#12

American Iron and Steel Institute

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February 1, 2010

J. David Musselwhite, P.E.
Senior Staff Engineer
ICC Evaluation Service, Inc.
900 Montclair Road, Suite A
Birmingham, AL 35213

Re: Responses to "Proposed Revisions to the Acceptance Criteria for Steel Deck Roof and Floor Systems, Subject AC43-210-R1 (DM/WM)"

Dear Mr. Musselwhite:

We appreciate ICC Evaluation Services providing us the opportunity to review and submit comments to the Proposed Revisions to the Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43). Following our committee operation procedures, I believe that we will not be able to move all of our responses through the committee review and approval process that is required by our ANSI authorized standards writing body and still meet the deadline. In this letter, I have identified items that AISI will address and provided responses to those items that do not need committee action. The rest of the responses will be discussed by the committee at our February 16-18, 2010 meetings, and will be forwarded to you after the meetings.

Sincerely,

Helen Chen

Helen Chen, Ph.D., P.E., LEED AP
Secretary, AISI Committee on Specifications
American Iron and Steel Institute

Question c-iv:

iv. Section 8.2.2.3 of AISI S905-08 states, "The edge dimension (w/2) perpendicular to the line of force shall be no greater than 2d when this is representative of the product design." This is a new requirement, not in the previous standard TS 5-02. ICC-ES staff questions whether the phase "no greater than" is incorrect and should be replaced with "no less than 2d" since Table 1 states the value for "w" for different fastener diameters, and at no time will the requirement as stated in Section 8.2.2.3 be satisfied if Table 1 is followed. Industry is asked to comment."

Response:
This question will be considered by the AISI Committee and will provide response later.

Question c-vii:

vii. Sections 9.1.2 and 9.1.3 of AISI S905-08 provides for both manual and computerized test systems. The computerized system has limits on the speed of the machine head and rate cause by loading (i.e., 500 pounds per minute). The manual system does not have a load rate stated, other than load increments of 1/5 the estimated maximum load and a hold time of at least one minute. Industry comments are requested as to whether both procedures are equal.

Response:
This question will be considered by the AISI Committee and will provide response later.

Question c-Viii-1:

viii. There are several items concerning AISI S905-08 that ICC-ES request industry comment on. They are as follows:

1. Neither TS 5-02 nor S905-08 specifically address when to use test setups in Figures 1, 2(a) and 2(b). Therefore, what test setup should be used for deck to support connection? What test setup should be used for side lap connections? It would appear that Figure 1 is for support fasteners and side lap fasteners when the connector is in the bottom trough and not at elevated side laps. However, when is Figure 2(a) used instead of Figure 2(b) for elevated side laps?

Response:
This question will be considered by the AISI Committee and will provide response later.

Question 4-e:

e. The diaphragm net deflection Equation 2 in AC43 does not match Equation 2 in AISI S907. The question is, "Which equation is correct?" ICC-ES believes that the equation in AC43 is the

correct and is a conservative approach. The industry is requested to provide information that establishes the correct equation.

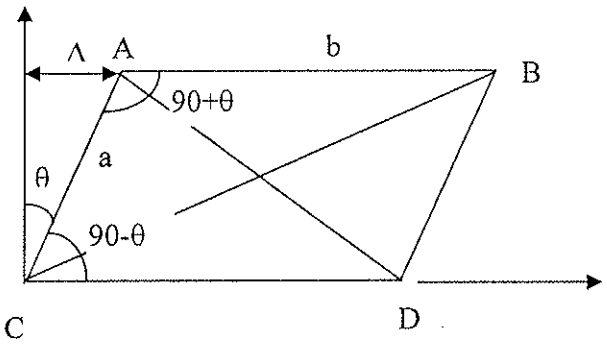
$$\Delta_n = (|\Delta_1| + |\Delta_2|)\frac{b}{2\sqrt{a^2+b^2}} \qquad \text{(Eq.-2)}$$

The one above is from AC43. The one below is from AISI S907-08

$$\Delta_n = (|\Delta_1| + |\Delta_2|)\frac{\sqrt{a^2+b^2}}{2b} \qquad \text{(Eq.-2)}$$

Response:

The following derivation is provided which supports (Eq.-2)



In the figure above

$\Delta = a\sin\theta$ This is the deflection that we are interested.

From triangle ABC,

$$L_{BC} = \sqrt{a^2+b^2-2ab\cos(90+\theta)} = \sqrt{a^2+b^2+2ab\sin\theta}$$

From triangle ADC,

$$L_{BC} = \sqrt{a^2+b^2-2ab\cos(90-\theta)} = \sqrt{a^2+b^2-2ab\sin\theta}$$

$$|\Delta_{BC}| = L_{BC} - \sqrt{a^2+b^2};$$

$$|\Delta_{AD}| = \sqrt{a^2+b^2} - L_{AD}$$

$$|\Delta_{BC}| + |\Delta_{AD}| = L_{BC} - \sqrt{a^2+b^2} + \sqrt{a^2+b^2} - L_{AD}$$

$$= \sqrt{a^2+b^2+2ab\sin\theta} - \sqrt{a^2+b^2-2ab\sin\theta}$$

$$= \frac{(\sqrt{a^2+b^2+2ab\sin\theta} - \sqrt{a^2+b^2-2ab\sin\theta})(\sqrt{a^2+b^2+2ab\sin\theta} + \sqrt{a^2+b^2-2ab\sin\theta})}{\sqrt{a^2+b^2+2ab\sin\theta} + \sqrt{a^2+b^2-2ab\sin\theta}}$$

$$= \frac{(a^2+b^2+2ab\sin\theta) - (a^2+b^2-2ab\sin\theta)}{\sqrt{a^2+b^2+2ab\sin\theta} + \sqrt{a^2+b^2-2ab\sin\theta}} = \frac{4ab\sin\theta}{\sqrt{a^2+b^2+2ab\sin\theta} + \sqrt{a^2+b^2-2ab\sin\theta}}$$

Since absinθ is much smaller in quantity as compared to a^2+b^2, the denominator can be approximated to $2\sqrt{a^2+b^2}$

Consequently,

$$|\Delta_{BC}|+|\Delta_{AD}|=\frac{4ab\sin\theta}{2\sqrt{a^2+b^2}}=\frac{2ab\sin\theta}{\sqrt{a^2+b^2}}=\frac{2b\Delta}{\sqrt{a^2+b^2}}$$

or

$$\Delta=(|\Delta_{BC}|+|\Delta_{AD}|)\frac{\sqrt{a^2+b^2}}{2b}$$

#12

Removal of Tri-Services Manual (TM5-809-10) as an AC43 Reference

As this country's Standards and Testing Procedures evolve, we, as design professionals and Industry Suppliers and Building Code Officials and Certification Agencies; we must keep up with changes to safely and effectively bring the best engineering practices and principles to the people. Not only have design standards changed but more specifically the Diaphragm Shear Strength and Flexibility (Stiffness) Standards and their testing procedures as well all have changed over the last 25 to 30 years. Standard Groups (such as AISI, SDI, ASCE, etc.) have always come forward to continually revise outdated methods and antiquated procedures. The diaphragm shear strength and stiffness standards as well as product testing procedures used to develop these Standards are no exception.

Let's break down this argument by presenting facts and specific reasons on whether to keep or rescind the use of this outdated TSM (TM5-809-10) from the AC43 as a Reference Document. We have identified several reasons as follows:

Reasons to Rescind TSM from the AC43

1. Can **NOT** adequately evaluate individual fastener strengths or other components of the diaphragm based on predicted failure modes resulting from testing
2. TSM does **NOT** consider "Panel Buckling" as a 'Limit State'
3. **NO** Safety Factors stated for Working Shear values
4. **NO** direct/indirect correlation can be made between TSM and SDI DDM03 Diaphragm Shear values and the two documents can **NOT** be compared which leads to a double standard. AISI will be choosing the SDI DDM03.
5. **NO** known method to convert TSM Working Shear to more common and universal Factored Nominal Shear Strength or Allowable Strength Design Shear
6. Can **NOT** apply "Allowable Stress Design" (ASD) and "Load and Resistance Factor Design (LRFD) Limit State to so-called TSM Working (Allowable???) Shear values
7. Can **NOT** perform evaluations of Proprietary Fasteners
8. Sample Testing to determine Design Formulas were established under **OUTDATED** procedures and were **NEVER** retested to current procedures and/or practices
9. Can **NOT** determine Flexibility of Individual Fasteners
10. Flexibility (Stiffness) can still be derived through SDI Stiffness (G') Equations
11. Diaphragm Shear capacity should be different for 1, 2 or 3 span conditions but **NOT** according to TSM, they are the same. This creates major conflicts for designers.
12. TSM does **NOT** isolate failure modes
13. TSM (1982) is **NOT** a "Consensus" Standard
14. TSM (1982) is **NOT** an ANSI Standard
15. TSM (1982) has **NEVER** gone through a Balloting Process
16. TSM (1982) has **NEVER** been reviewed since its acceptance in 1975 or officially approved by Industry, Academia, Standards Organizations, etc.
17. TSM (1982) was created as a "Military Standard" developed for military structures
18. TSM (1982) method and procedures have **NOT** been updated since 1975 **(35 years)** and after that with only minor editorial changes since 1982
19. TSM (1982) has **NO** plans to be updated by any Organization
20. TSM (1982) is considered a **"DEAD"** document vs. SDI DDM03 as being a **"LIVING"** document
21. AISI is currently developing a Diaphragm Standard through the ANSI process
22. Removal of TSM doesn't mean retesting will be mandatory

Respectfully Submitted,
METAL DEK GROUP, a unit of CSi

Allan A. Abbata, P.E.
Engineering Manager, Research & Development
Emailed to: Mr. David Musselwhite
(dmusselwhite@icc-es.org)

#12

STEEL DECK INSTITUTE

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January 28, 2010

Mr. J. David Musselwhite, P.E.
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900 Montclair Road, Suite A
Birmingham, AL 35213

SUBJECT: Proposed Revisions to Acceptance Criteria for Steel Roof Deck and Floor Systems, Subject AC430210-R1

Dear Mr. Musselwhite:

The Steel Deck Institute welcomes the opportunity to work more closely with ICC-ES in the development of Acceptance Criteria for Steel Roof Deck and Floor Systems (AC43). However, at this time, SDI requests ICC-ES to postpone approval of the proposed subject revisions to AC43 until we have more time to review and comment on these extensive changes.

This delay will allow us time to formulate detailed responses to the technical questions and issues. For example, SDI has several members that are currently serving on AISI Sub-Committee 33 that has been working on a new diaphragm design standard for a number of years. This standard is currently out for ballot and is nearing completion.

We believe ICC-ES should still update AC43 to include IBC 2009, including any required changes involving steel roof deck and floor systems, but address the remaining technical issues at future hearings.

Thank you for your consideration of this request.

Sincerely,

Steven A. Roehrig

Steven A. Roehrig
Managing Director

SAR/lwr

ICC-ES AC43 Hearing

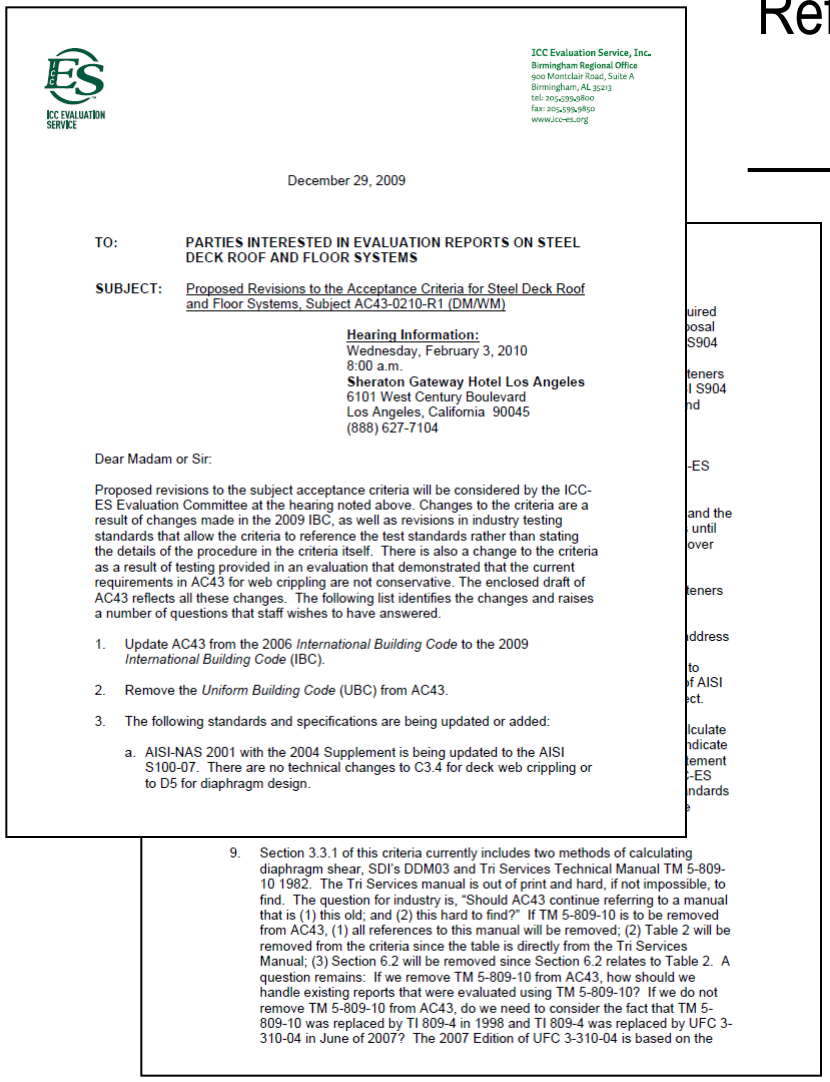
Proposed Removal of TM 5-809-10

February 3, 2010

Keith Cullum

VERCO DECKING, INC.
a NUCOR company

Removal of TM 5-809-10



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ICC EVALUATION SERVICE

December 29, 2009

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON STEEL DECK ROOF AND FLOOR SYSTEMS

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

Hearing Information:
Wednesday, February 3, 2010
8:00 a.m.
Sheraton Gateway Hotel Los Angeles
6101 West Century Boulevard
Los Angeles, California 90045
(888) 627-7104

Dear Madam or Sir:

Proposed revisions to the subject acceptance criteria will be considered by the ICC-ES Evaluation Committee at the hearing noted above. Changes to the criteria are a result of changes made in the 2009 IBC, as well as revisions in industry testing standards that allow the criteria to reference the test standards rather than stating the details of the procedure in the criteria itself. There is also a change to the criteria as a result of testing provided in an evaluation that demonstrated that the current requirements in AC43 for web crippling are not conservative. The enclosed draft of AC43 reflects all these changes. The following list identifies the changes and raises a number of questions that staff wishes to have answered.

1. Update AC43 from the 2006 *International Building Code* to the 2009 *International Building Code* (IBC).
2. Remove the *Uniform Building Code* (UBC) from AC43.
3. The following standards and specifications are being updated or added:
   a. AISI-NAS 2001 with the 2004 Supplement is being updated to the AISI S100-07. There are no technical changes to C3.4 for deck web crippling or to D5 for diaphragm design.

9. Section 3.3.1 of this criteria currently includes two methods of calculating diaphragm shear, SDI's DDM03 and Tri Services Technical Manual TM 5-809-10 1982. The Tri Services manual is out of print and hard, if not impossible, to find. The question for industry is, "Should AC43 continue referring to a manual that is (1) this old; and (2) this hard to find?" If TM 5-809-10 is to be removed from AC43, (1) all references to this manual will be removed; (2) Table 2 will be removed from the criteria since the table is directly from the Tri Services Manual; (3) Section 6.2 will be removed since Section 6.2 relates to Table 2. A question remains: If we remove TM 5-809-10 from AC43, how should we handle existing reports that were evaluated using TM 5-809-10? If we do not remove TM 5-809-10 from AC43, do we need to consider the fact that TM 5-809-10 was replaced by TI 809-4 in 1998 and TI 809-4 was replaced by UFC 3-310-04 in June of 2007? The 2007 Edition of UFC 3-310-04 is based on the

Refer to Item 9 (pp 6-7) of Mr. Musselwhite's letter dated December 29, 2009.

Two Issues:

1. Manual as an acceptable design methodology
2. Table 2 as an alternative to a rational deflection analysis

Removal of TM 5-809-10

1. As an Acceptable Design Methodology

- Current ICC-ES Reports
- Industry Testing
- Conservative
- Successive Documents & Building Codes
- AISI Test Standards

Removal of TM 5-809-10

2. In Lieu of a Rational Analysis for Deflection

Table 2 of AC43
(Table 5-1 of TM)

TABLE 2—DIAPHRAGM FLEXIBILITY LIMITATIONS TABLE[1,2,3,4,5]

F	MAXIMUM DIAPHRAGM SPAN FOR MASONRY OR CONCRETE WALLS (feet)	DIAPHRAGM SPAN-DEPTH LIMITATION			
		Rotation Not Considered in Diaphragm		Rotation Considered in Diaphragm	
		Masonry or Concrete Walls	Flexible Walls	Masonry or Concrete Walls	Flexible Walls
More than 150	Not used	Not used	2:1	Not used	1 1/2:1
70-150	200	2:1 or as required for deflection	3:1	Not used	2:1
10-70	400	2 1/2:1 or as required for deflection	4:1	As required for deflection	2 1/2:1
1-10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	3 1/2:1

For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.594 N/m, 1 psi = 6894 Pa.

[1]Diaphragms are to be investigated regarding their flexibility and recommended span-depth limitations.
[2]Diaphragms supporting masonry or concrete walls are to have their deflections limited to the following amount:

$$\Delta_{wall} = \frac{H^2 f_c}{0.01 Et}$$

where:

H = Unsupported height of wall in feet.
t = Thickness of wall in inches.
E = Modulus of elasticity of wall material for deflection determination in pounds per square inch.
f_c = Allowable compression strength of wall material in flexure in pounds per square inch. For concrete, $f_c = 0.45\, f'_c$. For masonry, $f_c = F_b = 0.33\, f'_m$.

[3]The total deflection Δ of the diaphragm may be computed from the equation: $\Delta = \Delta_f + \Delta_w$

where:

Δ_f = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams
Δ_w = The web deflection may be determined by the equation:

$$\Delta_w = \frac{q_{ave} L F}{10^6}$$

where:

L = Distance in feet between vertical resisting element (such as shear wall) and the point to which the deflection is to be determined.
q_{ave} = Average shear in diaphragm in pounds per foot over length L.
F = Flexibility factor: The average micro inches (μm) a diaphragm web will deflect in a span of 1 foot (m) under a shear of 1 pound per foot (N/m).

[4]When applying these limitations to cantilevered diaphragms, the allowable span-depth ratio will be half that shown.
[5]Diaphragm classification (flexible or rigid) and deflection limits shall comply with the Diaphragm Design Considerations section of the evaluation report.

Removal of TM 5-809-10

2. In Lieu of a Rational Analysis for Deflection

Table 2 is Referenced in 2007 CBC for DSA & OSHPD:

Wood

1604A.3.7.2 Horizontal diaphragms. The maximum span-width ratio for any roof or floor diaphragm shall not exceed those given in Table 2305.2.3 or ICC-ES AC43 unless test data and design calculations acceptable to the enforcement agency are submitted and approved for the use of other span-width ratios. Concrete diaphragms shall not exceed span-width ratios for equivalent composite floor diaphragms in ICC-ES AC43.

Steel Deck & Concrete

Removal of TM 5-809-10

ICC staff comment in memo dated 1/25/2010:

"Item 5: One writer requested that ASTM E72 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 E72 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."

VERCO DECKING, INC.
a NUCOR company

Removal of TM 5-809-10

If TM 5-809-10 Removed:

- Structured phase-out
- New ICC-ES reports cannot reference it
- Existing ICC-ES reports expiration date
  - Same date for all reports
  - Must give sufficient time

Thank You

#12

Wheeling Corrugating

DAVID W. BOLTZ
DIRECTOR QUALITY AND
PRODUCT ENGINEERING
WHEELING CORRUGATING COMPANY

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FAX: 304-234-2343
BOLTZDW@WHEELINGCORRUGATING.COM

January 28, 2010

Attn: J. David Musselwhite, P.E.
Senior Staff Engineer
ICC Evaluation Service, Inc.
Birmingham Regional Office
900 Montclair Road, Suite A
Birmingham, AL 35213

SUBJECT: Proposed Revisions to Acceptance Criteria for Steel Deck Roof and Floor Systems, Subject AC430210-R1

Dear Mr. Musselwhite,

I as well as many other ESR report holders need more time to review the proposed extensive technical changes to AC43, but I will attempt to comment on the important points of interest, that if ignored could result in more problems for ICC-ES and Current Report holders in the future.

AC43 Acceptance Criteria makes several references to AISI documents. AISI Sub-Committee 33 has been working on a New Diaphragm Design Standard for quite some time now. Much effort has been put into this project by the AISI Committee. It is currently out for ballot, and approaching completion. Since the main scope of AC43 is diaphragm shear resistance, I urge ICC-ES to wait until this New Standard is completed to allow it to be referenced in AC43. I realize there are items such as the implementation of the 2009 IBC, that need to changed at this time, but there are no life safety issue's that require the body of the current AC43 to be changed at this time, from it's current form.

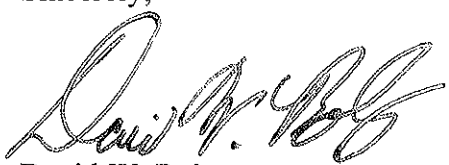
Wheeling's current ESR-1116 report as well as many other Manufactures existing ICC-ES reports are based on the TRI-SERVICES METHOD, TM 5-809-10, as well as SDI Methodology where applicable. Our report is primarily developed from extensive full scale testing for diaphragm shear, analyzed using TM 5-809-10 methodology.

We have spent a significant amount of time and finance to develop useful and conservative tables that conform to current AISI standards. These tables and calculations were reviewed and accepted by ICC-ES, during the last renewal, as recently as 2008. Diaphragms from ESR-1116, and others using the TRI-SERVICES METHOD, have performed very well in the past. As stated above, there are no life safety issues that require or justify the removal of the TRI-SERVICES METHOD from AC43. Not to mention the countries current economy, our markets have been devastated, and there simply is not finance available to justify what would have to be done if the current ESR reports that reference the TRI-SERVICES METHOD were not accepted.

There are, as this response is being written, diaphragms being constructed using ICC-ESR reports based on the TRI-SERVICES METHOD, and quantitatively there have been thousands upon thousands of structures built with ICC-ESR reports based on the TRI-SERVICES METHOD. As far as availability of TM 5-809-10, anyone submitting calculations or data based on the TRI-SERVICES METHOD, TM 5-809-10 would have a copy, or could submit it upon ICC-ES evaluation of the backup calculations, test data, etc. in order to renew a current ESR report. I will gladly send ICC-ES a copy of the TRI-SERVICES METHOD, TM 5-809-10, the methodology is written in black and white. I would think that the removal and or dismissal of current ESR reports using the TRI-SERVICES METHOD would turn in to a legal issue for ICC-ES. The current reports are based on full scale test, mathematical equations, and the tables were developed with the current AISI Safety Factors. The current ICC-ES ESR report design tables are still and will be valid for many years, justified by extensive testing and calculations.

We as Steel Deck Manufactures set on many design committees for AISI, SDI, etc., and volunteer our time, experience and expense to provide engineers, code developers, architects, and erectors engineered product data that is useful and safe for construction. Accepted past practice as well as new research needs to be kept in mind (e.g. acoustical decks, cellular decks, deep decks, web crippling, connections, etc.), to make this Acceptance Criteria both useful and reasonable to Steel Deck Manufactures, and it's Associates that hold current Evaluation Reports, as well as those developing new innovations that will require new evaluation reports.

Sincerely,



David W. Boltz
Director of Quality and Product Engineering