levels are confirmed. If including such a full-scale seismic test protocol as part of AC43 is beyond the technical expertise of the ICC-ES staff, then ICC-ES should work with NCSEA to develop the seismic evaluation procedure.</p> <p>We believe that this interpretation made by ICC-ES staff is a mistake and misinterprets the intent of including the Tri-Services Manual as a design reference in AC43. As with the SDI DDM03, the Tri-Services Manual is not a "code" and is simply referenced in AC43 as a design reference that provides an established method for evaluating full-scale diaphragm test data and applying empirical calculations for configurations. For this reason, the fact that a particular product is not specifically listed in one of the manuals and/or because one of the manuals makes a specific statement about particular products, should not affect the ability of a product to be recognized for seismic design categories. It does not make sense for ICC-ES to restrict powder- or pneumatic-actuated fasteners to Seismic Zones A and B just because one of the empirical method used to evaluate the full-scale test data. Furthermore, as we discussed, the 1992 version of the Tri-Services Manual includes a separate note addressing the applicability of the method to connections other than welds (reference Enclosure C):</p> <p>(5) Nonwelded fasteners. Fastening methods other than welds—such as self- drilling, powder actuated, or pneumatically driven fasteners— may be used provided that equivalence to the welded method can be shown by approved test data. The results of such test data will be presented by means of equations or tables for q and F in a manner similar to that used in paragraphs 5-9b, 5-9c, and 5-9d.</p>	<p>design professionals, contractors, owners, and the occupants of buildings constructed utilizing the previously recognized design values should ICC enforce this proposal. What would be the explanation to these stakeholders for the retraction of previously recognized design values?</p> <p>6) Invoking this provision would be in conflict with ICC's long standing recognition of reports for deck attached with pins based on test data analyzed with the concepts included in the Tri-Services Manual. Reversing direction at this point without a technical basis to support the reversal would seem to create the potential for credibility if not legal issues for ICC-ES.</p> <hr/> <p>In the event that the provisions of either Item 1c or 1e are adopted as proposed in the letter, then that adoption should include some sort of grandfather clause to permit existing reports to remain in force. Alternately, a less preferred option would be to adopt sunset provisions that provide adequate time for all affected proponents to develop new tables either thru testing or re-calculation and to get those new tables thru ICC in a timely manner such that all affected reports are changed simultaneously.</p>	
1.d		<p>Hilti disagrees with this statement. If a steel deck or fastener manufacturer wishes to use steel deck that is designated as "non-standard" steel deck, then confirmatory full-scale diaphragm system testing should be able to be provided along with the development of an empirical method based upon the Tri-Services Manual or SDI design methods.</p>		
1.e		<p>While requiring some full-scale diaphragm system tests of bare steel deck diaphragms is definitely practical, full-scale testing of concrete filled steel deck floor systems may be impractical. Here is a case where smaller scale push-out tests may be acceptable. ICC-ES needs to consider the relative cost and effort involved in constructing concrete fill steel deck test specimens for these types of investigations.</p>	<p>The cover letter states that the empirical equations in the Tri-Services Manual may be used for welded bare decks, but in Item 1e it states that concrete filled decks require full scale testing even though they are covered in the Tri-Services Manual. As noted in Item 1a above, this item of the letter is in conflict with Section 3.3.1.1 of the proposed AC which identifies Section 5-6 for bare and concrete filled assemblies</p>	<p>The Tri-services method should be allowed for calculating shear capacities for concrete filled steel decks within the scope of the tri-services method. This would be limited to deck types covered in the tri-services manual with welds to supports and welded or button punched side laps and a 2-1/2" concrete minimum cover in accordance with the requirements of the tri-services method. We believe that there is no</p>

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		<p>Concrete filled steel decks are different than steel deck diaphragms without concrete. The contribution of the steel deck connections to the shear strength of concrete filled steel decks is low, and the connections have little influence on the overall shear performance. This fact should drive the formulation of reasonable test requirements in AC43.</p>	<p>in the title, and does not require full scale testing for concrete filled decks when they are attached in accordance with the provisions of the Tri-Services Manual. Based on our conversation last week, we understand the intent of Item 1e was to state that full scale testing was required for concrete filled diaphragms that were not connected to the structure with welds. We would ask that this be clarified.</p> <p>In the event that the provisions of either Item 1c or 1e are adopted as proposed in the letter, then that adoption should include some sort of grandfather clause to permit existing reports to remain in force. Alternately, a less preferred option would be to adopt sunset provisions that provide adequate time for all affected proponents to develop new tables either thru testing or re-calculation and to get those new tables thru ICC in a timely manner such that all affected reports are changed simultaneously.</p>	<p>rational basis for excluding concrete filled diaphragms if the non-concrete filled diaphragms are accepted based on this method.</p>
2			<p>The use of the terms "generic" and "proprietary" seems confusing. The language of the AC makes it clear that screw connected diaphragms may be designed based on the design values for screws listed in the DDM03 but power actuated fastener connected diaphragms require testing and may not be designed based on the design values for power actuated fasteners currently listed in DDM03.</p> <p>The "generic" screws for sidelaps are required to conform to ASTM C 1513 (per Item 2aiii) but the letter does not seem to address this requirement for support screws. Section 3.1.4.1 of the AC states compliance with ASTM C 1513 is required for screws and does not differentiate between sidelap and support applications. Item 2bii of the letter states that support screws used in DDM03 based diaphragm calculations must have a current evaluation report confirming the connections, therefore it seems all the screws must have evaluation reports. Which circles back to what is meant by "generic"?</p> <p>Current ICC reports for screws generally report fastener shear strength, as would be defined by S904, but not connection strength as would be defined by S905. The current report that includes connection strength does not define connection stiffness. Therefore under what circumstances would the "generic" screw design values in DDM03 be permitted to be used for the determination of diaphragm shear strength and stiffness? Would one be permitted to rely upon the DDM03 equations for stiffness based on screw diameter and deck thickness if the evaluation report for the screws confirms the connection strength conforms to DDM03?</p>	
2.a.i		<p>Hilti agrees with this statement, however, as previously communicated during the February 2010 ICC-ES public hearing, Hilti is concerned with and takes issue with the use of "generic screw". It seems clear that the proposed changes to AC43 do require "generic screws" to meet ASTM C 1513 and AC118, which we believe is sufficient, however we would still recommend changing the terminology to "national standard screw" or "ICC-ES AC118 recognized screw" or perhaps "ASTM C-1513 compliant screw". We would recommend removal of "generic" terminology from AC43.</p>		
2.a.ii		<p>Hilti disagrees with this statement. As discussed in Item 1b. above, Hilti believes that any sidelap connection varying greatly in strength, Q_s, from what the design method connection strength equations were originally written and based upon, should require at least some confirmatory full-scale diaphragm system testing. For example, a No. 14 "generic screw" has a Q_s of approximately 1.7 kips when used with 16 gauge steel deck according to the SDI design method. If a proprietary punch system is developed with a Q_s in the range of 2-3 times this value, would it be correct and accurate to assume that the original design equations in the SDI design method would still apply? Or does the SDI method still apply when the Q_s term is overloaded or over-proportional in such a manner? In order to ensure a balanced" diaphragm design with adequate ductility for the frame and sidelap</p>		

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		connections, the Qs term should be limited to a certain percentage contribution to the overall diaphragm shear strength.		
2.a.iii		Hilti agrees with this statement. However, it should be made clear in the ESR that any screw fastener intended for steel deck diaphragm applications must comply with ASTM C 1513, as well as having an ICC-ES AC118 evaluation. This will provide recognition for the screw fasteners under the International Building Code to which the project is designed.		
2.b.i		Hilti disagrees with this proposed change. It is problematic with differing qualification requirements for connections. All connection types should be evaluated in a similar manner for a level playing field. Connections should be evaluated according to AISI S905-08 for small element connection behavior and validated through some confirmatory full-scale diaphragm system tests according to AISI S907-08.		
2.b.ii		Hilti agrees with this statement, but is not clear why the same "requirement" would not be applied to the "generic screws" used for the sidelap connection as discussed in Item 2a(iii) above.		
2.b.iii		Hilti agrees with this statement. "Finger-printing" should also apply to arc spot puddle welding procedures including welding electrodes and welding equipment set-up used in the full-scale diaphragm tests in addition to weld strengths. This should be included as a requirement as the variability of arc spot puddle welds can differ substantially from laboratory test conditions to actual project job site conditions.		
2.b.iv		Hilti agrees with this statement. Once again, if the connection strength Qf of the proprietary frame connection far exceeds the connection strength Qf of the frame connections for which the equations were originally developed (e.g. arc-spot puddle welding) then some confirmatory full-scale diaphragm system testing should be required.		
3		Hilti agrees with the use of AISI S907-08 as the basis for full-scale diaphragm system test criteria. However, Hilti's position is that any data published in an ESR, which is based upon full-scale testing (confirmatory or otherwise) should require end laps to be included in the test specimens as this is representative of actual construction on the project site. Endlaps are commonly a critical location ("weak link") in steel deck diaphragm systems. If testing is performed without steel deck end laps, then the ESR should clearly state that the steel deck must be installed in a single steel deck layer with butted (no end lap) conditions.		We strongly believe that section 4.2.3 should be removed from the acceptance criteria because it is redundant in comparison to the existing test standard, with the exception of requiring an end lap. We agree with the statement in section 7 of S907 with regard to the requirement for an end lap if the test engineer determines that it is necessary. The problem with requiring an end lap in all assemblies is that generally only single and two span sheets of deck will be tested. This effectively eliminates 3 and 4 span condition testing. Shear stiffness is affected by the number of spans and testing 3 and 4 span-conditions is more representative of the typical length of multi-span deck sheets used in construction. We have tested both end-lapped and non-end lapped decks to better understand the effect of the end lap and longer sheet lengths. The wording in the current proposed criteria is too restrictive and does not allow for additional testing to develop an understanding of how the sheet length and number of span effects shear stiffness. In general, in assemblies without perimeter shear transfer elements the end lap does not affect the ultimate shear capacity of the diaphragm for most common decks.
4				
5			The letter states that the minimum slab thickness requirement of the Tri-Services Manual conflicts with that of SDI. This appears to be based on a mis-understanding of the differing requirements of SDI for diaphragm design and composite slab design for superimposed vertical loads. The following references from the various design demonstrate this: Diaphragm Design- - TSM Section 5-6(d) states minimum 2-1/2" cover and 6x6/10x10 mesh for diaphragms. - SDI DDM03 Section 5.3 states minimum 2.5" cover and 6x6-W1.4xW1.4 mesh for diaphragms.	We do not believe there is a conflict between the different concrete cover thicknesses. The tri-services method a minimum requires 2-1/2 inches to calculate diaphragm shear capacity and stiffness. The SDI/ANSI C1.0-2009 requires a minimum of cover of 2 inches for the design of composite concrete slabs for shear using DDM03 and superimposed load capacities in accordance with C1.0 attachment C3. We do not see this as a conflict. The 2-1/2 inches is simply a further restriction placed on the tri-services design equations. Also ASCE 3-91 requires a minimum of 2 inches of cover and a minimum total slab depth of 3-1/2" for superimposed load design. None of these minimums conflict because each is specific to the standard.

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			Composite slab – - ANSI/SDI C.1, Section 2.4B.3.a., which is addressing composite design for superimposed vertical loads, states minimum 2" cover.	
6		Hilti is unclear why this standard is being added to AC43 at this time, when it is not included or referenced in the IBC 2009. Hilti would recommend removing this standard from AC43 at this time until it is adopted in the International Building Code.	We question the necessity of including the ANSI/SDI C1.0-06 Standard for Composite Steel Floor Deck, unless it is referenced in the 2009 IBC.	
7				
8		Hilti agrees that the AISI S905-08 test standard should be utilized when pullout strength is to be developed for uplift resistance. However, Hilti's position is that the AISI or SDI DDM03 design method equations for uplift resistance should alternatively be allowed to be used to calculate pullover resistance.		
9		Hilti disagrees with this statement. Hilti is in favor of including a specific Condition of Use statement in the AC43 ESR's as follows: <i>"Fasteners may be used for attachment of steel deck roof systems temporarily exposed to the exterior during construction prior to application of built-up roof covering systems. The fasteners on permanently exposed steel deck roof deck coverings must be covered with a corrosion-resistant paint or sealant. As an alternate to applying a corrosion-resistant paint or sealant, fasteners may be used in conjunction with Stainless steel sealing caps, on permanently exposed steel deck roof coverings. For permanently exposed steel deck roof covering installations, the roof covering system's compliance with Chapter 15 of the code must be justified to the satisfaction of the code official."</i> ICC-ES has established a precedent by including this type of Condition of Use language in AC43 ESR to address the use of steel deck panels in exposed, exterior conditions. Hilti's position is that this statement is sufficient.	Structural roof decks are sometimes used in exposed applications such as walkway covers or sunshades. In these applications they are not expected or required to be weather tight by the designer, and are not represented as such by the steel deck manufacturers. A inclusion of a statement to the effect that the use of the decks as "roof covering" is outside of the scope of an AC43 report seems consistent with current practices related to structural roof decks, but not really necessary, unless the intent is to entirely prohibit this usage.	
Section 1.3.3			The current section numbers 1.3.3.4 thru 1.3.3.8 need to be revised to 1.3.3.1 thru 1.3.3.5 due to the deletions of Sections 1.3.3.1 thru 1.3.3.3.	
Section 1.3.10			All referenced standards except those from ASTM include the revision dates, while Table 1 is included for ASTM standard revision dates. Since there is no longer a need to differentiate between the UBC and IBC references, consider deleting Table 1 and including the revision dates in the ASTM Standard numbers in Section 1.3.10 of AC43.	
Section 1.4.11	design thicknesses are 0.0147in - minimum thickness is 95% = 0.014" design thickness 0.0747in - minimum thickness, 0.071 Refer to Section 3.3.1.2.2 (3)			
Section 1.4.12			Is there a reason why a "generic" sidelap screw must meet the requirements of ASTM C 1513 while a "generic" support screw does not?	
Section 1.4.14			The use of the term "mechanical device" to describe a connection which does not require the introduction of a fastener (device) instead of the term "mechanical connection", seems awkward.	
Section 2.1.2.1				We disagree with the requirement to include the minimum base metal thickness on product label. This information has no bearing on the construction process. All steel decks are specified called out by gage

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				and the design base steel thickness are listed in the approval report(s) for the design engineer and inspection laboratory for further engineering analysis and lab testing. . The ANSI standards, RD1.0, NC1.0 and C1.0 all mandated the design base steel thickness by gage. Field inspectors do not have the necessary equipment to etch off the metallic coatings to measure the base steel thickness in the field. They should verify that the material supplied is per the plans and specifications which will call out a manufacture, product type and gage thickness. The supplied decimal thickness for the base steel cannot be accurately measured in the field and may lead to confusion because this is a lesser thickness than the design base steel thickness listed in an approval report. Minimum = 95% of design per AISI S100.
Section 2.3.6		Hilti Comment A: Differences reported as required by Section 2.3.6 should result in statements in the final ESR and not just the Test Report. For example, the lack of an end lap condition as discussed above, should require a statement that the steel deck sheets be butted at the sheet ends (not overlapped). A further example would be the requirement that the welding procedure, equipment setting and information should be reported in the final ESR (See also Hilti Comment B).		
Section 3.1.4.2		Hilti Comment D: Section 3.1.4.2 needs to be revised extensively. AISI S904- 08 testing should not be required when actual connection tests are completed using AISI S905-08. Furthermore, actual strength tests should not be required as part of ongoing quality control testing. This type of quality control is commonly handled by material and hardness specification requirements. As stated in Table 1 of AC118, fastener dimensional and mechanical specification checks should be based upon the averages of the required sample size and this should be made clear in this section. Finally, it is inconsistent to require corrosion testing of proprietary fasteners when similar requirements are not required for arc-spot puddle welds, which are more destructive of the corrosion protection coatings and zinc galvanized steel deck. Similarly, there should be a requirement for corrosion testing of proprietary punch system connections, as these may also damage corrosion protective coatings and zinc galvanized steel deck. Regardless, if these types of steel deck connections are intended for interior use only as part of a built-up roof system or concrete floor deck system, and not subject to exterior exposure and moisture, then the corrosion performance data would not be useful and only an added cost burden on the applicant. There is nothing in the IBC 2009 prompting such a change in the corrosion test requirements for steel deck connections.		
Section 3.2.3			In the last sentence of this section regarding deflection limitations, was it intended to reference IBC Section 1604.3 rather than 1603.1?	
Section 3.3.1.1			In the last sentence of this section, we would suggest that the repeated Section "5-6c" be replaced with "5- 6d". This would be in accordance with the comments related to Cover Letter Items 1a and 1e above.	
Section 3.3.1.2		Hilti Comment E: Section 3.3.1.2 should include language as shown in Section 3.3.3.3 (2) of AC70 regarding the option for the applicant to submit test data in more than one steel tensile strength for the development of a mathematical relationship to capture the influence of steel deck and / or base steel tensile strength on diaphragm shear strength.		
Section 3.3.1.2.1	Why are power driven fasteners excluded? Power driven fasteners have been tested, evaluated and approved for use with the SDI DDM methodology. Therefore, we believe this exclusion should removed.		The small element connection tests conducted per AISI S905 in accordance with this section will usually result in an equation similar to those currently included in DDM03 that predicts connection strength or stiffness based on the variables t and F as they are relevant to the performance. In the event that the tests are based only on a single strength, then the results should be modified to reflect the specified strength. In most cases the tests cover a range of thicknesses, thus	Conditions of Acceptance (page 13) and Section 3.3.1.2.1 (Similar) AC States: As stated in section F1.1c of AISI S100, if the yield strength and thickness of the steel from which the deck panel test sections are formed are greater than the specified yield values, the test results shall be reduced. The adjustment factor R_s shall be as follows:

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	<p>This is already included in S905 as a reference to AISI S100 (Refer to Chapter 10, line 2). S100 does not define an equation for adjusting the material properties. It only requires that they be accounted for in the analysis.</p> <p>Also, this section is only describing design methods, not testing procedures or acceptance criteria. Therefore we believe it should be removed.</p> <hr/> <p>Last paragraph of this section, move to Section 4.2.2.1</p>		<p>the process of correlating the predictive equation with the test results will account for variations in thickness and eliminate the need for the proposed thickness adjustment, unless the tests are intended to be applied only to a single thickness. In the case of connection stiffness, steel strength would not be expected to influence the results, so only the variations in thickness would need to be considered.</p> <p>We would propose that provisions similar to those included in Section 3.3.3.3 of AC70 be utilized in lieu of those proposed in AC43.</p> <p><i>Connection design strengths derived from tests shall be adjusted for steel strength as follows:</i></p> <p><i>1. If tests have been conducted in one steel strength, the following relationship shall be used to derive the reduction factor for lesser steel strengths:</i></p> $R = 1 - [(F_u, \text{test} - F_u, \text{specified}) / 100]$ <p><i>2. If tests have been conducted in more than one steel tensile strength with the difference between the maximum and minimum tested steel tensile strengths,)fu, greater than or equal to 10 ksi (68.9 MPa), a relationship for the influence of steel tensile strength on fastener capacity may be derived from the test results. Maximum fastener capacity shall be limited to those values associated with the maximum tested steel tensile strength.</i></p> <p>An approach similar to paragraph 1 above could be utilized in the event the tests are only conducted on a single thickness for either strength or stiffness.</p>	$R_s = \frac{F_u (\text{specified})}{F_u (\text{actual})} \times \frac{t (\text{specified})}{t (\text{actual})} \leq 1.0$ <p>We disagree with how this is implemented into the acceptance criteria and believe that it is factually an incorrect interpretation of Section F1.1c. The second paragraph of section F of S100 specifically states that section F does not apply to diaphragms. Section F1.1c states that the tested results shall be adjusted down if the yield strength and thickness is greater than specified but does not mandate a linear method as is mandated in the acceptance criteria. Section F of S100 may provide some guidance in interpreting testing for diaphragms but is not required for diaphragms and diaphragms are specifically excluded.</p> <p>If the failure mode of the diaphragm is plate like buckling then the strength of the steel deck is not a factor in the ultimate capacity of the steel deck but the thickness is. The relationship between thickness and the point of buckling is non-linear, as demonstrated in equation 2.3-1 of DDM03. This demonstrates that applying a linear adjustment to the testing is not appropriate for buckling failure modes.</p> <p>Diaphragm tests connected with power drive fasteners also will exhibit non-linear behavior, with respect to the thickness of the steel deck, as exhibited in the SDI DDM03 design equations in which many fasteners strengths are predicted by an equation involving the square of the thickness.</p> <p>As more knowledge is developed around the thickness and strength relationships of fasteners for steel deck diaphragms, design equations may be developed that do not use a linear relationship and the acceptance criteria should not mandate this.</p> <p>The intent of F1.1c was to adjust for the thickness and strength of steel for a specific assembly type in which no better design theory exists. In the case of diaphragms, the testing is used to developed design equations that should account for strength and thickness of the steel or the testing should demonstrate that the strength and thickness does not influence the test.</p>
Section 3.3.1.2.2	This section is confusing and needs to be rewritten. (submitted a proposed rewrite.			
Section 3.3.2		<p>Hilti Comment F: Section 3.3.2 implies that the Diaphragm Test Method can only be used when Section 3.3.1 cannot apply. Developing an empirical evaluation of full-scale diaphragm system test data should always be allowed and encouraged by ICC-ES, as the full-scale diaphragm system testing provides the most accurate system level results. Steel deck roof and floor systems are also similar to cold-formed steel shear walls under AC230, which require both full-scale wall system evaluations and small scale connection tests. Why would ICC-ES require full-scale static and seismic load tests for a vertical diaphragm (shear wall), but not also for a horizontal diaphragm (steel deck roof system)? This seems contradictory and not consistent.</p>	<p>Many current evaluation reports report the shear flexibility of the diaphragm web, <i>F</i>, in lieu of or in addition to the shear stiffness, <i>G'</i>. We would suggest adding the following to the first sentence of the third paragraph of this section:</p> <p><i>The shear strength, Su, and shear stiffness, G', or shear flexibility, F, of the....</i></p>	
Section 4.1.2	<p>Section F1 is not used to determine the nominal resistance, <i>Rn</i>. The nominal resistance would either be calculated from Section C3.4, or derived from test results through a modified design procedure.</p> <p>Section F1 would be used to determine the applicable safety factor, omega, and resistance factor, phi, based on the test data.</p> <p>You may want to rewrite to state something like,</p>			

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	<p><i>If the safety (resistance) factor calculated using Section F1 of AISI S100 are less conservative than the published safety (resistance) factor published in the appropriate table in Section C3.4 of AISI S100, then the published value shall govern.</i></p> <hr/> <p>Rewording of phrase in last paragraph next to last sentence.</p> <p>"...material thickness(s) not tested shall use the test value of the next thinner material thickness."</p>			
Section 4.1.3				<p>Section 4.1.3 Special Conditions We do not dispute that the equations in section 4.1.3.1 and 4.1.3.2 may be acceptable way to modify the design equations in AISI S100 for web crippling but these are not the only acceptable way to modify these equations and may not be appropriate for some conditions. The comparison of tested strength to a modified analytical equation should be based on a stastical process using the basic concepts of the development of a resistance factor of a LRFD design basis by comparing the variation of the tested value to the theoretical value in the stastical analysis. Mandating one method to apply adjustment factors effectively creates a road block to any other alternate means or methods in an ICC-ES report. The criteria should apply a process to approve alternate means and methods not mandate a specific method.</p> <p>We believe the method outlined on the attached page 1 and 2 of 2 titled "Acceptance of Testing for Cold- Formed Steel Structural Members" is the appropriate method to compare all testing of similar assemblies to an analytical equation meeting the same level of confidence of section F of the AISI for the analysis of a singular assembly. This should be applied to all testing, not just web crippling, including methods to determine section properties for perforated decks, development of connection strengths and diaphragm shear testing.</p>
Section 4.2.1	<p>Insert text:</p> <p>...small-scale testing shall be conducted in accordance with AISI S905 and/ or....</p> <p>, as required by Section 3.3.1.</p>	<p>Hilti Comment G: Similar to Hilti Comment F, Section 4.2.1 implies that the Diaphragm Test Method can only be used when Section 3.3.1 cannot apply. Developing an empirical evaluation of full-scale diaphragm system test data should always be allowed and encouraged by ICC-ES as full-scale diaphragm system testing provides the most accurate system level results.</p>		
Section 4.2.2	<p>Add a section for Small Scale Tests.</p> <p>4.2.2: Small Scale Connection Tests Strength and stiffness of connections made using proprietary fasteners or mechanical devices shall be evaluated using the test setups and procedures described in AISI S905.</p> <p>4.2.2.1: Conditions of Acceptance [taken from 3.3.1.2.1] As indicated in Section 10.3 of AISI S905, if the Φ and Ω values determined for the tested connections are more severe than the values in AISI S100 Table D5, full-scale testing of the diaphragm system shall be required. When full-scale testing is required test and analytical data supporting derivation of diaphragm shear strength, diaphragm stiffness, factors of safety, and resistance factors shall be submitted. Factors of safety and resistance factors shall be no less critical than values in Section D5 of AISI-S100.</p>			
Section 4.2.8	<p>Move this to a new section 4.2.3.1 and create this as a sub section for the full-scale tests.</p> <hr/> <p>This, R_s, is covered in Section 12 of AISI S907 as it refers to Section F of AISI S100.</p>	<p>Hilti Comment H: Hilti is not sure what section number this is supposed to be as the number 4.2.8 has been crossed out. Hilti wishes to comment to the modifications made to the old Section 4.2.8 where modifications to AISI S907- 08 are discussed. Hilti agrees that some boundary conditions must be verified by testing, but it must also be understood by ICC-ES that obtaining steel samples in the minimum</p>	<p>The discussion regarding Section 3.3.1.2.1 is equally applicable for this section concerning full scale testing. Unless the full scale tests are only being used to evaluate the performance of a singular assembly, the full scale test results will be reconciled against an analytical model. Material strength and thickness are variables in those models. The tested strengths and thicknesses must be utilized to confirm the</p>	

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	S100 does not define an equation for adjusting the material properties. It only requires that they be accounted for in the analysis. Therefore, to define this equation here seems inappropriate.	tensile strengths for which recognition is sought is oftentimes very difficult and that strength reductions similar to what is provided in this section must be allowed. However, similar to Hilti Comment E, the manufacturer should be allowed to develop a more accurate relationship of steel tensile strength as allowed in AC70 Section 3.3.3.3 (2) as the equation provided in this proposed AC43 section and Section 3.3.1.2 has proven to be inaccurate.	validity of the model. Tables published based upon that model are required to reflect the specified strengths and thicknesses of the materials included in the report. Therefore application of the proposed reduction factors to individual results prior to reconciliation of the tests with the design model would be inappropriate. Use of the reduction factor(s) should be limited to tests of singular systems where steel strength and thickness are not intended to be variables. In the case where reduction factors are required, we would refer to the AC70 provisions referenced above for determination of the reduction factors.	
Section 4.4.4	Should this section reference the AWS D1.3 for the procedures for completing the weld and AISI S100 for the calculated strength?	Hilti Comment B: Section 4.4.4 The AC43 draft does not include a requirement for the ESR to describe the welding procedures in sufficient detail. No detailed information on the required welding equipment, settings, electrodes and arc flash time used in the diaphragm system tests is provided. This information should be included in the ESR (added to Section 6 of AC43), as it can vary substantially in the field on project sites. Structural Engineers need to know this information so that they can specify it accordingly on their design documents. The Building Officials and Inspectors need to be able to verify this on the project site.	<p>This section is proposing that the specific puddle weld procedure utilized in testing be included in the ICC reports. In current practice, deck manufacturers do not dictate to the installers the weld procedure, rather the ICC reports define the required result and the installer is required to establish the welding procedure used to attain that result. This permits the installer to determine and qualify the weld procedures they prefer to utilize to attain the specified result in accordance with the requirements of AWS D1.3 (or AISI S100). The building code requirement for special inspection of field welding is intended to insure the specified result is attained.</p> <p>We do not think it is appropriate for us as a product manufacturer or for ICC to be responsible for dictating means and methods to the installer by stipulating a specific welding procedure as the only permitted way to attain a specified end result. The code (AWS D1.3) does not define the capacity of a specific weld based on the means by which it is made, but rather on the end result. The code does provide a mechanism to determine various methods which may be used to attain a specified end result.</p> <p>By dictating specific means and methods, it seems responsibility and liability for field performance is shifted to the SER, material supplier, and ICC. In the past, installers have made it quite clear that were we as a manufacturer to dictate means and methods, i.e. welding procedures, they would attempt to shift responsibility for unfavorable results to those dictating the means and methods.</p> <p>The critical element in the weld performance is the fusion diameter, which has been reflected in ICC and ICBO reports for decades. This should remain the focus. We would request that the words "in the ICC-ES report" be deleted from the proposed wording for this section.</p>	The added requirement to list the electrode amperage, setting and flash time for welds used in the test shall be reported in the ICC-ES report, location of any weld defects such as cracks shall be reported. This should not be listed in the evaluation report. The weld electrode size, type of welding process, arc time, are not in any way related to the performance of the diaphragm provided that the correct weld size is used and correct filler metal strength is used. Amperage setting used by one welders techniques and the preference for one weld rod verses another is the welders responsibility as part of construction means and methods. It is appropriate to include this information in the test reports submitted to ICC-ES for review to demonstrate that the assemblies meet the minimum quality control requirements for welding as specified in the building code but must not be mandated in the ICC-ES report. An inspector will interpret this as the only acceptable procedure and, if mandated, may lead to inferior quality welds because of field conditions that are different that the lab conditions leading to weld quality issues that may compromise life safety of the installed product.
Section 4.4.5		Hilti Comment I: Hilti disagrees with Section 4.4.5. This requirement is not reasonable. ICC-ES AC70 provides a reliable model for what is required for data evaluation of power-actuated mechanical fasteners in steel connections. ICC-ES AC70 requires the fasteners to meet the manufacturer's specification and limits the hardness range of those specifications. The hardness and material specification control the strength of the fastener.	<p>Language has been added that dictates diaphragm system test results must be modified based on the ultimate tensile and shear strengths of the connectors used in the tests, apparently even if the fastener property in question is not the limiting behavior in the system performance. We would suggest that language similar to that included in Section 3.3.3.4 of AC70 be utilized which recognizes that the fastener material itself may not be critical to the system behavior. We would suggest something like:</p> <p><i>When failure is attributed to the power actuated fastener material, and the average core hardness of the fasteners, H_c, test, exceeds the minimum specified core hardness, H_c, by more than ten percent, fastener load test results shall be adjusted by the following reduction factor:</i></p> $R = H_c / H_{c, test}$ <p>An alternative version for screws could be based on the fastener strength, possibly similar to:</p> <p><i>When failure is attributed to the screw material, and the average strength the screws, Q test, exceeds the minimum specified strength, Q, by more than ten percent, fastener load test results shall be adjusted by the following reduction factor:</i></p>	

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			<i>R = Q/Q test</i>	
Section 5.1.3.5	Include ANSI/SDI-C1.0-06.		What does ICC consider applicable from these documents? Since Sections 2209.2.2 and 2209.2.3 say non- composite decks or roof decks "are permitted to be designed in accordance with...", and not "shall be designed in accordance with...", conformance with the Standards would not necessarily be mandatory.	
Section 5.4		Hilti Comment K: Hilti would request clarification of the change to Section 5.4. Will this now require quality documentation similar to what is required for screws and power-actuated mechanical fasteners for proprietary button punch systems as well? This is not a level playing field for all types of connection methods used in steel deck diaphragm construction.		
Section 5.6		Hilti Comment C: Section 5.6 AC10 quality documentation should be required for all steel deck connector types and steel deck products. This should be a level playing field with quality documentation for all connection types.		
Section 6.2			<p>ICC's willingness to drop the diaphragm design considerations in Section 6.2 and Table 2 (diaphragm flexibility limitations) in their entirety from the February draft, shows that they could be retained as optional rather than mandatory requirements. Thus Table 2 could be retained as a guide in lieu of an alternative analysis. This approach would seem to be consistent with the language of Section 12.1.2.2 of ASCE 7, which is already referenced in this section of the AC. We would also request that the final item in the design considerations should be expanded to include references to Sections 12.9.5 and 12.14.8.3 of ASCE 7 to reflect the inclusion of references to those sections in current reports. Proposed changes to Section 6.2 are shown below:</p> <p>6.2 Evaluation reports that include recognition of the steel deck panels for use in steel deck diaphragms shall include a table similar to Table 2 of this criteria and including, within a Diaphragm Design Considerations section of the report, requirements that the diaphragm design take into account the following:</p> <ul style="list-style-type: none"> • Diaphragm classification (flexible or rigid) shall comply with Section 1630.6 of the UBC or Section 1602 of the IBC; the diaphragm deflection (δ) shall be calculated using the equations noted in the Diaphragm Flexibility Limitations Table (Table No. XXX). • Diaphragm flexibility limitations in Table xx are permitted to be used as a guide in lieu of an alternative analysis shall comply with the table. • Diaphragm deflection limits shall comply with Section 1633.2.9 of the UBC or Sections 12.10.1 and 12.12.2 of ASCE 7. • Horizontal shears must be distributed in accordance with Sections 1630.6 and 1630.7 of the UBC or Sections 12.8.4, 12.9.5, or 12.14.8.3 of ASCE 7. 	
Table 1			All referenced standards except those from ASTM include the revision dates, while Table 1 is included for ASTM standard revision dates. Since there is no longer a need to differentiate between the UBC and IBC references, consider deleting Table 1 and including the revision dates in the ASTM Standard numbers in Section 1.3.10 of AC43.	
Table 2			ICC's willingness to drop the diaphragm design considerations in Section 6.2 and Table 2 (diaphragm flexibility limitations) in their entirety from the February draft, shows that they could be retained as optional rather than mandatory requirements. Thus Table 2 could be retained as a guide in lieu of an alternative analysis. This approach would seem to be consistent with the language of Section 12.1.2.2 of ASCE 7, which is already referenced in this section of the AC. We would also request that the final item in the design considerations should be expanded to include references to Sections 12.9.5 and 12.14.8.3 of ASCE 7 to reflect the inclusion of references to those	<p>Table 2 – Diaphragm Limitations Table The diaphragm flexibility limitations table should be removed and replaced with language following the IBC requirements for building deflection and deformation compatibility.</p> <p>Recommended language:</p> <p><i>The diaphragm length and width shall be limited by; 1) engineering mechanics 2) the applied loads 3) shear capacity of the diaphragm 4) the diaphragm shear deflection limited by the requirements of ASCE 7</i></p>

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			<p>sections in current reports. Proposed changes to Section 6.2 are shown below:</p> <p>6.2 Evaluation reports that include recognition of the steel deck panels for use in steel deck diaphragms shall include a table similar to Table 2 of this criteria and including, within a Diaphragm Design Considerations section of the report, requirements that the diaphragm design take into account the following:</p> <ul style="list-style-type: none"> • Diaphragm classification (flexible or rigid) shall comply with Section 1630.6 of the UBC or Section 1602 of the IBC; the diaphragm deflection (δ) shall be calculated using the equations noted in the Diaphragm Flexibility Limitations Table (Table No. XXX). • Diaphragm flexibility limitations in Table xx are permitted to be used as a guide in lieu of an alternative analysis shall comply with the table. • Diaphragm deflection limits shall comply with Section 1633.2.9 of the UBC or Sections 12.10.1 and 12.12.2 of ASCE 7. • Horizontal shears must be distributed in accordance with Sections 1630.6 and 1630.7 of the UBC or Sections 12.8.4, 12.9.5, or 12.14.8.3 of ASCE 7. 	<p><i>in Sections 12.8.6 entitled, "Story Drift Determination" and Section 12.12 entitled, "Drift and Deformation". The shear deflection is based on the stiffness or flexibility factors for the diaphragm and equations of mechanics.</i></p> <p><i>The shear deflection equations of mechanics, diagrams, notations, and symbols in Attachment (attachment showing common equations of engineering mechanics for deflection based on shear stiffness, G, or flexibility factor, f) shall be included in the evaluation report as an aid to designers in determining the diaphragm deflection. The total diaphragm deflection shear web deflection and flexural deflection shall only be considered for diaphragms with aspect ratios large enough to validate slender beam theory. Slender beam theory may be used to determine the flexural deflection and the equations in attachment B may be used to determine the shear web deflection.</i></p> <p>The diaphragm limitations table is a legacy of the seismic design requirements for the tri-services manual based on late 1970's SEAOC Blue Book recommendations. This table in section 5.4 of chapter 13 was not specific to steel deck, it applied to all common horizontal diaphragm materials including steel deck, plywood, diagonal sheeting, skip sheeting, and concrete. The current IBC model prescribes an analytical approach to deterring acceptable story drift and deformation compatibility between vertical and horizontal elements of a structure. The IBC code model has evolved beyond an empirical table because the computational capabilities available to engineers today are for superior to the method available to engineers in the late 1977's and early 1980's. The requirement for steel deck to meet out dated diaphragm limitations for all horizontal diaphragm materials that are no longer required for other material such as plywood and OSB is not reasonable.</p>
<p>Table 3</p>	<p>Why is the calculated DDM03 excluded on the Standard deck welded to supports for Crimps or etc. on side seam?</p>	<p>Hilti Comment L: Table 3 in the proposed AC43 needs to be clarified. Full-scale diaphragm system tests per AISI S907-08 should remain as a test requirement for any "new" fastening systems, connectors or steel deck profiles that vary substantially from the original design method equations or from what has been previously tested and evaluated.</p> <p>It is unclear from Table 3 whether ICC-ES is implying that any steel deck manufacturer applicants that only present diaphragm shear data with arc spot puddle welds, "generic" button punches and "generic" screws do not need to hold AC43 ESR's or not. In other words, if a manufacturer was only going to use SDI DDM design method calculations and refer to DDM03, then why would they need to hold an ICC ESR at all? This comment was made to ICC-ES at the February 2010 public hearing, but there doesn't seem to be a clear distinction being made as to when and why a steel deck or fastener manufacturer would have to hold an AC43 report. Alternatively, if the Steel Deck Institute (SDI) held one AC43 report for all steel deck manufacturer members, similar to the Steel Stud Manufacturers Alliance (SSMA), would this then relieve members from having to hold individual AC43 ESR's for their products?</p> <p>Table 3 should always allow for the option to test according to AISI S905-08 and AISI S907-08 whether the fastening system and steel deck products are considered "proprietary" or not. The resulting predictive equations developed for diaphragm shear strength and stiffness should correlate to 95% or greater accuracy with the test data. This will allow for continued research into the accuracy of the steel deck diaphragm model and support further developments of innovative building products in the industry.</p> <p>Finally, footnote 3 of Table 3 says, "...submitted by deck manufacturer". This should be revised to "submitted by the applicant", as some AC43 report holders and applicants are not deck manufacturers.</p>	<p>The requirements for small element vs. large scale testing has been clarified in the proposed AC as summarized in Table 3. The currently proposed approach requires no large scale confirmatory tests as long as small element tests are conducted and the diaphragm values are calculated per the SDI DDM03. While DDM03 does contain language which essentially states that the formulas in the manual may be applied to fasteners whose small element test performance falls within the range of those of the fasteners covered in DDM03, it had been customarily understood that some confirmatory large scale tests were to be done with a new fastener or system. Diaphragm testing done under Section 4.2.3 of AC43 is required to include end laps in the tests if end laps are used in the field. Except for very small structures, end laps in roof deck construction are pretty much a given. Unless the end lap consideration is addressed in some other way, full scale confirming tests which comply with Section 4.2.3 would provide a way to address this requirement. As another point for consideration, do small element fastener tests alone accurately predict the system behavior for high strength steels? We suggest retention of a requirement for some confirming large scale tests for the introduction of new systems.</p>	

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Misc 1		Hilti Comment J: As proprietary button punch system and generic button punch fastenings do not undergo nearly the level of quality control required by ICC-ES and are essentially similar to arc-spot puddle welds with respect to field quality control, these fastenings should be treated like arc-spot puddle welds and similarly require special inspection.		