National Type Evaluation Program (NTEP)
Weighing Sector Meeting Summary

August 25-26, 2015 / Denver, CO

INTRODUCTION

The charge of the NTEP Weighing Sector is important in providing appropriate type evaluation criteria based on specifications, tolerances and technical requirements of NIST Handbook 44 Sections 1.10. General Code, 2.20 Scales, 2.22 Automatic Bulk Weighing Systems, and 2.24 Automatic Weighing Systems. The Sector's recommendations will be presented to the National Type Evaluation Program (NTEP) Committee each January for approval and inclusion in *NCWM Publication 14 Technical Policy, Checklists, and Test Procedures* for national type evaluation.

The Sector is also called upon occasionally for technical expertise in addressing difficult NIST Handbook 44 issues on the agenda of National Conference on Weights and Measures (NCWM) Specifications and Tolerances (S&T) Committee. Sector membership includes industry, NTEP laboratory representatives, technical advisors and the NTEP Administrator. Meetings are held annually, or as needed and are open to all NCWM members and other registered parties.

Suggested revisions are shown in **bold face print** by ~~**striking out**~~ information to be deleted and **underlining** information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***.

Table A
Table of Contents

Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
ABWS	Automatic Bulk Weighing Systems	NCWM	National Conference on Weights and Measures
AREMA	American Railway Engineering Maintenance-of-Way Association	NTEP	National Type Evaluation Program
AWS	Automatic Weighing Systems	OIML	International Organization of Legal Metrology
CC	Certificate of Conformance	OWM	Office of Weights and Measures
DES	Digital Electronic Scales	R	Recommendation
IZSM	Initial Zero-Setting Mechanism	SS	National Type Evaluation Program Software Sector
LMD	Liquid Measuring Device	S&T	Specifications and Tolerances Committee
MC	Measurement Canada	SMA	Scale Manufacturers Association
MRA	Mutual Recognition Agreement	WS	National Type Evaluation Program Weighing Sector

Details of All Items
(In order by Reference Key)

CARRY-OVER ITEMS

1. Recommended Changes to NCWM Publication 14 Based on Actions at the 2015 NCWM Annual Meeting

Source:
Mr. Richard Harshman, National Institute of Standards and Technology (NIST) Technical Advisor provided the Sector with specific recommendations for incorporating test procedures and checklist language based upon actions of the 2015 NCWM Annual Meeting. The Sector is asked to briefly discuss each item and, if appropriate, provide general input on the technical aspects of the issues.

1.a. Item 310-2 G-UR.4.1. Maintenance of Equipment.

Source:
2015 S&T Committee Final Report

Background / Discussion:
At the 2015 NCWM Annual Meeting, NCWM voted to amend NIST Handbook 44 (HB 44) paragraph G-UR.4.1. Maintenance of Equipment as follows:

> **G-UR.4.1. Maintenance of Equipment.** – All equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service at a single place of business ~~**found to be in error predominantly in a direction favorable to the device user (Also see the Introduction, Section Q**~~) shall not be considered "maintained in a proper operating condition~~.~~" **if:**
>
> **a. predominantly, equipment of all types or applications are found to be in error in a direction favorable to the device user, or**
>
> **b. predominantly, equipment of the same type or application is found to be in error favorable to the device user.**
>
> (Amended 1973**,** ~~**and**~~ 1991**, and 2015**)

Recommendation: Mr. Harshman, NIST Technical Advisor, believes that no changes are required for *NCWM Publication 14* and that no further actions by the Weighing Sector are necessary. This item was included on the Sector's agenda to make members aware of the changes to the paragraph. The S&T Committee's interpretation of the second sentence of paragraph G-UR.4.1., in consideration of the changes that were adopted, is that predominance could be applied to equipment of the same type (e.g., all of the retail motor fuel dispensers at a fueling station) and the same application (e.g., all devices, regardless of type, used in a commercial application) at a single place of business.

1.b. Item 320-1 T.N.3.5. Separate Main Elements.

Source:
2015 S&T Committee Final Report

Background / Discussion:

At the 2015 NCWM Annual Meeting, NCWM voted to amend HB 44 Scales Code paragraph T.N.3.5. Separate Main Elements: Load Transmitting Element, Indicating Element, Etc. as follows:

> **T.N.3.5. Separate Main Elements: Load Transmitting Element, Indicating Element, Etc**. – If a main element separate from a **complete** weighing device is submitted for **laboratory** type evaluation, the tolerance for the **main** element is 0.7 that for the complete weighing device. This fraction includes the tolerance attributable to the testing devices used.

Recommendation: Scales Code Paragraph T.N.3.5. is referenced in NCWM Publication 14 DES Section 57 Device Tolerances and has been copied below. Footnote 6, which appears beneath the tolerances table in Section 57 explains how tolerances are to be applied to separate main elements.

57. Device Tolerances

Code References: G-T.1. (e), T.N.3.2., T.N.3.5. and Table 6.

The acceptance tolerances for complete scales are shown below and apply to complete devices and separable main elements during type evaluation.

Acceptance Tolerances (All values in this table are in scale divisions)				
Tolerance in scale divisions				
Complete Devices	0.5	1.0	1.5	2.5
Separable Main Elements[6]	0.35	0.7	1.05	1.75
Separable Indications w/o Expanded Resolution	0	0	1	1
Class	Test Load			
I	0 - 50 000	50 001 - 200 000	200 0001 +	
II	0 - 5 000	5 001 - 20 000	20 0001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1/2d for each additional 500d or fraction thereof)	

It is strongly recommended that indicating elements submitted separately for evaluation have a test mode providing reading indications to 0.1e to provide adequate resolution to apply the tolerance (expanded resolution). If the indicator provides indications to only the maximum number of divisions requested for the Certificate of Conformance, the tolerance will be truncated to the number of divisions that can be indicated.

[6] When main elements (indicating elements and weighing/load-receiving elements) are tested separately, the tolerance applied to all laboratory tests (influence factors and permanence tests) are 0.7 times the acceptance tolerance for complete scales.

Mr. Harshman believes that footnote 6 adequately explains how tolerances are to be determined for main elements evaluated separately and that no changes are needed. However, the Sector might consider amending footnote 6 as follows to be consistent with the changes to T.N.3.5. that were adopted:

> [6] When main elements (indicating elements and weighing/load-receiving elements) are tested separately **from a complete weighing device**, the tolerance applied to all laboratory tests (influence factors and permanence tests) **of those main elements shall be** ~~are~~ 0.7 times the acceptance tolerance **applicable to** ~~for~~ complete scales.

1.c. Item 320-5 Part 2.20. Weigh-In-Motion Vehicle Scales for Law Enforcement – Work Group

Source:
2015 S&T Committee Final Report

Background / Discussion:
At the 2015 NCWM Annual Meeting, NCWM voted to adopt a new HB 44 device code applicable to weigh-in-motion systems used for vehicle enforcement screening and include it in Section 2 of HB 44 assigning it a new code reference number "2.25." The new code was adopted as "tentative," meaning that it will be in a trial or experimental status and not intended to be enforced until such time that the tentative status is removed. Removal of the tentative status requires NCWM adoption of a proposal to remove it, which would then make the code fully enforceable. Definitions of terms used in the code were also adopted in support of the new code and will appear at the end of the code. The new code, titled "Weigh-In-Motion Vehicle Scales for Law Enforcement," along with the definitions of terms appearing in the code are included in this agenda as an attachment to Agenda Item 1.c.

Recommendation: Mr. Harshman, NIST Technical Advisor, believes that no changes are required for *NCWM Publication 14* and that no further actions by the Weighing Sector are necessary at this time. However, should NCWM decide to develop type evaluation criteria for the different components of WIM systems as a result of the new WIM code being added to NIST Handbook 44, the Weighing Sector may be called upon to help develop this criteria, including a new type evaluation checklist for the NTEP evaluators to use when evaluating such equipment.

1.d. Item 360-3 Appendix D – Definitions. point-of-sale-system.

Source:
2015 S&T Committee Final Report

Background / Discussion:
At the 2015 NCWM Annual Meeting, NCWM voted to amend the definition of point-of-sale system in NIST Handbook 44 Appendix D as follows:

> **point-of-sale system. –** An assembly of elements including a weighing or measuring element, an indicating element, and a recording element (and may also be equipped with a "scanner") used to complete a direct sales transaction. **The system components, when operated together must be capable of the following:**
>
> **1. determining the weight or measure of a product or service offered;**
> **2. calculating a charge for the product or service based on the weight or measure and an established price/rate structure;**
> **3. determining a total cost that includes all associated charges involved with the transaction; and**
> **4 providing a sales receipt.**
>
> [2.20, 3.30, 3.32, 3.37]
> (Added 1986) (Amended 1997 **and 2015**)

Although amended based on a recommendation by the USNWG on Taximeters (the submitter of the S&T Agenda Item), the definition, as amended, applies not only to the Taximeters Code, but also to other device codes in HB 44;

one of which is likely to be of interest to some members of the Weighing Sector; Section 2.20., the Scales Code. Mr. Harshman, NIST Technical Advisor, believes that no changes are required for NCWM Publication 14 and that no further actions by the Weighing Sector are necessary. This item was added to the Sector's agenda to make members aware of the changes to the definition.

2. Acceptable Symbols/Abbreviations to Display the CC Number Via a Device's User Interface

Sources:

- 2010-2013 Final Reports of the S&T Committee: ncwm.net/content/annual-archive
- 2014 Final Report of the S&T Committee: *To be added*
- 2015 Final Report of the S&T Committee: *To be added*
- 2008-2013 Software Sector summaries: http://www.ncwm.net/committees/ntep/sectors/software/archive
- 2013-2014 Weighing Sector summaries: http://www.ncwm.net/committees/ntep/sectors/weighing/archive

Background:
Local weights and measures inspectors need a means to determine whether equipment discovered in the field has been evaluated by NTEP. If so, the inspector needs to know at a minimum the CC number. From this starting point, other required information can be ascertained, e.g., the software version or revision identifier of the software installed in an electronic device at the time it was evaluated. NIST Handbook 44 currently includes three options for marking of the CC:

1. Permanent marking
2. Continuous display
3. Recall using a special operation

Among other tasks, the Software Sector (SS) was charged by the NCWM Board of Directors to recommend NIST Handbook 44 specifications and requirements for software incorporated into weighing and measuring devices, which may include tools used for software identification. During its October 2007 meeting, the SS discussed the value and merits of required markings for software, including possible differences in some types of software-based devices and methods of marking requirements.

In 2008, the SS developed and submitted a proposal to the NCWM S&T Committee to modify G-S.1. and associated paragraphs to reflect these technical requirements. Between 2008 and 2011, this item appeared on the S&T Committee's main agenda and the Committee and the Sector received numerous comments and suggestions relative to the proposal. The SS developed and presented several alternatives based on feedback from weights and measures officials and manufacturers. Among the key points and concerns raised during discussions over this period were how to address the following:

(a) **Limited Character Sets and Space.** – How to address devices that have limited character sets or restricted space for marking.

(b) **Built-for-Purpose vs. Not-Built-for-Purpose.** - Whether or not these should be treated differently.

(c) **Ease of Access.** – Ease of accessing marking information in the field.
   (1) Complexity of locating the marking information
   (2) Use of menus for accessing the marking information electronically
   (3) Limits on the number of levels required to access information electronically
   (4) Possibility of single, uniform method of access

(d) **Hard Marking vs. Electronic.** – Whether or not some information should be required to be hard marked on the device.

(e) **Continuous Display.** – Whether or not required markings must be continuously displayed.

(f) **Abbreviations and Icons.** – Establishment of unique abbreviations, identifiers, and icons and how to codify those.

(g) **Certificate of Conformance Information.** – How to facilitate correlation of software version information to a CC, including the use of possible

Further details on the alternatives considered can be found in the S&T Committee's Final Reports from 2008 to 2014, and the SS summaries from 2009-2013.

During its 2013 meeting, the WS reviewed and provided feedback to the SS on a proposal to amend NIST Handbook 44 General Code paragraphs G-S.1.Identification and G-S.1.1. Location of Marking Information for Not-Built-For-Purpose, Software-Based Devices. See the 2013 WS Final Report to view the feedback provided by the WS on the proposal and for additional background information on this item.

Prior to the 2014 WS meeting, members of OWM's Legal Metrology Devices Program (LMDP) amended the proposal considered by the WS at its 2013 meeting; this after being asked by the SS to provide additional input and modify G-S.1. and G.S.1.1. in consideration of the goals of the SS and the comments provided during the 2014 Open Hearings of the S&T Committee relating to this item.

The following is a list of the goals provided by the SS in modifying G-S.1. and G.S.1.1. as communicated to the members of OWM's LMDP:

1. Remove the existing distinction between software identification requirements for built-for-purpose and not-built-for-purpose devices.
2. To require that <u>all</u> software-based devices have a software version or revision identifier for metrologically significant software.
3. Require that <u>certified</u> software versions or revision identifiers for metrologically significant software is recorded on the CC for access by inspectors.
4. Software itself does not require serial numbers.
5. Require that software-based devices version or revision identifier shall be accessible via the display and user interface and only if device's display is incapable of displaying the identifier or has no display and/or interface; then permanently marking the version or revision identifier shall be acceptable (e.g., digital load cell).
6. Nonretroactive as of January 1, 2016, if passed by the NCWM in July 2015.

OWM's LMDP developed the following proposed draft alternative changes to G-S.1. based on the SS's request for additional input on how best to meet its goals and forwarded them to the Chairman of the SS for consideration at the 2014 WS/SS joint meeting:

Amend NIST Handbook 44*:* G-S.1. Identification and G-S.1.1. Location of Marking Information for Not-Built-For-Purpose, Software-Based Devices as follows:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect**,** shall be clearly and permanently marked for the purposes of identification with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model identifier that positively identifies the pattern or design of the device;

(1) The model identifier shall be prefaced by the word "Model," "Type," or "Pattern." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod." Prefix lettering may be initial capitals, all capitals, or all lowercase.

[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)

(*c*) *a nonrepetitive serial number, except for equipment with no moving or electronic component parts and* ~~***not-built-for-purpose software-based devices***~~ ***software****;*
[Nonretroactive as of January 1, 1968]
(Amended 2003)

(1) The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.
[Nonretroactive as of January 1, 1986]

(2) Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No., and S. No.).
[Nonretroactive as of January 1, 2001]

(*d*) the current software version or revision identifier for not-built-for-purpose software-based devices~~;~~ **manufactured as of January 1, 2004 through December 31, 2015, and all software based devices or equipment manufactured as of January 1, 2016;**
~~***[Nonretroactive as of January 1, 2004]***~~
(Added 2003) **(Amended 20XX)**

(1) The version or revision identifier shall be:

i. prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision;
[Nonretroactive as of January 1, 2007]
(Added 2006)

ii. directly linked to the software itself; and
[Nonretroactive as of January 1, 2016]
(Added 20XX)

iii. continuously displayed* or be accessible via the display menus. Instructions for displaying the version or revision identifier shall be described in the CC. As an exception, permanently marking the version or revision identifier shall be acceptable providing the device does not have an integral interface to communicate the version or revision identifier.
[Nonretroactive as of January 1, 2016]
(Added 20XX)

****The version or revision identifier shall be displayed continuously on software-based equipment with a digital display manufactured as of January 1, 20XX and all software-based equipment with a digital display as of January 1, 20YY.***

(2) Abbreviations for the word "Version" shall, as a minimum, begin with the letter "V" and may be followed by the word "Number." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R" and may be followed by the word "Number." The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).
[Nonretroactive as of January 1, 2007]
(Added 2006)

(e) an National Type Evaluation Program (NTEP) Certificate of Conformance (CC) *number or a corresponding CC Addendum Number for devices that have a CC.*

(1) *The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin*

with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device. (Amended 1985, 1991, 1999, 2000, 2001, 2003, ~~**and,**~~ 2006 **and 201X**)

G-S.1.1. Location of Marking Information for ~~Not Built For Purpose~~ All Software-Based Devices. *– For ~~**not built for purpose,**~~ software-based devices, either:*

*(a) The required information in G-S.1. Identification. (a), (b), ~~**(d),**~~ and (e) shall be permanently marked or continuously displayed on the device; or*

(b) The CC Number shall be:

(1) permanently marked on the device;

(2) continuously displayed; or

(3) accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, "Help," "System Identification," "G-S.1. Identification," or "Weights and Measures Identification."

Note: *For (b), clear instructions for accessing the information required in G-S.1. (a), (b), and (d) shall be listed on the CC, including information necessary to identify that the software in the device is the same type that was evaluated.*
[Nonretroactive as of January 1, 2004]
(Added 2003) (Amended 2006 **and 20XX**)

No changes to subparagraph G-S.1.1. were proposed by OWM's LMDP since the SS had indicated earlier that it may be possible to eventually eliminate G-S.1.1. Thus, the proposed changes to subparagraph G-S.1.1. shown above in OWM's draft alternative changes are those originating from the SS's 2013 proposal.

In providing feedback to the SS, OWM's LMDP noted that the shaded portion of G-S.1.(d)(1)iii. of their draft alternative changes was developed solely by OWM (i.e., does not reflect any of the goals communicated by the SS) and was being offered for consideration with the understanding that:

1. this change will make it easier in the future for inspectors to be able to identify software installed in equipment;
2. a reasonable amount of time for the changes to take effect can be specified;
3. it is probable that improvements in technology over time will make it easier for equipment manufacturers to comply.

In addition to the alternative changes proposed by OWM's LMDP, a member of the SS submitted the following definition of "software-based devices" for discussion during the joint meeting of the Weighing and Software Sectors and possible future inclusion into Appendix D of NIST Handbook 44:

software-based devices: devices used to compute and control processes using software, where software is a general term for the programs and data used to operate the computers and/or related electronic devices. Software-based device may also consist of just software (e.g., weigh in/weigh out software).

At its 2014 meeting, the WS met jointly with the SS to consider the proposal as amended by OWM's LMDP. After further amending the proposal, the two sectors agreed to submit the following proposal to the regional associations for consideration and requested its status be change from Developing to Informational.

Amend NIST Handbook 44*:* G-S.1. Identification as follows:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect**,** shall be clearly and permanently marked for the purposes of identification with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model identifier that positively identifies the pattern or design of the device;

(1) The model identifier shall be prefaced by the word "Model," "Type," or "Pattern." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod." Prefix lettering may be initial capitals, all capitals, or all lowercase.

[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)

(*c*) *a nonrepetitive serial number, except for equipment with no moving or electronic component parts and* ~~***not-built-for-purpose software-based software devices***~~ ***software****;*
[Nonretroactive as of January 1, 1968]
(Amended 2003)

(1) The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.
[Nonretroactive as of January 1, 1986]

(2) Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No., and S. No.).
[Nonretroactive as of January 1, 2001]

(*d*) the current software version or revision identifier for not-built-for-purpose software-based devices~~;~~ **manufactured as of January 1, 2004 and all software-based devices or equipment manufactured as of January 1, 2020;**
~~***[Nonretroactive as of January 1, 2004]***~~
(Added 2003) **(Amended 20XX)**

(1) The version or revision identifier shall be:

i. *prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision;*
[Nonretroactive as of January 1, 2007]
(Added 2006)

Note: If the equipment is capable of displaying the version or revision identifier but is unable to meet the formatting requirement, through the NTEP type evaluation process, other options may be deemed acceptable and described in the CC.
(Added 20XX)

ii. ***directly linked to the software itself; and***
[Nonretroactive as of January 1, 2020]
(Added 20XX)

iii. continuously displayed or be accessible via the display. Instructions for displaying the version or revision identifier shall be described in the CC. As an exception, permanently marking the version or revision identifier shall be acceptable providing the device does not have an integral interface to communicate the version or revision identifier.
[Nonretroactive as of January 1, 2020]
(Added 20XX)

(2) Abbreviations for the word "Version" shall, as a minimum, begin with the letter "V" and may be followed by the word "Number." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R" and may be followed by the word "Number." The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). ***Prefix lettering may be initial capitals, all capitals, or all lowercase.***
[Nonretroactive as of January 1, 2007]
(Added 2006)

(e) an National Type Evaluation Program (NTEP) Certificate of Conformance (CC) *number or a corresponding CC Addendum Number for devices that have a CC.*

(1) The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device. (Amended 1985, 1991, 1999, 2000, 2001, 2003, ~~and,~~ 2006 **and 201X**)

Technical Advisor's note: *Although the SS had earlier proposed changes to G-S.1.1., it was decided during the joint meeting that no changes to G-S.1.1. were necessary since the sectors had agreed to retain the term "not-built-for-purpose software-based devices" in G-S.1.(d). Thus, no changes are proposed to paragraph G-S.1.1. Members of the two sectors also reviewed the draft definition of "software-based devices." The draft definition had been developed by a member of the SS in consideration of a comment that had been received by the S&T Committee during one of the 2014 NCWM Conferences. The sectors agreed that no action was currently necessary other than that the definition be retained for future consideration should the need develop.*

See the 2013 and 2014 WS summary reports for additional details.

Recommendation: No recommendation is being made at this time. A joint meeting of the Measuring Sector and Software Sector is planned in September 2015 to further consider the proposal as amended by the Software Sector and Weighing Sector during their joint meeting. This item also appears on the 2015 S&T Committee's agenda as a Developing item (agenda Item 310-1). The NIST Technical Advisor will provide an update on the progress of this item to the Sector.

3. NCWM Publication 14 DES Section D. Substitution of Load Cells, Load Cells Section 5.

Source:
NCWM/NTEP (2014)

Background:
Current Load Cell Substitution Policy is outdated and needs revised to include the use of new load cell output technology and to make the requirements less open to interpretation.

At it's 2014 meeting, the WS considered the following proposal to replace the current load cell substitution policy in Section D. *Substitution of Load Cell in Scales* on Page DES-11 and Section *5. Substitution of Metrologically Equivalent Load Cells in Scales* on Page LC-2 of the 2014 edition of *NCWM Publication 14*, Weighing Devices:

In a Weighing/Load Receiving Element with a single or multiple load cells installed, the replacement of one or more load cells, from the same or a different manufacturer, is considered a metrologically equivalent replacement provided requirements (1) through (7) below are met.

1. The original and the replacement load cells have a Certificate of Conformance from having been evaluated individually and not as a component in a complete weighing instrument.

2. **Have as many or more verification scale intervals (n_{max}) as required for the scale's capacity and division size.**
3. **Have a minimum load cell verification interval (v_{min}) that is suitable for the application.**
4. **Are of the same load cell design as the cell being replaced. Note: load cell design defines the physical design of the load cell. e.g. canister compression, dual ended shear beam, etc…**
5. **Have a capacity equal to or greater than 85% of the capacity of the load cells installed during type evaluation testing.**
6. **Can be placed in the scale without any modification, as defined in Publication 14, Digital Scales Code, Technical Policy, to the basic design of the Load Receiving Element or the load cell mounting assembly. Note: The use of spacers to compensate for differences in load cell height is permitted.**
7. **Utilize the same output technology (e.g. analog, digital, hydraulic, etc…) as all other load cells in the system or weighing element. Note: For replacement load cells with analog output technology; the same wiring configuration must be maintained as the cells being replaced without adding jumper wires, connecting sense wires to excitation wires, or by removing the sense leads.**

In a system with multiple load cells, the replacement of ALL load cells in the system with National Type Evaluation Program certified and compatible load cells that have an output technology different than the original load cell is considered a metrologically equivalent replacement provided all requirements in (1) through (6) above are met.

During the discussion, it was noted that Item 4. of the current load cell substitution policy specifies that load cells to be substituted must be of the same basic type as the cells being replaced. Thus, in order to correctly apply Item 4. of the current load cell substitution policy, one must have knowledge of the different variables that establish load cell type. No explanation of the criteria or factors that were intended to be used to establish same basic type is provided in the policy, nor are any examples of different types of load cells given. Thus, the policy leaves open for interpretation the different factors that establish load cell type.

Much of the discussion by the Sector on this item involved attempts in identifying the criteria or factors that define the "type" (or "design") of a load cell. There was no consensus reached by the Sector regarding what those factors are or should be. Members of the Sector offered many suggestions of the different factors that they believed might or should define type to include: the method of force introduction, output characteristic, output capacity, impedance, supply voltage, material used in its construction, method of construction, shape, etc. The Sector concluded that the word "design" encompasses many characteristics of a load cell.

The Sector considered whether the load cell substitution policy is intended to apply to the replacement of all the load cells in a scale or just some of the load cells and concluded that that the proposed alphabetic list of requirements is intended to apply only to the replacement of one or more load cells in a scale but not full replacement of all the cells.

The Sector agreed to recommend the following changes to the proposal based on comments heard from its members during the discussion of this item:

- Item 4. in the proposed list should read as follows:

Are of the same basic physical characteristic load cell design as the cell being replaced. Note: load cell design defines the physical design of the load cell. E.g. canister compression, dual ended shear beam, etc…

- The following sentence is to replace the sentence in Item 5. of the proposed list:

  Have a capacity that is greater than or not less than 85% of the capacity of the original cell.

- It was suggested that the following two sentences be added to the end of the proposed list:

  1) **The replacement of a load cell(s) resulting in a combination of analog, digital, or hydraulic load cells in one system is not considered a metrologically equivalent replacement.**

  2) **All load cells in a multiple load cell system must have the same type of output (e.g. all analog, all digital, or all hydraulic.)**

The Sector agreed that additional work on this item is still needed and that it is to remain on next year's WS agenda. Mr. Darrell Flocken (NTEP) agreed to rewrite the proposal taking into account the changes agreed to by the Sector and to make clear the intended application of the alphabetic list of requirements that establish the load cell substitution policy.

Recommendation: The Sector is asked to consider the following revised proposal for the load cell substitution policy, which was recently updated by Mr. Flocken:

Revised Proposal for the Load Cell Substitution Policy:

In a Weighing/Load Receiving Element with a single or multiple load cells installed, the replacement of one or more load cells, from the same or a different manufacturer, is considered a metrologically equivalent replacement provided requirements (1) through (7) below are met.

1. The original and the replacement load cell or load cells have a Certificate of Conformance from having been evaluated individually and not as a component in a complete weighing instrument.
2. Have as many or more verification scale intervals (n_{max}) as required for the scale's capacity and division size.
3. Have a minimum load cell verification interval (v_{min}) that is suitable for the application.
4. Are of the same basic physical characteristic load cell design as the cell being replaced. Note: load cell design defines the physical design of the load cell. E.g. canister compression, dual ended shear beam, etc…
5. Have a capacity that is greater than or not less than 85% of the capacity of the original load cell.
6. Can be placed in the scale without any modification, as defined in Publication 14, Digital Scales Code, Technical Policy, to the basic design of the Load Receiving Element or the load cell mounting assembly. Note: The use of spacers to compensate for differences in load cell height is permitted.
7. Utilize the same output technology (e.g. analog, digital, hydraulic, etc…) as all other load cells in the system or weighing element. Note: For replacement load cells with analog output technology; the same wiring configuration must be maintained as the cells being replaced without adding jumper wires, connecting sense wires to excitation wires, or by removing the sense leads.

In a system with multiple load cells, the replacement of ALL load cells in the system with National Type Evaluation Program certified and compatible load cells that have an output technology different than the original load cell is considered a metrologically equivalent replacement provided all requirements in (1) through (6) above are met.

a) The replacement of a load cell(s) resulting in a combination of output technology as stated in item (7) in one Weighing/Load Receiving Element is not considered a metrologically equivalent replacement.

b) All load cells in a multiple load cell system must have the same type of output (e.g. all analog, all digital, or all hydraulic.)

NEW ITEMS

4. NIST Handbook 44 Scales Code Paragraph S.5.4 Relationship of Load Cell Verification Interval Value to the Scale Division

Source:
NCWM/NTEP

Background:
NTEP has identified two different interpretations of how to apply the formula specified in NIST Handbook 44 Scales Code paragraph S.5.4. Relationship of Load Cell Verification Interval Value to the Scale Division; specifically, to bulleted item (a). The formula determines the suitability of the v_{min} value of a load cell in relationship to the value of the scale division (d) for scales without lever systems. The different interpretations occur only when applying the formula to a scale having multiple platforms (Weighing/Load Receiving Elements (W/LRE)) where the output of each W/LRE has its own weight display and is capable of operating as an independent scale in a commercial application.

Consider the number of load cells in each W/LRE of the following example scale and how the formula is to be applied:

Platform	Number of Load Cells
1	4
2	4
3	6

The first interpretation applies the formula to the three W/LREs as a single platform using the total of all load cells (14) for the value of "N" in the formula.

The second interpretation applies the formula to each of the three W/LRE's individually using only the number of load cells (4, 4 and 6) in the W/LRE for the value of "N" in the formula.

Recommendation:
This item appeared on the Sector's 2014 agenda, but there was no action taken on it during the 2014 WS meeting. The reason being, not all stakeholders were in attendance when this item was first introduced during the 2014 WS meeting due to conflicting NCWM announcements of the meeting start time. Consequently, the NCWM agreed to reintroduce this item at the 2015 Weighing Sector Meeting in the interest of fairness to all.

Most recently, there have been two NCWM Form 15 proposals submitted to the NCWM proposing changes to Scales Code paragraph S.5.4. Relationship of Load Cell Verification Interval Value to the Scale Division. The regional weights and measures associations will consider those proposals during the 2016 NCWM cycle. It is recommended that this item be held open on the Sector's agenda pending the outcome of the two proposals by the S&T Committees.

5. NCWM Publication 14 ABWS Technical Policy Section E. Automatic Bulk Weighing Systems - NTEP On-Site Evaluation, and ABWS Checklists Paragraph 32

Source:
NCWM/NTEP

Background:
Current Technical Policy, Section E, of the Automatic Bulk Weighing Systems (ABWS) Code states:

> During laboratory evaluation, the bulk weighing controller is tested under simulated field conditions; therefore, the results of such an evaluation should not be used to determine compliance with all pertinent requirements. Compliance with all requirements shall be determined only when the bulk weighing controller, having successfully passed National Type Evaluation Program laboratory evaluation, is installed and tested under actual field conditions as part of an automatic bulk weighing system.

In addition, Paragraph 32. Performance and Permanence Tests for Automatic Bulk Weighing Systems of the ABWS Code states:

> The tests described here, apply to the entire automatic bulk weighing system, (e.g., the bulk weighing scale controller interfaced with the weigh hopper, load cell(s), material handling system, etc.). It is assumed that all components of the automatic bulk weighing scale controller have already been examined and found to comply with applicable National Type Evaluation Program requirements. If the design and performance of the bulk weighing controller is to be determined during the same test, the applicable requirements for automatic bulk weighing systems must be referenced.

The wording implies that a complete evaluation of the weighing controller is not possible without connecting the weighing controller to an actual hopper. After discussing this with the NTEP Labs and a few manufacturers it was concluded that the weighing control can receive a complete evaluation in the lab with proper simulation.

Recommendation:
The following changes to Section E of the ABWS Technical Policy and to Paragraph 32 of the ABWS Checklist are suggested to eliminate the requirement of having to test the weighing controller under field conditions providing a complete simulated test can be conducted during lab evaluation:

E. Automatic Bulk Weighing Systems - NTEP On-Site Evaluation

During laboratory evaluation, the bulk weighing controller is tested under simulated field conditions.~~;~~ ~~**therefore, the results of such an evaluation should not be used to determine compliance with all pertinent requirements. Compliance with all requirements shall be determined only when the bulk weighing controller, having successfully passed National Type Evaluation Program laboratory evaluation, is installed and tested under actual field conditions as part of an automatic bulk weighing system.**~~ **If the simulation is not capable of simulating all functions and operations of a complete system; the weighing controller is to be installed and all functions or operations not simulated during the laboratory evaluation are to be tested under actual field conditions as part of an automatic bulk weighing system.**

32. Performance and Permanence Tests for Automatic Bulk Weighing Systems

Performance tests are conducted to ensure compliance with the tolerance requirements of NIST Handbook 44 and for systems used to weigh grain with additional requirements of the GIPSA.

The tests described here, apply to the entire automatic bulk weighing system, (e.g., the bulk weighing scale controller interfaced with the weigh hopper, load cell(s), material handling system, etc.) ~~**It is assumed that all components of the automatic bulk weighing scale controller have already been examined and found to comply with applicable National Type Evaluation Program requirements.**~~ If the design and performance of the bulk weighing controller is to be determined during the same test, the applicable requirements for automatic bulk weighing systems must be referenced.

…

6. NCWM Publication 14 DES Section 62 Permanence Tests for Scales

Source:
Mr. Darrell Flocken (NCWM/NTEP)

Background:
The wording related to the test load used for the permanence test in Sections 62.1. and 63.6.5. is misleading as to what test load is to be used when conducting this test.

- Section *62.1. Laboratory Permanence Test* states a test load of "one-quarter to one-half scale capacity,…" This can be interpreted as an allowable range and an acceptable test load could be any load between the two values.

- Section *63.6.5. Test Load:* defines absolute test loads determined by the maximum capacity of the device being tested.

  - Section 63.6.5.1. states "For laboratory tests of scales with a capacity of 1000 lb or less, the test load required for the permanence test is 50% of maximum capacity…"

  - Section 63.6.5.2. states "For laboratory tests of scales with a capacity greater than 1000 lb, the test load required for the permanence test is 250 kg (550 lb),…"

Recommendation:
Modify the statement in Section 62.1. as follows:

> "A laboratory permanence test consists of repeatedly applying to the scale, a test load ~~of one-quarter to one-half scale capacity~~ as defined in Section 63.6.5., simulating normal load application, and periodically conducting normal tests for accuracy."

7. NCWM Publication 14 DES Technical Policy

Source:
Mr. Darrell Flocken (NCWM/NTEP)

Background:
Footnote 2, referenced in paragraph 8.d of the DES Technical Policy and found at the bottom of page DES-6 of the 2015 edition of Publication 14 is misleading. The footnote (repeated below) leads the reader to believe that it is possible to increase the CLC rating of a device that had its Certificate of Conformance issued before October 1998 provided the manufacturer submits evidence of appropriate changes to support the request.

> [2] *For a CC issued prior to October of 1998, the CLC for additional models is allowed to be 5 tons higher than the CLC of the device evaluated, provided evidence is submitted to NTEP that appropriate changes have been made to the weighing/load receiving element to adequately support the increased CLC. If a CC with the additional 5 ton allowance is amended, the 5 ton increased CLC will be retained for models already covered by the CC; however, higher CLCs for additional models may not be included without additional testing.*

When in fact, this policy allowance was removed from the policy for non-modular vehicle platforms per a decision of the Weighing Sector during their 1998 Meeting. Attached is an excerpt from the 1998 meeting detailing the decision of the Weighing Sector Members. (Bold and highlights were added to make the appropriate information easy to locate.)

The following was excerpted from the 1998 Weighing Sector Meeting Summary:

Appendix J – Weighing Sector
1998 Meeting Summary
NTEP-63
Meeting Summary
Carry-Over Items

1) Criteria for Modular Scales

Source: NTEP Labs

Background: At its last meeting, the Weighing Sector agreed to ask the Scale Manufacturers Association's (SMA) Technical Committee to review this item and submit a proposal for changes to Publication 14 relative to modular scales. The Sector specifically asked if SMA could review the current policy for parameters to be covered on a modular scale Certificate of Conformance (CC) based on the model tested. The Sector is asked to consider the resulting proposal developed by the SMA Technical Committee as outlined in Appendix A. The Sector was also asked to review the issue of whether or not a permanence test should be required to expand existing modular scale CCs to include additional capacities and sizes.

Discussion: Darrell Flocken (Mettler-Toledo) reviewed the background for the issue and introduced the proposal found in Appendix A. Darrell stated that, although the document has been reviewed by some of the members, the document should not be considered an SMA position because it had not been reviewed by the entire SMA membership. The proposal was presented for consideration on its own merit. The Sector reviewed the basic types of modular scale designs, which were approved at the last meeting. There was general agreement that the intent of the modular criteria was to allow longer scales to be produced by a manufacturer without requiring re-evaluation provided that the appropriate load cell parameters were met. There also was discussion of possibly eliminating the lower length limit of 50% of the shortest module tested. The majority of the Sector favored keeping the lower limit in place.

Conclusion: The Sector agreed to modify the NTEP Technical Policy for Scales Section B, Part 6, Pub 14 page 1-11 modular vehicle scale criteria as follows:

6 (a): No change.
6 (b): No change
6 (c): Modify the section as follows:
c. A scale with at least two modules must be tested. The module with the largest CLC is to be tested. Strive to test the module with the longest distance between two sections. If the longest span between sections is not tested, the Certificate of Conformance will include up to 120 percent of the span between sections that was tested. Arrangements regarding the specific scale in the family to be tested will be established in consultation with NTEP representatives.
6 second Part (b): Modify the section as follows:
b. Platform area not less than 50 percent of the smallest two-section (four-cell) module incorporated in the device evaluated to 150 percent of the scale longest module evaluated. Increased platform areas and lengths for scales with two or more modules are not restricted as long as the width complies with 6(e) and the load cells meet the vmin formula; (i.e., vmin = d / □n). Additional modules to increase length must be of the same type as those used in the device submitted for evaluation (i.e., 4 - cell, 2- cell, 0 - cell.)
6 second Part (c): Modify the section as follows:
c. CLC's complying with the minimum CLC rating (i.e., not less than 80 percent of the capacity of one cell) to 5 tons above device evaluated, but not exceeding twice the capacity of one load cell.
6 second (d) through (h): No change

The Sector also agreed to modify the non-modular vehicle scale criteria as follows:

Part 5(f): Eliminate the 5-ton allowance above the CLC tested as follows:

f. concentrated load capacities (CLC) of 50 percent of the CLC of the device tested to a the maximum of 5 ton higher (for optional higher capacities of devices); however, the manufacturer must provide evidence that the scale with the higher CLC has been structurally strengthened to accommodate the higher loading concentration; in addition the scale that is tested is limited to the CLC rating that applies at the time of the test CLC evaluated; the minimum CLC rating shall not be less than 80 percent of the capacity of one cell but not exceeding twice the capacity of one load cell (the dead load of the weighbridge must be considered);

The Sector discussed eliminating the lower (50%) restriction on length for non-modular vehicle scales; however, it could not reach a consensus on this proposed change. The Sector also considered making modifications to other non-modular vehicle scale

criteria; however, it agreed that it would be better to bring this back as a separate issue for discussion at a future meeting. The Sector agreed that manufacturers can request to have their CCs expanded under the new criteria. The elimination of the 5 ton allowance for CLC (under part 5[f] and part 6 second [c]) will not be applied retroactively, but will be applied to new CCs and to requests to modify the CLC beyond that originally listed on the CC.

The Sector discussed a proposal to waive permanence testing on evaluations performed to expand CCs beyond the lengths listed on the original CC. However, in view of changes made by the Sector to expand the criteria, the Sector did not feel that this proposal was still appropriate. Consequently, any testing performed to expand the CC beyond its original platform size or capacity will require a full permanence test.

The outcome of the 1998 discussion was to remove this allowance but to document that the removal will not be applied retroactively meaning the increased CLC value on certificates already modified under this allowance will remain at the modified value. However, the higher CLC allowance will not be applied to new models added to this certificate or to new certificates issued after 1998.

Recommendation:
Remove from the DES, Technical Policy:

1. The reference to footnote 2 in paragraph 8.d.
2. The actual footnote (2) located at the bottom of page DES-6.

Alternatively, revise the wording of footnote 2 to read as follows:

[2] For a CC issued prior to October of 1998, NTEP allowed the CLC value, for additional models, to be increased by 5 tons greater than the CLC of the device evaluated, provided evidence was submitted to NTEP that appropriate changes were made to the weighing/load receiving element to adequately support the increased CLC. This allowance was no longer offered by NTEP for CCs issued after 1998 however, the elimination of this allowance was non-retroactive. CC which were modified per this allowance will remain with the higher CLC value.

This alternate proposal would change the wording of the footnote to eliminate the possible misunderstanding that this allowance is still offered while maintaining the history of the allowance.

8. NCWM Publication 14 DES Section 46. Tare Operation – Facilitation of Fraud

Source:
Rick Harshman (NIST OWM) on behalf of the 2015 NTEP Weighing Lab Evaluators

Background:
Representatives from Measurement Canada have identified a possible contradiction in NCWM Publication 14 DES Section 46. Tare Operation - Facilitation of Fraud. This concern was brought to the attention of the NTEP Weighing Labs and discussed at the 2015 NTEP Lab meeting (RE: Weighing Labs Item 4 on the 2015 NTEP Lab Meeting Agenda). The NTEP evaluators were not able to resolve the matter and asked that the Weighing Sector take up this issue at its 2015 meeting in hopes that it could provide a correct interpretation of the type evaluation criteria.

A description of the concern is as follows:

The following statements appear in subsection 46.2:

46.2. Devices equipped with a tare capability, except for electronic cash registers, are required to provide a clear indication that a tare value has been entered. This indication may be GROSS and NET indications (display modes), or a lighted legend or annunciator such as TARE ENTERED" .... At

least one of the following methods must be used to indicate that a tare value has been entered. Indicate which method is used.

46.2.1. A separate continuous display of tare.	☐ Yes	☐ No	☐ No
46.2.2. The device has selectable GROSS, TARE, and NET weight display modes with proper descriptors for this information.	☐ Yes	☐ No	☐ No
46.2.3. The device has selectable GROSS and NET weight display modes with proper descriptors for this information.	☐ Yes	☐ No	☐ No
46.2.4. The display indicates only the net weight and a NET legend or annunciator appears when a tare weight is entered. Gross weight is displayed when the tare weight entry is zero and the NET legend or annunciator is off.	☐ Yes	☐ No	☐ No

"TARE ENTERED," although mentioned in the preamble as being an acceptable means of providing a clear indication that tare has been entered, is not one of the options specified in checklist sections 46.2.1. through 46.2.4. Thus, the preamble uses "TARE ENTERED" as an example of an acceptable means of providing an indication that tare has been taken, whereas, the checklist seems to suggest otherwise.

It was noted during discussion at the 2015 NTEP Lab meeting that the term “net weight” is well defined in NIST handbooks and means the weight of the product alone, whereas, “tare entered” could be interpreted to mean something different (not necessarily that a value being displayed on a scale is the net weight). Canadian representatives reported that Measurement Canada allows a "tare entered" annunciator to be used when the net weight is displayed.

The following meaning of the term “net weight” was copied from the 2015 version of NIST Handbook 130 *Uniform Laws and Regulations in the areas of legal metrology and engine fuel quantity:*

Meaning of the term “net weight” copied from 2015 NIST Handbook 130 Uniform Weights and Measures Law

1.8. Net “Mass” or Net “Weight.” – The term “net mass” or “net weight” means the weight [***NOTE 1***, page 21] of a commodity excluding any materials, substances, or items not considered to be part of the commodity. Materials, substances, or items not considered to be part of the commodity include, but are not limited to, containers, conveyances, bags, wrappers, packaging materials, labels, individual piece coverings, decorative accompaniments, and coupons, except that, depending on the type of service rendered, packaging materials may be considered to be part of the service. For example, the service of shipping includes the weight of packing materials.

(Added 1988) (Amended 1989, 1991, and 1993)

Recommendation: Review DES Section 46.2., including the checklist portions 46.2.1. through 46.2.4. and recommend changes where appropriate to better clarify the acceptable means of providing a clear indication that a tare value has been entered, including conditions in which the words “tare entered” might be considered appropriate in defining a net weight indication on a scale.

Technical Advisor’s note: Members of OWM’s Legal Metrology Devices Program reviewed this WS agenda item and offers the following comments and recommendations:

> The words “tare entered,” when defining a value displayed on a scale designed with a single weight display, can be interpreted to mean that the displayed value is the value of a tare that’s been entered, or that a tare has been entered and the value displayed is a net weight. If a lighted legend or annunciator indicating “tare entered” were used to identify a net weight indication, OWM believes such marking would conflict with HB 44 paragraph G-S.6. Marking Operational Controls, Indications, and Features. For this reason, OWM recommends that “tare entered” not be permitted as a means of identifying a net weight indication

on a scale. It is OWM's view that the entire second sentence in Section 46.2. can be deleted since 46.2.1. through 46.2.4. provide indication of all the different acceptable ways a scale is able to comply with Section 46.2.

Additionally, OWM finds the language in 46.2.1. ambiguous and suggests it be amended to clarify the meaning of the word "tare." It is not clear from the language if the word "tare" is intended to mean "tare value" or some type of descriptor, such as a tare annunciator? If it is intended that the tare value be continuously displayed and that the value be identified as such, OWM recommends adding additional text to make this clear.

9. NCWM Publication 14 DES Section73 Performance and Permanence Test Procedures for Dynamic Monorail Scales

Source:
Maryland NTEP Lab

Background:
In Publication 14 Digital Electronic Scales, there is no distinction between testing procedures for Dynamic Monorail Scales and Static Monorail Scales.

Recommendation:
To clarify the NTEP evaluation test procedures for Static Monorail Scales, it is recommended that the following procedures be added to Section 73 of DES Publication:

Procedures to be added to Section 73:

Tests for Static Monorail Scales:

1. Discrimination test at zero-load or near zero-outside the range of the AZT, and at scale capacity or the maximum test load, whichever is less.
2. Increasing and decreasing load test from zero to scales capacity at tolerance break points of 500e, 2000e, 4000e, and 4001+e, load centered on the live rail.
3. A shift test at scale capacity, at maximum used capacity but not less than 1/2 scale capacity. Test loads located at the left, center, and right ends of the scale.
4. Temperature tests, and creep test. Temperature effect on zero.
5. Permanence test cycle of 100 000 weight applications conducted for each model submitted.

10. NCWM Publication 14 DES Section 31 Multi-Interval Scales

Source:
Measurement Canada/Canada

Background:
As part of a routine general maintenance of its documents, Measurement Canada is currently reviewing requirements for multi-interval tare. Because of our mutual recognition agreement, we have to be careful in not changing something that could contradict or conflict with Handbook 44 or Pub 14. In order to avoid this scenario, we need an interpretation of these following sections of Pub 14, that, in our sense, are conflicting.

The preamble to section 31 contains examples and clauses that conflict with the requirements set out in 31.1 and 31.2. For example, the tare calculation example shows a net weight value that is not consistent with the scale

interval of the weighing segment in which it falls, but both 31.1 and 31.2 require that it be consistent. The preamble also states that "Except for semi-automatic tare, all tare values shall not exceed the maximum capacity of the first weighing segment" whereas as 31.1.5 states "Tare may be taken to the maximum capacity of the smallest weighing range (segment) of the scale.", leading to another contradiction

Another issue with section 31 is the applicability of 31.1 vs 31.2. It seems to be implied that either one or the other applies, depending on how the device operates, but it is not clear. It seems that 31.1 applies to devices that display all three values, while 31.2 is for devices that only display in one mode. However, review of the sub-clauses in each section show that this isn't correct (e.g. 31.1.9 refers to scales that only show net weight). We feel that section 31 needs to be reviewed to consolidate redundant clauses and clearly state the applicability of 31.1 and 31.2.

Recommendation:
The Sector is asked to review NCWM Publication 14, Section 31 for consistency and recommend changes as needed to resolve any conflicts or ambiguous parts.

APPENDIX A – ATTENDEES

To be added

ATTACHMENTS

Attachment to agenda Item 1.c. Item 320-5 Part 2.20. Weigh-In-Motion Vehicle Scales for Law Enforcement – Work Group

Tentative Code Applicable to Weigh-In-Motion Systems Used for Vehicle Enforcement Screening

A. Application

A.1. General. – This code applies to systems used to weigh vehicles, while in motion, for the purpose of screening and sorting the vehicles based on the vehicle weight to determine if a static weighment is necessary.

A.2. The code does not apply to weighing systems intended for the collection of statistical traffic data.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Weigh-In-Motion Screening Systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements and of Recorded Representations.

S.1.1. Ready Indication. – The system shall provide a means of verifying that the system is operational and ready for use.

S.1.2. Value of System Division Units. – The value of a system division "d" expressed in a unit of weight shall be equal to:

(a) 1, 2, or 5; or

(b) a decimal multiple or submultiple of 1, 2, or 5.

Examples: divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

S.1.2.1. Units of Measure. – The system shall indicate weight values using only a single unit of measure.

S.1.3. Maximum Value of Division Size. – The value of the system division "d" for a Class A, Weight-In-Motion System shall not be greater than 50 kg (100 lb).

S.1.4. Value of Other Units of Measure.

S.1.4.1. Speed. – Vehicle speeds shall be measured in miles per hour or kilometers per hour.

S.1.4.2. Axle-Spacing (Length). – The center-to-center distance between any two successive axles shall be measured in:

(a) feet and inches;

(b) feet and decimal submultiples of a foot; or

(c) meters and decimal submultiples of a meter.

S.1.4.3. Vehicle Length. – If the system is capable of measuring the overall length of the vehicle, the length of the vehicle shall be measured in feet and/or inches, or meters.

S.1.5. Capacity Indication. – An indicating or recording element shall not display nor record any values greater than 105% of the specified capacity of the load receiving element.

S.1.6. Identification of a Fault. – Fault conditions shall be presented to the operator in a clear and unambiguous means. The following fault conditions shall be identified:

(a) Vehicle speed is below the minimum or above the maximum speed as specified.
(b) The maximum number of vehicle axles as specified has been exceeded.
(c) A change in vehicle speed greater than that specified has been detected.

S.1.7. Recorded Representations.

S.1.7.1. Values to be Recorded. – At a minimum, the following values shall be printed and/or stored electronically for each vehicle weighment:

(a) transaction identification number;
(b) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in-motion);
(c) vehicle speed;
(d) number of axles;
(e) weight of each axle;
(f) identification and weight of axles groups;
(g) axle spacing;
(h) total vehicle weight;
(i) all fault conditions that occurred during the weighing of the vehicle;
(j) violations, as identified in paragraph S.2.1., that occurred during the weighing of the vehicle; and
(k) time & date.

S.1.8. Value of the Indicated and Recorded System Division. – The value of the system's division " (d)", as recorded, shall be the same as the division value indicated.

S.2. System Design Requirements.

S.2.1. Violation Parameters. – The instrument shall be capable of accepting user entered violation parameters for the following items:

(a) single axle weight limit;
(b) axle group weight limit;
(c) gross vehicle weight limit; and
(d) bridge formula maximum.

The instrument shall display and or record violation conditions when these parameters have been exceeded.

S.3. Design of Weighing Elements.

S.3.1. Multiple Load-Receiving Elements. –An instrument with a single indicating or recording element, or a combination indicating-recording element, that is coupled to two or more load-receiving elements with independent weighing systems, shall be provided with means to prohibit the activation of any load-receiving element (or elements) not in use, and shall be provided with automatic means to indicate clearly and definitely which load receiving element (or elements) is in use.

S.4. Design of Weighing Devices, Accuracy Class.

S.4.1. Designation of Accuracy. – WIM Systems meeting the requirements of this code shall be designated as accuracy Class A.

Note: This does not preclude higher accuracy classes from being proposed and added to this Code in the future when it can be demonstrated that WIM systems grouped within those accuracy classes can achieve the higher level of accuracy specified for those devices.

S.5. Marking Requirements. – In addition to the marking requirements in G-S.1. Identification (except G.S.1.(e)), he system shall be marked with the following information:

(a) Accuracy Class;
(b) Value of the System Division "d";
(c) Operational Temperature Limits;
(d) Number of Instrumented Lanes (not required if only one lane is instrumented.);
(e) Minimum and Maximum Vehicle Speed;
(f) Maximum Number of Axles per Vehicle;
(g) Maximum Change in Vehicle Speed during Weighment; and
(h) Minimum and Maximum Load.

S.5.1. Location of Marking Information. – The marking information required in G-S.1. of the General Code and S.5. shall be visible after installation. The information shall be marked on the system or recalled from an information screen.

N. Notes

N.1. Test Procedures.

N.1.1. Selection of Test Vehicles. – All dynamic testing associated with the procedures described in each of the subparagraphs of N.1.5 shall be performed with a minimum of two test vehicles.

(a) The first test vehicle may be a two axle, six tire, single unit truck; that is, a vehicle with two axles with the rear axle having dual wheels. The vehicle shall have a maximum Gross Vehicle Weight of 10,000 lbs.
(b) The second test vehicle shall be a five axle, single trailer truck with a maximum Gross Vehicle Weight of 80,000 lbs.

Note: Consideration should be made for testing the systems using vehicles which are typical to the systems daily operation.

N.1.1.1. Weighing of Test Vehicles. – All test vehicles shall be weighed on a reference scale before being used to conduct the dynamic tests.

N.1.1.2. Determining Reference Weights for Axle, Axle Groups and Gross Vehicle Weight. – The reference weights shall be the average weight value of a minimum of three static weighments of all single axle, axle groups and gross vehicle weight.

Note: The axles within an axle group are not considered single axles.

N.1.2. Test Loads.

N.1.2.1. Static Test Loads. – All static test loads shall use certified test weights.

N.1.2.2. Dynamic Test Loads. – Test vehicles used for dynamic testing shall be loaded to 85 to 95% of their legal maximum Gross Vehicle Weight. The "load" shall be non-shifting and shall be positioned to present as close as possible, an equal side-to-side load.

N.1.3. Reference Scale. – Each reference vehicle shall be weighed statically on a multiple platform vehicle scale comprised of three individual weighing/load-receiving elements, each an independent scale. The three individual weighing/load receiving elements shall be of such dimension and spacing to facilitate 1) the single-draft weighing of all reference test vehicles, and 2) the simultaneous weighing of each single axle and axle group of the reference test vehicles on different individual elements of the scale; gross vehicle weight determined by summing the values of the different reference axle and reference axle groups of a test vehicle. The scale shall be tested immediately prior to using it to establish reference test loads and in no case more than 24 hours prior. To qualify for use as a suitable reference scale, it must meet NIST Handbook 44, Class III L maintenance tolerances.

N.1.3.1. Location of a Reference Scale. – The location of the reference scale must be considered as vehicle weights will change due to fuel consumption.

N.1.4. Test Speeds. – All dynamic tests shall be conducted within 20% below or at the posted speed limit.

N.1.5. Test Procedures.

N.1.5.1. Dynamic Load Test. – The dynamic test shall be conducted using the test vehicles defined in N.1.1. The test shall consist of a minimum of 20 runs for each test vehicle at the speed as stated in N.1.4.

At the conclusion of the dynamic test there will be a minimum of 20 weight readings for each single axle, axle group and gross vehicle weight of the test vehicle. The tolerance for each weight reading shall be based on the percentage values specified in Table T.2.2.

N.1.5.2. Vehicle Position Test. – During the conduct of the dynamic testing ensure that the vehicle stays within the defined roadway along the width of the sensor. The test shall be conducted with 10 runs with the vehicle centered along the width of the sensor, 5 runs with the vehicle on the right side along the width of the sensor, and 5 runs with the vehicle on the left side along the width of the sensor. Only gross vehicle weight is used for this test and the tolerance for each weighment shall be based on the tolerance value specified in T.2.3.

N.1.5.3. Axle Spacing Test. – The axle spacing test is a review of the displayed and/or recorded axle spacing distance of the test vehicles. The tolerance value for each distance shall be based on the tolerance value specified in T.2.4.

T. Tolerances

T.1. Principles.

T.1.1. Design. – The tolerance for a weigh-in-motion system is a performance requirement independent of the design principle used.

T.2. Tolerance Values for Accuracy Class A.

T.2.1. To Tests Involving Digital Indications or Representations – To the tolerances that would otherwise be applied in paragraphs T.2.2 and T.2.3, there shall be added an amount equal to one-half the value of the scale division to account for the uncertainty of digital rounding.

T.2.2. Tolerance Values for Dynamic Load Test. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.2.

Table T.2.2. – Tolerances for Accuracy Class A	
Load Description*	**Tolerance as a Percentage of Applied Test Load**
Axle Load	±20%
Axle Group Load	±15%
Gross Vehicle Weight	±10%
* No more than 5% of the weighments in each of the load description subgroups shown in this table shall exceed the applicable tolerance.	

T.2.3. Tolerance Value for Vehicle Position Test. – The tolerance value applied to each gross vehicle weighment is ±10% of the applied test load.

T.2.4. Tolerance Value for Axle Spacing. – The tolerance value applied to each axle spacing measurement shall be ± 0.15 meter (0.5 feet).

T.3. Influence Factors. – The following factor is applicable to tests conducted under controlled conditions only.

T.3.1. Temperature. – Systems shall satisfy the tolerance requirements under all operating temperature unless a limited operating temperature range is specified by the manufacturer.

T.4. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed the tolerance value as stated in Table T.2.2.

UR. USER REQUIREMENTS

UR.1. Selection Requirements. – Equipment shall be suitable for the service in which it is used with respect to elements of its design, including but not limited to, its capacity, number of scale divisions, value of the scale division or verification scale division and minimum capacity.

UR.1.1. General

The typical class or type of device for particular weighing applications is shown in Table 1. Typical Class or Type of Device for Weighing Applications.

Table 1. **Typical Class or Type of Device for Weighing Applications**	
Class	**Weighing Application**
A	Screening and sorting of vehicles based on axle, axle group and gross vehicle weight.
Note: A WIM system with a higher accuracy class than that specified as "typical" may be used.	

UR.2. User Location Conditions and Maintenance. – The system shall be installed and maintained as defined in the manufacturer's recommendation.

UR.2.1. System Modification. – The dimensions (e.g., length, width, thickness, etc.) of the load receiving element of a system shall not be changed beyond the manufacturer's specifications, nor shall the capacity of a scale be increased beyond its design capacity by replacing or modifying the original primary indicating or

recording element with one of a higher capacity, except when the modification has been approved by a competent engineering authority, preferably that of the engineering department of the manufacturer of the system, and by the weights and measures authority having jurisdiction over the system.

UR.2.2. Foundation, Supports, and Clearance. – The foundation and supports shall be such as to provide strength, rigidity, and permanence of all components.

On load-receiving elements which use moving parts for determining the load value, clearance shall be provided around all live parts to the extent that no contacts may result when the load-receiving element is empty, nor throughout the weighing range of the system.

UR.2.3. Access to Weighing Elements. – If necessary, adequate provision shall be made for inspection and maintenance of the weighing elements.

UR.3. Maximum Load. – A system shall not be used to weigh a load of more than the marked maximum load of the system.

The following are the definitions of terms used in the Weigh-In-Motion Systems used for Vehicle Enforcement Screening – Tentative Code and will appear in HB 44 at the end of the code. Once the tentative status is removed from the code, these definitions will then be moved to Appendix D of HB 44.

weigh-in-motion (WIM). A process of estimating a moving vehicle's gross weight and the portion of that weight that is carried by each wheel, axle, or axle group, or combination thereof, by measurement and analysis of dynamic vehicle tire forces.

axle. The axis oriented transversely to the nominal direction of vehicle motion, and extending the full width of the vehicle, about which the wheel(s) at both ends rotate.

axle-group load. The sum of all tire loads of the wheels on a group of adjacent axles; a portion of the gross-vehicle weight.

axle load. The sum of all tire loads of the wheels on an axle; a portion of the gross-vehicle weight.

axle spacing. The distance between the centers of any two axles. When specifying axle spacing, you also need to identify the axles used.

single-axle load. The load transmitted to the road surface by the tires lying on the same longitudinal axis (that axis transverse to the movement of the vehicle and about which the wheels rotate).

tandem-axle load. The load transmitted to the road surface by the tires of two single-axles lying on the same longitudinal axis (that axis transverse to the movement of the vehicle and about which the wheels rotate).

triple-axle load. The load transmitted to the road surface by the tires of three single-axles lying on the same longitudinal axis (that axis transverse to the movement of the vehicle and about which the wheels rotate).

Weigh-in-Motion Screening Scale . A WIM system used to identify potentially overweight vehicles.

Wheel weight. The weight value of any single or set of wheels on one side of a vehicle on a single axle.

WIM System. A set of sensors and supporting instruments that measure the presence of a moving vehicle and the related dynamic tire forces at specified locations with respect to time; estimate tire loads; calculate speed, axle spacing, vehicle class according to axle arrangement, and other parameters concerning the vehicle; and process, display, store, and transmit this information. This standard applies only to highway vehicles.

NEXT Meeting

2016 Suggested Meeting Locations and Dates:
TBD
The following locations are being considered for the next Sector Meeting: