Chapter 7

7-1– 12

Add new text as follows:

105.2.13 Light reflectance value (LRV) of a surface. Method of Test. BS 8493:2008 + A1: 2010 (British Standards Institution, 389 Chiswick High Road, London W4 4AL, United Kingdon).

701.1.2 Light Reflectance Value. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493 for the following surface types:

1. Opaque paint coatings and paint systems, including those that cause extreme angular dependences of reflected light and those that have a surface texture of less than 2 mm;

2. Opaque coverings including those that cause extreme angular dependences of reflected light, and those that have an unyielding texture of less than 2 mm;

3. Opaque coverings with a yielding pile, e.g. carpet;

4. Opaque materials, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm, e.g. finished metals;

5. Opaque materials coated with non-opaque coatings or coverings, e.g. timber door coated with a woodstain, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm;

6. Multi-colored surfaces;

701.1.2.1 Other Surfaces. Other surfaces shall comply with Section 703.1.3.1.

701.1.3 Contrast Value. The contrast between the LRVs of adjacent surfaces required by Sections 703.2.1.2, 703.5.3.2, 703.6.3.2, 705.3, and 504.5.1 shall be determined by Equation 7-1,

Contrast = [(B1-B2)/B1] x 100 percent **Equation 7-1**

Where

B1 = light reflectance value (LRV) of the lighter surface,
B2 = light reflectance value (LRV) of the darker surface.

701.1.3.1 Other Surfaces. Surfaces not within the scope of BS 8493 shall provide contrast between adjacent surfaces that are either light on dark or dark on light.

Revise as follows

703.2.1 General. Visual characters shall comply with the following:

(Balance of section is not changed)

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.

703.2.1.2 Contrast. The Light Reflectance Value (LRV) of characters and their background shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

703.5.3 Finish and Contrast. Pictograms and their fields shall have a nonglare finish. Pictograms shall contrast with their fields, with either light pictograms on a dark field, or dark pictograms on a light field.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. The Light Reflectance Value (LRV) of pictograms and their fields shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

703.6.2 Finish and Contrast. Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.

703.6.3.2 Contrast. The Light Reflectance Value (LRV) of symbols of accessibility and their backgrounds shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

705.3 Contrast. Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.

The Light Reflectance Value (LRV) of the surfaces shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

504.5.1 Visual Contrast. The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread.

The Light Reflectance Value (LRV) of the 2-inch (51 mm) stripe and tread shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

7-1-12 PC1

Christopher G. Bell, representing American Council of the Blind

Comment: ACB strongly supports the revisions to this standard proffered by Allan Fraser. ACB has been told by one of its affiliates that builders are frequently using dots or dashes on tread edges rather than the continuous two surface contrasting colors across the width of the tread which this section contemplates. Because of this apparent confusion, ACB believes the revisions proposed by Mr. Fraser makes clear that there can be no break in the contrasting surface colors.

7-1-12 PC2

Gene Boecker, Code Consultants, Inc, representing National Association of Theatre Owners

Further revise as follows:

~~**701.1.2**~~ **310.1 Light Reflectance Value**. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493 for the following surface types:

1. Opaque paint coatings and paint systems, including those that cause extreme angular dependences of reflected light and those that have a surface texture of less than 2 mm;

2. Opaque coverings including those that cause extreme angular dependences of reflected light, and those that have an unyielding texture of less than 2 mm;

3. Opaque coverings with a yielding pile, e.g. carpet;

4. Opaque materials, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm, e.g. finished metals;

5. Opaque materials coated with non-opaque coatings or coverings, e.g. timber door coated with a woodstain, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm;

6. Multi-colored surfaces;

~~**701.1.2.1**~~ **310.1.1 Other Surfaces.** Other surfaces shall comply with Section ~~703.1.3.1~~ 310.3.

~~**701.1.3**~~ **310.2 Contrast Value.** The contrast between the LRVs of adjacent surfaces required by Sections 703.2.1.2, 703.5.3.2, 703.6.3.2, 705.3, and 504.5.1 shall be determined by ~~Equation 7-1~~, the following equation:

Contrast = [(B1-B2)/B1] x 100 percent ~~**Equation 7-1**~~

Where

B1 = light reflectance value (LRV) of the lighter surface,
B2 = light reflectance value (LRV) of the darker surface.

~~**701.1.3.1**~~ **310.3 Other Surfaces.** Surfaces not within the scope of BS 8493 shall provide contrast between adjacent surfaces that are either light on dark or dark on light.

Revise as follows

703.2.1 General. Visual characters shall comply with the following:

(Balance of section is not changed)

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.

703.2.1.2 Contrast. The Light Reflectance Value (LRV) of characters and their background shall contrast 70 percent minimum as determined in accordance with ~~Equation 7-1~~ Section 310.2. The lighter surface shall have a LRV of not less than 45.

703.5.3 Finish and Contrast. Pictograms and their fields shall have a nonglare finish. Pictograms shall contrast with their fields, with either light pictograms on a dark field, or dark pictograms on a light field.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. The Light Reflectance Value (LRV) of pictograms and their fields shall contrast 70 percent minimum as determined in accordance with ~~Equation 7-1~~ Section 310.2. The lighter surface shall have a LRV of not less than 45.

703.6.2 Finish and Contrast. Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.

703.6.3.2 Contrast. The Light Reflectance Value (LRV) of symbols of accessibility and their backgrounds shall contrast 70 percent minimum, as determined in accordance with ~~Equation 7-1~~ Section 310.2. The lighter surface shall have a LRV of not less than 45.

705.3 Contrast. Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.

The Light Reflectance Value (LRV) of the surfaces shall contrast 70 percent minimum, as determined in accordance with ~~Equation 7-1~~ Section 310.2. The lighter surface shall have a LRV of not less than 45.

504.5.1 Visual Contrast. The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread.

The Light Reflectance Value (LRV) of the 2-inch (51 mm) stripe and tread shall contrast 70 percent minimum, as determined in accordance with ~~Equation 7-1~~ Section 310.2. The lighter surface shall have a LRV of not less than 45.

Portions not shown remain unchanged.

Reason: The added language is a building block and not limited to visual communication items in Chapter 7. Section 504.4.1 is included so this should be relocated to Chapter 3 where it can be referenced as necessary for any additional contrast and/or LRV provisions that may enter into the standard. The majority of the change is the renumbering to make it compatible with the new location in Chapter 3 and a new title to the 310 Section.

One additional change was in Section 701.1.3 (new 310.2). Rather than list an equation number, the language is changed to reflect the manner in which another equation is used in the standard. Section 407.3.4 addresses elevator door and signal timing. The equation is maintained but the reference is to the section in which the equation is located.

7-1-12 PC3

Teresa E. Cox, representing International Sign Association

Delete and substitute as follows:

~~**105.2.13 Light reflectance value (LRV) of a surface. Method of Test.** BS 8493:2008 + A1: 2010 (British Standards Institution, 389 Chiswick High Road, London W4 4AL, United Kingdon).~~

~~**701.1.2 Light Reflectance Value**. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493 for the following surface types:~~

~~1. Opaque paint coatings and paint systems, including those that cause extreme angular dependences of reflected light and those that have a surface texture of less than 2 mm;~~

~~2. Opaque coverings including those that cause extreme angular dependences of reflected light, and those that have an unyielding texture of less than 2 mm;~~

~~3. Opaque coverings with a yielding pile, e.g. carpet;~~

~~4. Opaque materials, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm, e.g. finished metals;~~

5. Opaque materials coated with non-opaque coatings or coverings, e.g. timber door coated with a woodstain, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm;

6. Multi-colored surfaces;

701.1.2.1 Other Surfaces. Other surfaces shall comply with Section 703.1.3.1.

701.1.3 Contrast Value. The contrast between the LRVs of adjacent surfaces required by Sections 703.2.1.2, 703.5.3.2, 703.6.3.2, 705.3, and 504.5.1 shall be determined by Equation 7-1,

Contrast = [(B1-B2)/B1] x 100 percent **Equation 7-1**

Where

B1 = light reflectance value (LRV) of the lighter surface,
B2 = light reflectance value (LRV) of the darker surface.

701.1.3.1 Other Surfaces. Surfaces not within the scope of BS 8493 shall provide contrast between adjacent surfaces that are either light on dark or dark on light.

Revise as follows

703.2.1 General. Visual characters shall comply with the following:

(Balance of section is not changed)

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.

703.2.1.2 Contrast. The Light Reflectance Value (LRV) of characters and their background shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

703.5.3 Finish and Contrast. Pictograms and their fields shall have a nonglare finish. Pictograms shall contrast with their fields, with either light pictograms on a dark field, or dark pictograms on a light field.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. The Light Reflectance Value (LRV) of pictograms and their fields shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

703.6.2 Finish and Contrast. Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.

703.6.3.2 Contrast. The Light Reflectance Value (LRV) of symbols of accessibility and their backgrounds shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.

~~**705.3 Contrast.** Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.~~

~~The Light Reflectance Value (LRV) of the surfaces shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

~~**504.5.1 Visual Contrast.** The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread.~~

~~The Light Reflectance Value (LRV) of the 2-inch (51 mm) stripe and tread shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

703.2.1 General. Visual characters shall comply with the following:

(Balance of section is not changed)

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.

703.2.10 Contrast. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

703.6.2 Finish and Contrast. Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.

705.3 Contrast. Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.

504.5.1 Visual Contrast. The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread.

Reason: 1. The LRV's of many standard sign materials cannot be measured using the British Standard Method of Test.

2. Site conditions, particularly the type and intensity of lighting, have great impact on perceived contrast. Following the formula without considering site conditions, would allow combinations that do not have enough contrast, and prohibit others that are perfectly legible when appropriate lighting is provided.

3. The British Standard states in part "The method described in this standard is not appropriate for making on-site measurements. Therefore it is recommended that published LRV data, determined in accordance with this standard, are used for the determination of visual contrast." Relying on the British Standard (BS) establishes a design standard that lacks a corresponding field method to accurately calculate conforming color contrast of signs installed on-site.

4. The BS is referenced by a British government accessibility standard, Approved Document M (ADM 2010, with 2013 amendments), in association with measuring the difference in LRV's of adjacent building elements. Consistent with this application, the BS specifies sample sizes ranging from 450 mm x 450 mm (appx. 17.7 inches x 17.7 inches) to 25 mm x 25 mm (appx. 1 inch x 1 inch). But there appears to be no supporting evidence that the BS's LRV difference measurements are predictive of legibility for any population with special visual needs (e.g. elders, those with mild low vision), and the BS does not provide a means to measure for conformance, under actual field conditions, the LRV's of small graphic elements, especially text or visual symbols.

5. This proposal is really no different than proposals that have been defeated numerous times for multiple reasons, except for the addition of a new standard of questionable utility. The mere addition of any new standard, though, does not in any way support the adoption of 70% as a threshold value. In fact, the 70% figure is not mentioned in the BS.

6. Research is sorely needed to provide a rational basis for a signage contrast standard that can be applied simply, and prior to final site installation, whose conformance is predictive of legibility under typical if not actual field conditions.

7-1-12 PC4

David Hall, representing self

Disapprove the change. Return the text to that found in existing standard.

Reason: You people are out of your minds. Delete this new section. Although I can sympathize with people that have visual impairments, as I have the beginnings of cataracts, it is my opinion that you people have stepped over the line. It was always the physically disabled wanted to be treated equally. This change and a few others now appear to make the physically disabled a special group above the so call "normal" people. It would be much simpler and better if you just called out 2 colors that eceryone has to use of for any non-electric signs.

The building community will not be happy with what you are proposing. You have no idea how many calls I get as a building code official from people complaining that they have to spend all this money for accessibility when on one, especially people in wheel chairs, ever comes to their buildings.

I expect you to write this comment off, but from my perspective as a building official. You guys are heading for a huge backlash from the real world.

7-1-12 PC5

Harold Kiewel, representing self

Revise as follows:

Add definitions of *Visual Contrast* and *Non-Glare Finish* to Part 1 reading as follows

Visual Contrast means 70-percent or more separation between the LRV of an object and its field or background when calculated using Cv = 100 ((B1 - B2) / B1), where:

Cv = visual contrast expressed as the percent of LRV separation,
B1 = BS 8493 LRV of the lighter surface, and
B2 = BS 8493 LRV of the darker surface

Non-Glare Finish means an ASTM D 523, specular gloss of 19 or less when measured with a 60-degree gloss meter.

Add to list of references in Part 1 of the Standard:

BS 8493-2008 - Test Method for Light Reflectance Value (LRV) of a surface
ASTM D 523 - Specular Gloss

703.2.1.1 Nonglare Finish. ~~The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.~~ Characters, their background field, and surrounding surface coverings shall have non-glare finish.

Reason: How available is the BS 8493 test data for the kinds of materials in question? Is there a hand-held meter that you can point-and-shoot at materials in the field (like concrete)? Are we going to be able to police this?

How realistic is 70-percent contrast as an across-the-board standard? It may be readily achievable in signage, but in other construction material combinations like detectable warning tile and concrete, or stair-nosing inserts and bar-grating treads, it may be difficult to approach even 50-percent separation.

703.2.1.1; 703.5.3.1; and 703.6.3.1 verbatim redundancy
703.2.1.2; 703.5.3.2; and 703.6.3.2 verbatim redundancy

The repetition of this language clearly points to an inefficient and archaic writing style; we should mount an effort to streamline the Standard.

7-1-12 PC6

Rick Lupton, representing self

Revise as follows:

106.2.3 ~~105.2.13~~ Light reflectance value (LRV) of a surface. Method of Test. BS 8493:2008 + A1: 2010 (British Standards Institution, 389 Chiswick High Road, London W4 4AL, United ~~Kingdon~~ Kingdom).

106.5 Defined Terms.

gloss units (GU): The measurement scale of a glossmeter, based on a reference black glass standard with a defined refractive index having a specular reflectance of 100GU at the specified angle.

310 Contrast

310.1 General. The contrast of adjacent surfaces shall comply with Section 310.

310.2 ~~701.1.3~~ Percent Contrast ~~Value~~. The percent contrast between the light reflectance value (LRV)~~s~~ of adjacent surfaces ~~required by Sections 703.2.1.2, 703.5.3.2, 703.6.3.2, 705.3, and 504.5.1~~ shall be calculated ~~determined~~ by the following equation: ~~Equation 7-1,~~

Percent Contrast = [(B1 - B2) / B1] x 100 percent- **~~Equation 7-1~~**

Where:

B1 = ~~light reflectance value (LRV)~~ the LRV of the lighter surface~~,~~
B2 = ~~light reflectance value (LRV)~~ the LRV of the darker surface.

310.2.1 ~~701.1.2~~ Light Reflectance Value. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493, listed in Section 106.2.3, for the following surface types:

1. Opaque paint coatings and paint systems, including those that cause extreme angular dependences of reflected light and those that have a surface texture of less than 2 mm;

2. Opaque coverings including those that cause extreme angular dependences of reflected light, and those that have an unyielding texture of less than 2 mm;

3. Opaque coverings with a yielding pile~~, e.g. carpet~~;

4. Opaque materials, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm~~, e.g. finished metals~~;

5. Opaque materials coated with non-opaque coatings or coverings, ~~e.g. timber door coated with a woodstain,~~ including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm;

6. Multi-colored surfaces;

~~**701.1.2.1 Other Surfaces.** Other surfaces shall comply with Section 703.1.3.1.~~

> **Exception: ~~701.1.3.1 Other Surfaces.~~** Surfaces not within the scope of BS 8493, listed in Section 106.2.3, shall provide contrast between adjacent surfaces that are either light on dark or dark on light.

504.5.1 Visual Contrast. The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light- on-dark from the remainder of the tread.

The contrast ~~Light Reflectance Value (LRV)~~ of the 2-inch (51 mm) stripe to the ~~and~~ tread shall be

~~contrast~~ 70 percent minimum, in accordance with Section 310. ~~as determined in accordance with Equation 7-1.~~ The lighter surface shall have a LRV of not less than 45.

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 *gloss units (GU)* as measured on a 60-degree gloss meter.

703.2.1.2 Contrast. The contrast ~~Light Reflectance Value (LRV)~~ of characters to ~~and~~ their background shall be ~~contrast~~ 70 percent minimum in accordance with Section 310. ~~as determined in accordance with Equation 7-1.~~ The lighter surface shall have a LRV of not less than 45.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 *gloss units (GU)* as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. The contrast ~~Light Reflectance Value (LRV)~~ of pictograms and their fields shall be ~~contrast~~ 70 percent minimum in accordance with Section 310. ~~as determined in accordance with Equation 7-1.~~ The lighter surface shall have a LRV of not less than 45.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 *gloss units (GU)* as measured on a 60-degree gloss meter.

703.6.3.2 Contrast. The contrast ~~Light Reflectance Value (LRV)~~ of symbols of accessibility to ~~and~~ their backgrounds shall be ~~contrast~~ 70 percent minimum, in accordance with Section 310. ~~as determined in accordance with Equation 7-1.~~ The lighter surface shall have a LRV of not less than 45.

705.3 Contrast. Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on- light.

The contrast ~~Light Reflectance Value (LRV)~~ of the surfaces shall be ~~contrast~~ 70 percent minimum, in accordance with Section 310. ~~as determined in accordance with Equation 7-1.~~ The lighter surface shall have a LRV of not less than 45.

Reason: I've submitted this public comment to:

- Relocate the section on how contrast is measured to Chapter 3 Building Blocks;
- Clarify that appropriate contrast of adjacent surfaces is the measure sought;
- Provide language consistent with the conventions of the A117.1 standard, and;
- Omit commentary.
- Define the units for measuring glare;

There is no intent to modify the technical substance of the original proposal.

The proposed Sections 701.1.2 through 701.1.3.1, regarding the measurement of contrast, are improperly located as a subsection to the "scope" section in Chapter 7. It is not a part of scope but an independent provision. Additionally, the measure of contrast is applicable to more than communication elements and features; for example, by reference from Section 504.5.1 regarding edge stripping at stair treads. I propose locating these provisions as a new Section 310 in Chapter 3 Building Blocks is more appropriate, as was suggested to me, as a Public Comment, by the editing committee. The scoping provisions of Chapter 3 will limit the applicability of the contrast provisions to where required by Chapters 4 through 11, rather than providing a laundry list of code sections. Public Comment Sections 310 through 310.2.1, plus an exception, includes all technical substance of the current proposal, Sections 701.1.2 through 701.1.3.1.

While the current proposal leads with how to measure the reflectance of a surface (light reflectance value) then follows with an equation to calculate contrast, I reason that the contrast of adjacent surfaces is the primary consideration of these provisions, and measuring the reflectance (LRV) necessary only a means to measure the contrast between adjacent surfaces. Hence, I propose leading with the equation for measuring contrast and the method for measuring surface reflectance as a subsection to the equation. And, Sections 504.5.1, 703.2.1.2, 703.5.3.2, 703.6.3.2 and 705.3, each of which points to Section 310, are modified to reflect a percentage of contrast rather than a percentage of light reflectance value. The term "percent" is added, within Section 310.2 to coincide with reference sections, as the resultant measure of contrast.

In addition, because 701.1.2.1 serves only to reference 701.1.3.1, and 701.1.3.1 is an exception for when the surfaces do not fall within the scope of BS 8493; I've omitted Section 701.1.2.1 and changed Section 701.1.3.1 to an exception to new Section 310.2. The result is one either calculates the contrast, using the light reflectance value of adjacent surfaces, or one provides light on dark or dark on light where the surface materials are not within the scope of BS8493.

Then I've used this standard's convention for referencing a standard outside of A117.1 and I propose omitting, as commentary, examples of materials described in new Section 310.2.1.

Lastly, I've proposed labeling the units of the value limiting glare (as measured by a gloss meter), so that the

scale used by this standard (A117.1) is clear. By my research, gloss meters use a scale based on gloss units. Introducing "gloss units (GU)" meant adding a definition in Section 106.5.

In summary, the original proposal is intended to provide minimum limits for contrast and maximum limits for glare. The result of this Public Comment is the provisions are moved to building blocks; the order and language clarifies that the critical determination is the contrast between adjacent surfaces; ANSI convention used to reference outside standard and commentary language omitted, and; glare limits are related to the scale of a gloss meter.

7-1-12 PC7

David W. Miller, representing Society for Experiential Graphic Design

Delete and substitute as follows:

~~**105.2.13 Light reflectance value (LRV) of a surface. Method of Test.** BS 8493:2008 + A1: 2010 (British Standards Institution, 389 Chiswick High Road, London W4 4AL, United Kingdon).~~

~~**701.1.2 Light Reflectance Value**. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493 for the following surface types:~~

~~1. Opaque paint coatings and paint systems, including those that cause extreme angular dependences of reflected light and those that have a surface texture of less than 2 mm;~~

~~2. Opaque coverings including those that cause extreme angular dependences of reflected light, and those that have an unyielding texture of less than 2 mm;~~

~~3. Opaque coverings with a yielding pile, e.g. carpet;~~

~~4. Opaque materials, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm, e.g. finished metals;~~

~~5. Opaque materials coated with non-opaque coatings or coverings, e.g. timber door coated with a woodstain, including those that cause extreme angular dependences of reflected light, and those that have a texture of less than 2 mm;~~

~~6. Multi-colored surfaces;~~

~~**701.1.2.1 Other Surfaces.** Other surfaces shall comply with Section 703.1.3.1.~~

~~**701.1.3 Contrast Value.** The contrast between the LRVs of adjacent surfaces required by Sections 703.2.1.2, 703.5.3.2, 703.6.3.2, 705.3, and 504.5.1 shall be determined by Equation 7-1,~~

~~Contrast = [(B1-B2)/B1] x 100 percent **Equation 7-1**~~

~~Where~~

~~B1 = light reflectance value (LRV) of the lighter surface,~~
~~B2 = light reflectance value (LRV) of the darker surface.~~

~~**701.1.3.1 Other Surfaces.** Surfaces not within the scope of BS 8493 shall provide contrast between adjacent surfaces that are either light on dark or dark on light.~~

~~**Revise as follows**~~

~~**703.2.1 General.** Visual characters shall comply with the following:~~

~~*(Balance of section is not changed)*~~

~~**703.2.1.1 Nonglare Finish**. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.~~

~~**703.2.1.2 Contrast.** The Light Reflectance Value (LRV) of characters and their background shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

~~**703.5.3 Finish and Contrast.** Pictograms and their fields shall have a nonglare finish. Pictograms shall contrast with their fields, with either light pictograms on a dark field, or dark pictograms on a light field.~~

~~**703.5.3.1 Nonglare Finish**. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.~~

~~**703.5.3.2 Contrast.** The Light Reflectance Value (LRV) of pictograms and their fields shall contrast 70 percent minimum as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

~~**703.6.2 Finish and Contrast.** Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.~~

~~**703.6.3.1 Nonglare Finish**. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.~~

~~**703.6.3.2 Contrast.** The Light Reflectance Value (LRV) of symbols of accessibility and their backgrounds shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

~~**705.3 Contrast.** Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.~~

~~The Light Reflectance Value (LRV) of the surfaces shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

~~**504.5.1 Visual Contrast.** The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread.~~

~~The Light Reflectance Value (LRV) of the 2-inch (51 mm) stripe and tread shall contrast 70 percent minimum, as determined in accordance with Equation 7-1. The lighter surface shall have a LRV of not less than 45.~~

703.2.1.1 Nonglare Finish. The glare from coverings, the finish of characters and their background shall not exceed 19 as measured on a 60-degree gloss meter.

703.2.10 Contrast. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

703.5.3.1 Nonglare Finish. The glare from coverings and the finish of pictograms and their fields shall not exceed 19 as measured on a 60-degree gloss meter.

703.5.3.2 Contrast. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

703.6.2 Finish and Contrast. Symbols of accessibility and their backgrounds shall have non-glare finish. Symbols of accessibility shall contrast with their backgrounds with either a light symbol on a dark background or a dark symbol on a light background.

703.6.3.1 Nonglare Finish. The glare from coverings and the finish of symbols of accessibility and their backgrounds shall not exceed 19 as measured on a 60-degree gloss meter.

705.3 Contrast. Detectable warning surfaces shall contrast visually with adjacent surfaces, either light-on-dark or dark- on-light.

504.5.1 Visual Contrast. The leading 2 inches (51 mm) of the tread shall have visual contrast of dark-on-light or light-on- dark from the remainder of the tread.

Reason: 1. The LRV's of many standard sign materials cannot be measured using the British Standard Method of Test.

2. Site conditions, particularly the type and intensity of lighting, have great impact on perceived contrast. Following the formula without considering site conditions, would allow combinations that do not have enough contrast, and prohibit others that are perfectly legible when appropriate lighting is provided.

3. The British Standard states in part "The method described in this standard is not appropriate for making on-site measurements. Therefore it is recommended that published LRV data, determined in accordance with this standard, are used for the determination of visual contrast." Relying on the British Standard (BS) establishes a design standard that lacks a corresponding field method to accurately calculate conforming color contrast of signs installed on-site.

4. The British Standard is referenced by a British government accessibility standard, Approved Document M (ADM 2010, with 2013 amendments), in association with measuring the difference in LRV's of adjacent building elements. Consistent with this application, the British Standard specifies sample sizes ranging from 450 mm x 450 mm (approximately 17.7 inches x 17.7 inches) to 25 mm x 25 mm (approximately 1 inch x 1 inch), but there appears to be no supporting evidence that the British Standard's LRV difference measurements are predictive of legibility for any population with special visual needs (e.g. elders, those with mild low vision), and the British Standard does not provide a means to measure for conformance, under actual field conditions, the LRV's of especially for small graphic elements, such as text or visual symbols.

5. This proposal is really no different than proposals that have been defeated numerous times for multiple reasons, except for the addition of a new standard of questionable utility. The mere addition of any new standard, though, does not in any way support the adoption of 70% as a threshold value. In fact, the 70% figure is not mentioned in the British Standard.

When the 70% "standard" was mentioned in the Appendix to the 1991 ADAAG, the recommendation was to measure reflectivity with a 60° Gloss Meter. The British Standard requires the use of a "Global Reflectometer," a piece of equipment that is even more rare than the 60° Gloss Meter, which is uncommon enough and usually found only in the possession of a paint manufacturer. Very few independent labs, if any, now offer the service of establishing an LRV on a commercially available basis. If this were the case, all sign manufacturers and designers would use them. They do not. Even though the recommendation was in effect for some 20 years, no "cottage industry" emerged to provide LRV's for colors not provided on commercial paint charts, attesting to the difficulty of offering such a service.

An interesting negative effect of adopting the British Standard is that any LRV figures now available would be rendered useless because they have been measured on a flat lumisphere Reflectometer, not a Global Reflectometer, as newly required by the proposal. Re-measurement of all present published values is not likely to happen because the size of the sign industry is minuscule compared to all components of the construction industry.

6. More research is needed to improve existing requirements for contrast on signage and how to measure for conformance under actual field conditions.

7-1-12 PC8

Sharon Toji, representing Hearing Loss Association of America

Further revise as follows:

701.1.2 Light Reflectance Value. The light reflectance value (LRV) of surfaces shall be determined in accordance with BS 8493 for the following surface types:

Numbers 1 through 6 are unchanged.

7. Ordinary surfaces, which are defined as material which is neither retroreflecting nor fluorescent nor phosphorescent nor involves electrical power for light emission nor is self-luminous.

701.1.3.1 Other Surfaces. Surfaces not within the scope of BS 8493 shall provide contrast between adjacent surfaces that are either light on dark or dark on light. Other surfaces shall include

1. Thermochromic;
2. Photochromic;
3. Retroreflective;
4. Fluorescent;
5. Phosphorescent;
6. Surfaces involving electrical power for light emission;
7. Self-luminous
8. Free-standing non-opaque materials such as glass and clear plastic for curved surfaces.

Reason: I have three major points to deal with in my comments. For one, I don't think we take seriously enough the issue of defective color vision when it is not accompanied by another severe vision impairment. However, this topic is now getting a lot more attention, and defective color vision, with or without the accompaniment of another disability, is at the heart of the issue of contrast in the built environment.

A. The issue of impaired color vision is just now entering the consciousness, partly because of the increased use of color in teaching and testing materials, and because technology is increasing our ability to present all kinds of elements in color, and to do so inexpensively and with some fidelity.

Normally, when impaired color vision is not accompanied by some other vision impairment, we do not consider the person to have a disability. However, that view is changing. When a person with impaired color vision is confronted with a message, whether printed, on a sign, or on the internet, that is in colors that he or she cannot distinguish clearly, that person might as well be functionally blind during that instant. The "message" is out of reach. On top of that, the list of professions that are that are either closed to or discouraged for a person with defective color vision is growing.

We are talking about a very large group of people. Some defective color vision is genetic, including the common "red/green" type which affects about 8 percent of males, and 1/2 percent of females. The females are carriers. This condition can be seriously affected by signs, since so many safety signs and transportation signs are red on black, or vice versa. Those two colors are virtually indistinguishable for people with this type. On top of that, there is an even larger group with an acquired type of condition. In an email from T.J. Waggoner, Director, Color Vision Products of Konan Medical USA, he said: "You are correct in saying that 8% of males are born with a color vision deficiency. One statistic that I did not see mentioned is that 10% - 15% of the general population, both males and females, have an acquired (tritan) deficiency according to Rayman's Clinical Aviation Medicine 5th Edition. It is chapter 9 that discusses color vision and mentions the 10%-15% statistic." There is a wealth of material on color deficiency, and I have received a letter from one doctor affiliated with the Navy about it. One list of jobs and professions possibly closed to those with color deficiencies probably had 25 jobs on it. Certainly, the inability to read directional and informational signs, some of which are safety oriented, is important. I will be sending more material as I receive it.

B. Marsha Mazz, delegate from the Access Board, changed her vote to "negative" on the strength of a comment presented by Dr. Edward Steinfeld of RESNA, as well as a quote from Dr. Geoffrey Cook, as relayed by Dr. Aries Arditi. I have been speaking and corresponding with Dr. Cook in regard to the contrast issue, as well as the Standard of Test, for some time. He had assured me that ordinary sign materials, and specifically materials where a layer of color has been applied to the second surface of a clear cover material, where a colored material is coated with a clear coating, or a clear piece of material is installed directly on top of a piece of colored material without a measurable separation, would not have a deflection that would influence the LRV reading in any appreciable manner.

These situations describe the great majority of instances where there is a clear layer of material over or above a layer of colored material, as used for architectural signs that come under the restrictions of the ADA Design Standards.

Dr. Cook has now replied directly to these comments. Dr Cook has a very large body of work having to do with contrast and color in the built environment, and its effect on persons with vision impairments. He is the lead author of the Method of Test, clearly understands it, and has told me that he is anxious to see it adopted as widely as possible, since he believes it is the most reliable way to determine the LRVs of many different kinds of surfaces. Since the IOS has not currently adopted a Method of Test, although their own standards do require contrast for various architectural elements, CEN (European Committee for Standardization) has adopted the British Standard for the determination of LRVs for this purpose. An Australian organization called CIAL has done the same. So, this is a widely recognized standard of test. Some countries use the 70 percent formula, others such as the UK list the required difference between two LRV extremes. In the UK, the suggested difference for signs is 70 (not 70 percent), which is much more stringent than what we are recommending.

About Dr Geoff Cook

I am attaching a link to his very impressive list of qualifications and publications on the subjects of lighting, color, and vision impairments in the built environment. I have not encountered anyone else with such an extensive background in these topics that are so relevant to our discussion. https://www.reading.ac.uk/CME/about/staff/g-k-cook.aspx.

The University of Reading: The School of Construction Management and Engineering

Testimony in support of BS8493:2008+A1:2010

Overview of the Impact of the UK approach to Colour & Contrast

The research as described in the references to this testimony has allowed the definition of best practice in visual contrast in the built and transport environments to be established. It has brought significant benefit to VIPs. The findings are also of direct benefit to those responsible for the design and management of these environments. They can be confident that they are providing inclusive, accessible environments rather than environments that may be considered non-inclusive, unsafe and discriminatory under the scope of the UK Disability Discrimination Acts 1995 and 2005 (as embedded within the more recent UK Equality Act 2010). Results have led directly to new formal standards and design/test methods and, crucially, to changes in national regulation.

The research findings relating to colour and contrast have been adopted by large companies including ICI Dulux. Celia Taylor, Business Area R&D Director commenting on the 'Colour and Contrast' guide and CD published by ICI Dulux as a result of the Reading work (in correspondence dated 4 March 2013) noted:
".. this guide forms the basis of various offerings to specifiers and healthcare organisations… It is regularly presented around the country, and showing how the colour palette notation makes it easy to specify in accordance with the Equality Act guidelines is also good for sales volumes."
The company Gradus refer to the Reading findings on contrast in their product literature in their 'Experts view' at: http://www.gradusworld.com/geoff-cook-expert-view-part-1. The charity The Thomas Pocklington Trust have used the findings of the Reading work to produce a design guide for housing for people with sight loss which is available at: http://www.pocklingtontrust.org.uk/Resources/Thomas%20Pocklington/Documents/PDF/Research%20Publications/RF17.pdf
Sue Sharp, Director of Services and Public Affairs at charity RLSB has noted (in correspondence dated 4 March 2013) how the research continues to be used to advise on the provision for vision impaired people, and concludes:
"Overall, Project Rainbow has, in my view, had a significant impact on the regulation and design of public transport and public infrastructure for the benefit of vision impaired people."
In the area of standards development, BS8300:2001 (a code of practice for designing buildings to meet the needs of disabled people) provides the foundation for the latest edition of BS8300:2009. . This is now incorporated into Annex B of BS8300:2009 which defines contrast requirements and references the Reading work. The measurement Standard, BS 8493:2008+A1:2010 specifies the test method to determine the light reflectance value (LRV) of different surfaces of materials and is drawn from the Reading work and is now a referenced document in BS8300:2009. The UK Building Regulations 2010 Approved Document M, available at:
http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_M_2010.pdf, continues to include the need for adequate visual contrast to be provided in new buildings (as appeared in the 2004 version), and continues to make reference to the Reading work. Current developments include the international standard ISO 23599 (Assistive products for blind and vision-impaired persons) which is concerned with tactile surfaces and has adopted the Reading LRV contrast approach. Also standards development at the European level (via CEN/BT/WG 207 on accessibility in the built environment) is also drawing on the Reading work. This is shown in references to the Reading work and detail relating to LRV measurement in Sections 33 and 35 and more detailed comments in Annex B 9.2 of ISO21542. The work is continuing to have impact in the transport sector. Commenting on a new emerging pan-European access standard for mainline trains and stations (PRM TSI, from 2008) John Bengough of the UK Department for Transport (DfT) has http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_M_2010.pdf, continues to include the need for adequate visual contrast to be provided in new buildings (as appeared in the 2004 version), and continues to make reference to the Reading work. Current developments include the international standard ISO 23599 (Assistive products for blind and vision-impaired persons) which is concerned with tactile surfaces and has adopted the Reading LRV contrast approach. Also standards development at the European level (via CEN/BT/WG 207 on accessibility in the built environment) is also drawing on the Reading work. This is shown in references to the Reading work and detail relating to LRV measurement in Sections 33 and 35 and more detailed comments in Annex B 9.2 of ISO21542. The work is continuing to have impact in the transport sector. Commenting on a new emerging pan-European access standard for mainline trains and stations (PRM TSI, from 2008) John Bengough of the UK Department for Transport (DfT) has noted (in correspondence dated 5 March 2013) that it initially used a different contrast measure from the Reading work for adequate contrast but:
"… This has proved to be unworkable so British representatives [on the EN drafting committee] have used Reading's work to develop a Euro-Norm that combines both techniques… Once in force, it will guide the interpretation of the PRM TSI across the European Union."
The In 2008 the Government amended and updated the Rail Vehicle Accessibility Regulations 1998 (RVAR) (S.I.1998/2456), the latest version drawing directly on the Reading work. Several sections of these regulations, including Appendix A of the RVAR Guidance 1998, explain contrast in terms of the Reading work. Indeed the Reading researchers were consulted in the drafting of the RVAR. Therefore all new Regulated rail vehicles must now comply with the contrast requirements defined at Reading. The work has also been adopted by the Department for Transport (DfT) in relation to the requirements for train stations as: DfT Accessible Train Station Design for Disabled People, published in 2011 and available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3191/accessible-train-station-design-cop.pdf This is in addition to existing DfT documents which include the Reading work and which, despite predating the Impact Period, continue to have impact - including 'Inclusive Mobility', available at: www.dft.gov.uk/transportforyou/access/peti/inclusivemobility!!
The reach of the contrast wok at Reading is very wide, covering the built environment sector as well as major elements of the transport sector also, particularly relating to public transport provision. Its impact is in the areas of quality of life (including health and safety), employment and manufacturing. Additionally, employers need to deal with current and potential employees (including VIPs) in a non-discriminatory way and thus the Reading LRV work is highly relevant for improving the employability of VIPs as well as their safety in the workplace. Manufacturers, e.g. ICI Dulux and Gradus, have used the Reading work to develop a unique market position and enhance their activities and tailor their products to meet clear LRV criteria. Further evidence of impact can also be found in many new buildings completed since 2004, including Heathrow Terminal 5 and the London Olympics 2012 facilities. The ODA/LOCOG Inclusive Design Standard Sources used in this testimony:
1. Celia Taylor, Business Area R&D Director, Decorative Paints, ICI Dulux (a brand of AkzoNobel), Member of the drafting committee on BS8394:2009.
2. John Bengough, Department for Transport (Rolling Stock – Technical &Accessibility).
3. Sue Sharp, Director of Services and Public Affairs, Royal London Society for Blind People
4. Keith Oakes, Technical Director, Gradus Ltd; also a member of the drafting committee of BS8394.
5. Iain MacKinnon, Senior Manager - Accessibility and Inclusive Design, London Legacy Development Corporation.
Publications: Cook, G.K., Lighting Quality aspects - Essential Requirements for Visually Impaired People, Proceedings of the First Symposium on Lighting Quality, National Research Council, Ottawa, Canada, 1998, pp48-59 ISBN 3 900 734 91 7.
Cook, G.K., Bright, K.T., 1999, Project Rainbow: A Research Project to Provide Colour and Contrast Design Guidance for Internal Built Environments, Occasional Paper No. 57, The Chartered Institute of Building, Ascot, Berkshire. ISBN 1 85380 084 8 (Winner of the CIOB Innovation Award Research Papers Competition 1997).

Cook, G.K., Bright, K.B., Harris, J., 1999, Building Design: The importance of flooring pattern and finish for people with a visual impairment, The British Journal of Visual Impairment, 17, 3, 121-126.
Cook, G.K., Bright, K., 2010, The colour, light and contrast manual- Designing and managing inclusive built environments, Wiley-Blackwell, Oxford ISBN 978 1 4051 9504 1.
http://www.london2012.com/documents/oda-publications/inclusive-designstandards.pdf) goes further than BS8300: 2001/9 and makes specific reference to the concept of LRV developed by Reading.
The School of Construction Management and Engineering

Comments in relation to the email from Sharon Toji dated 19th December 2013
My comments are shown as red in the text.

In relation to comments from Edward Steinfeld: RESNA – Edward Steinfeld
Negative: Ballot:
Comment/reason: Research was not presented to demonstrate that this is a serious issue. Making objects perceptible to people with poor vision is assisted by the provision of adequate contrast (Bright & Cook, 1999). Before adopting extensive standards, it would be good to know whether it is or not. See reference (Bright & Cook, 1999) Further, the standards are based on testing a sample. This is not equivalent to field conditions. Very few research studies involving people with poor vision use real-world conditions, but the Bright & Cook 1999 reference shows that real-world tests were carried out as part of the study.

Following the standard will not necessarily lead to signage that is usable for people with visual impairments, or anyone else for that matter. In field conditions, lighting levels, type of light source, the presence of disabling glare in the visual field, and the angle of incidence of the light sources can have a greater effect on readability than surface characteristics. Whilst this is an opinion, adopting this view would mean that there is no real need for any artificial lighting design recommendations, as all of the factors listed are equally applicable. However, this is nonsense as it ignores the real value to be achieved by the non-cost option of changing the colour of a material – most coloured materials cost the same. Further, in daylight, the conditions vary significantly within short periods of time. While this may be enforceable based on laboratory testing, it is highly doubtful that this rule will actually contribute to improved usability. Interesting point as the wider utilization of daylight is seen internationally as a good thing since it reduces electrical energy consumption. Since daylight, even inside buildings can equal or exceed the illuminance provided by artificial lights, when sufficient contrast is provided as drawn from laboratory conditions which have a generally low illuminance; this will actually enhance the perception of contrast as contrast perception increases with increased illuminance – up to the point where glare or veiling reflections start to appear. In general the points about glare, illuminance and types of light source all impact on the perception of surfaces inside buildings. However, good designers can predict these things with accuracy and ensure that signs are effective – providing they have sufficient LRV differences between the symbols/letters on the sign.

Further comments received from Marsha Mazz:
Of particular concern is Dr. Aries Arditit's observation that "Many of the accessible signs in use in the US today are made from clear material with color applied to the second surface (subsurface). *According to Dr.Geoff Cook and Mark Rose, the BS8493 test method is not suitable for multi---layered materials as the measurement equipment needs to accurately assess the difference between the light sent to the measurement surface and that reflected from the measurement surface. A layer of clear material between the meter and colored measurement surface would allow light to escape after reflection and render the measurement invalid*." The role of LRV is to give an accurate measure of the light reflectance of a surface. Where an opaque coloured surface is overlaid with a clear surface, then the comments italicised are true, but this is not the way to consider the use of the standard. The standard is a way of determining the LRV of opaque surfaces which are to be seen by people with poor vision. If the LRV of an opaque surface is measured then it is placed behind a clear protective layer, the LRV of the surface will not fundamentally change. Therefore the LRV of the underlying opaque material can be measured with the standard and can be used. Remember that this standard is making measurements to help people see a contrast when looking at two surfaces, not precluding from LRV measurements multi-layered materials. In a strictly scientific sense there may be some reduction in the light being reflected from the underlying opaque surface as there will be a very small amount absorbed by the overlaying surface, but this is not likely to be a significant effect. Several commenters indicated that research is underway in other countries. Perhaps we should await those studies prior to establishing a standard that is potentially flawed. It is difficult to believe that any respectable funding body would fund such a weak project. The LRV of the opaque underlying layer will not change so the losses due to different overlying layers would be interesting to measure, but if these overlying layers remain clear, the effects will continue to be insignificant. So the way forward for multi-layer signs to try to measure of the LRV of the coloured surface directly. The other points in previous emails relate to very thin coloured surfaces being included in a material which becomes part of a sign. It is possible to measure the LRV of these materials, even if they have to be mounted onto some material to allow this. It is also worth considering that; presumably, the colour of these materials is known and therefore measured? If so then the LRV can be measured.

References:
Bright, K.T., Cook, G.K.,1999, Project Rainbow: A Research Project to Provide Colour and Contrast Design Guidance for Internal Built Environments, Occasional Paper No. 57, The Chartered Institute of Building, Ascot, Berkshire. ISBN 1 85380 084 8

Third, there is still some reluctance to approve a standard that cannot be easily tested in the field, and also a belief that lighting is so important, that we might as well not even concern ourselves with contrast, if lighting may not be adequate. Dr Cook deals with this somewhat, and he is an expert in the field of lighting. We all recognize that if the lighting is poor, or there is none, the signs, no matter how much contrast they may have, will not be visible. The fact is, though, that even if we passed standards for lighting that would require that every sign be perfectly lit, with controls that would change lighting for different conditions during the day, we could not control the maintenance of the lighting. To save money, management could remove bulbs, reduce watts, or just not replace bulbs when they burn out. Lights could be turned off. If we start with good contrast, and lighting is adequate, the sign will be useful to more people. If we start with poor contrast, the signs may not be usable, especially for people with defective color vision, no matter how good the lighting. If you cannot distinguish colors, lighting will not help much, if at all.

As to testing in the field, unfortunately I did not get the comments promised to me by the Company in the UK that has recently finished testing 105 people with vision impairments. This company has a testing device that is portable, and much less expensive than the ones we have seen earlier. I will be submitting these comments later through the Secretariat as soon as I receive them. Other comments are coming in from various sources as well, and I will be submitting those. Unfortunately, it has been difficult to light a fire under the various scientists I have been contacting, to get commentary back to me in a timely manner.
I believe that if those who are objecting to the Standard of Test will read it carefully, including the definitions and the scoping and commentary, they will understand that it can be a very useful standard. It is being adopted by other standards organizations. It is true that the UK does not enforce its standards in the same manner we do, but I am told that gradually, the standard and Method of Test are being used, and having an important influence on signage and other architectural elements.

8. Purpose and Reason: The purpose is to present a faithful representation of the Method of Test, one that includes all the materials that the Method of Test is intended to include. The purpose of the second addition is to present a faithful list of those exact materials that are not appropriate for the Method of Test.

The list of sign material types included in the BSI Standard of Test and in the amended standard introduced and voted on after my early departure from the July meeting, left out the most inclusive: "Ordinary Materials," a defined term. The revised standard is too restrictive when this category is eliminated. Perhaps the individuals who proposed adding the restrictive list of materials that could be tested by the BSI Method of Test were unaware that the term "Ordinary Materials" was a defined term, and should have been included in order to faithfully reflect the Standard. Without this item, the test is restricted to just a few materials, and many of them are not used very often for architectural signs covered by our Standard. In the case of the British Standard, "Ordinary" is not synonymous with "Other," or even "Miscellaneous," but includes one of the largest category of architectural sign materials, i.e. plastics. As long as the term "Ordinary" is defined, as it is in the Standard, it is appropriately restrictive and useful.
If the list of materials that cannot be tested is added, then the Standard becomes even more useful. I recommend both adding "Ordinary Materials" to the allowed list, and listing those that cannot be tested. I ask that we, as delegates to the organization that represents the United States in the field of accessibility in the built environment, join other national and international organizations in recognizing that people with disabilities based on communication deserve just as much specificity and attention paid to elements that are important to them, as we pay to those who use wheelchairs. It is time that we gave designers and inspectors something better than vague generalities. As technology improves, and testing instrumentation is more available, this standard will serve as a useful basis for further refinement.

7-2 – 12

Revise as follows:

702.1 General. Accessible audible and visible alarms and notification appliances <u>that are part of a building fire alarm system</u> shall be installed in accordance with NFPA 72 listed in Section 105.2.2, be powered by a commercial light and power source, be permanently connected to the wiring of the premises electric system, and be permanently installed.

> **<u>EXCEPTION:</u>** <u>Audible and visible notification appliances provided within dwelling or sleeping units shall comply with Sections 1006.2 through 1006.4.4.</u>

7-2-12 PC1

Harold Kiewel, representing self

Further revise as follows:

702.1 General. Accessible audible and visible alarms and notification appliances that are part of a building ~~fire~~ <u>emergency</u> alarm system shall be installed in accordance with NFPA 72 listed in Section 105.2.2, be powered by a commercial light and power source, be permanently connected to the wiring of the premises electric system, and be permanently installed.

> **EXCEPTION:** Audible and visible notification appliances provided within dwelling or sleeping units shall comply with Sections 1006.2 through 1006.4.4.

Reason: I am opposed to changing dimensions to non-modular (odd) numbers. I believe that dimensional requirements of the Standard should, to the maximum extent practicable, be modular in both Imperial and metric (SI) systems. Imperial dimensions should be multiples of 4-inches, and conversion to metric measure should use 4-inches = 100 mm. As a professional technical writer, I take exception to the modern practice of wasting the first Article of every major sub-part with the phrase "[this work] shall comply with this Standard." If the Standard has a purpose, and the Article has title, the phrase is superfluous. You could save a

couple of pages by deleting those lines. I have not pointed out spelling, tense, or minor grammatical errors. There are some, but I presume that the committee has access to editors who will, in due course, correct those items.

7-16– 12

Add new text as follows:

704.8 Visual Relay Service Booth. Each public Visual Relay Service Booth shall be accessible and accommodate one user with seating, a visual monitor, control device, diffuse lighting with a minimum lighting level of 20 foot candles (215 lux). And privacy enclosure with a flat, non-textured surface and finish color in contrast with the full range of human skin tones to provide a background for clear visual communication.

7-16-12 PC1

Harold Kiewel, representing self

Comment: In the phrase "*[the] finish color [shall be] in contrast with the full range of human skin tones*" does contrast mean 70-percent, BS 8493 LRV separation? Is that physically possible? Aren't there going to have to be booths with light backgrounds for people of color and booths with dark backgrounds for light-skinned people? More likely there would be louver blinds at the back of the booth that create a background that is switchable from a No. 9 Cool Gray (dark) to No.2 Warm Gray (light) (color names are from a Pentel marker set).

7-16-12 PC2

Rick Lupton, representing self

Revise as follows:

704.8 Visual Relay Service Booth. Each public Visual Relay Service Booth shall be ~~accessible and~~ accommodate one user with seating and privacy enclosure, a visual monitor, a video camera device, control device, diffuse lighting with a minimum lighting level of 20 foot candles (215 lux). ~~And privacy enclosure with a flat, non-textured surface and finish color in contrast with the full range of human skin tones to provide a background for clear visual communication.~~ The background of the seating area, and within range of the video camera device, shall have a flat, non-textured surface and finish color in the bright green or blue range.

Reason: The current proposal omits necessary equipment for the facility, includes language that cannot be consistently enforced, and is grammatically incorrect. This Public Comment attempts to address each of these issues.

The current last sentence is grammatically incorrect and cannot be enforced consistently. The "full range of human skin tones" is quite broad and unless one is expert, is subject to interpretation (see picture in Supporting Information below). In addition, the extent of contrast is not specified. I've proposed a color in the bright green or blue range. This is based on the need for a background at the seating area and in view of a video camera that provides a contrast from a broad range of human skin tones to provide a background for signing. Bright green or blue are specifically used in the film industry (see Supporting Information below) as mattes because they are seldom within the human skin color spectrum and so enable the human to stand out. There may be other colors that work but this provision should include the degree of contrast and point to the contrast provisions proposed for A117.1. In addition, the current language appears to require the entire privacy screen to require contrasting color, not addressing the specific need of a background to the video area.

I've added a video camera device to the laundry list of requirements for this facility (see FCC quote in Supporting Information below) and clarified (what I think was intended) that the privacy enclosure is for the seating area and not just the monitor.

I've omitted "be accessible" as scoping. Where accessibility is required by the scoping document, the current language provides no guidance. By accessible, is it intended that a wheelchair space be provided in addition to the seating, etc.

The result of this Public Comment is not perfect, but maintains the intent of the proposed provision while clarifying much of what is intended.

A description of visual relay service by the Federal Communications Commission (http://www.fcc.gov/guides/video-relay-services):
How VRS Works

VRS, like other forms of TRS, allows persons who are deaf or hard-of-hearing to communicate through the telephone system with hearing persons. The VRS caller, using a television or a computer with a video camera device and a broadband (high speed) Internet connection, contacts a VRS CA, who is a qualified sign language interpreter. They communicate with each other in sign language through a video link. The VRS CA then places a telephone call to the party the VRS user wishes to call. The VRS CA relays the conversation back and forth between the parties -- in sign language with the VRS user, and by voice with the called party. No typing or text is involved. A voice telephone user can also initiate a VRS call by calling a VRS center, usually through a toll-free number.
• From an article on photography and green screens, Creating Realistic Composites, Part 1: Shooting on a Green Screen by Rob Taylor (http://photography.tutsplus.com/tutorials/creating-realistic-composites-part-1-shooting-on-green-screen--photo-14288)

"Why am I choosing green? Well, chroma green is a color rarely found in nature, particularly human skin tones, so people stand out nicely in front of it."

A Color Wheel Based On The Range Of Human Skin Tones (http://www.fastcodesign.com/1669972/a-color-wheel-based-on-the-range-of-human-skin-tones#5)

Images courtesy of Superscript and Pierre David

7-16-12 PC3

Kimberly Paarlberg representing ICC

Delete without substitution:

Reason: There are several problems with the language in this requirement. If I have to have a space for both a wheelchair ("accessible") and a seat within this booth ("seating"), is my hearing impaired person close enough to the screen/keyboard to be able to use the device? If this is intended for wheelchair access, is a turning space needed similar to a dressing room? Where is

the light level measured? What would meet 'non-textured' surface? What is the full range of human skin tones? What color would contrast with that? How much contrast? What is the device required in the space anyhow?

7-21 – 12

Revise as follows:

TABLE 707.6.1—RAISED SYMBOLS

Key Function	Description of Raised Symbol	Raised Symbol
Enter or Proceed:	CIRCLE	◯
Clear or Correct:	LEFT ARROW	← or <
Cancel:	"X"	X
Add Value:	PLUS SIGN	+
Decreased Value:	MINUS SIGN	-

7-21-12 PC1

Harold Kiewel, representing self

Revise as follows:

TABLE 707.6.1—RAISED SYMBOLS

Key Function	**Description of Raised Symbol**	**Raised Symbol**
Enter or Proceed:	CIRCLE	◯
Clear or Correct:	LEFT ARROW	← or <
Cancel:	"X"	X
~~Add~~ Increase Value:	PLUS SIGN	+
~~Decreased~~ Decrease Value:	MINUS SIGN	-

Reason: I am opposed to changing dimensions to non-modular (odd) numbers. I believe that dimensional requirements of the Standard should, to the maximum extent practicable, be modular in both Imperial and metric (SI) systems. Imperial dimensions should be multiples of 4-inches, and conversion to metric measure should use 4-inches = 100 mm.

As a professional technical writer, I take exception to the modern practice of wasting the first Article of every major sub-part with the phrase "[this work] shall comply with this Standard." If the Standard has a purpose, and the Article has title, the phrase is superfluous. You could save a couple of pages by deleting those lines.

I have not pointed out spelling, tense, or minor grammatical errors. There are some, but I presume that the committee has access to editors who will, in due course, correct those items.

7-23– 12

Revise as follows:

703.3.8 Character Spacing. Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Spacing between individual raised characters shall be 15% or 1/8 inch (3.2 mm) minimum, whichever is greater, and 35% maximum of the character height measured at the top of the surface of the characters, 1/16 inch (1.6 mm) minimum measured at the base of the characters, ~~and four times the raised character stroke width maximum.~~ Characters shall be separated from raised borders and decorative elements 3/8 inch (9.5 mm) minimum.

7-23-12 PC1

Sharon Toji, representing Hearing Loss self

Disapprove the change. Return the text to that found in existing standard.

Reason: The proponents did not analyze the effect of the change. The proposed change would actually have, in many cases, the opposite effect to what they wish, and would have other negative impacts as well.

The proponents of the change state that the current standard does not allow for good graphic design in terms of spacing, because it forces artificial spacing between characters. However, the proposed solution is just as artificial, makes more work for layout artists, plan checkers and inspectors, and does not satisfy the designer's wishes for either tighter kerning or more design freedom. It does just the opposite, except for the very smallest sign characters.

Do the math!

We are requiring minimum spacing of 1/8 inch between the two closest points of characters because of a test we carried out, many years ago, of a large number of people at the national convention of the American Council of the Blind, under the direction of Julie Carroll, a former Committee delegate. Let's assume that the Committee has accepted that.

Since we are retaining the 1/8 inch space as a minimum, we must check and perhaps alter the spacing for all signs with characters up 7/8 inches in height (most designers would not tend to specify 27/32 inch characters.) Many designers prefer 5/8 inch characters for signs, but 15 percent of character height is not even 1/10 inch. Here is a chart for the smaller size characters normally used for tactile signs. It shows when we can
begin to use the 15 percent minimum spacing. It also shows that, in regard to "standard" spacing, the 35
percent maximum is more restrictive than the original maximum of 4 times the character stroke width, based on the minimum stroke width requirement of 10 percent:

Height	Decimal of 15%	Decimal of 35%	Required (1/8 inch)	Maximum 4 x stroke	Use 15%	Use 35%
5/8 inch (.625)	**.09375**	**.21875**	**.125**	**.250**	**No**	**Yes**
3/4 inch (.75)	.1125	.2625	.125	.300	No	Yes
13/16 inch (.8125)	.121875	.284375	.125	.325	No	Yes
53/64 inch (.8281)	.124215	.289835	.125	.33124	No	Yes
27/32 inch (.8437)	**.126555**	**.295295**	**.125**	**.33748**	**Yes**	**Yes**
7/8 inch (.875)	**.13125**	**.30625**	**.125**	**.350**	**Yes**	**Yes**

Once we go to characters 7/8 inch high, and if we use standard Adobe Illustrator spacing for characters, we find that very few character pairs don't already have spacing of at least 1/8 inch. In checking a number of common room function names, most words have one, or perhaps two such character pairs. Therefore, assuming we are satisfied with standard Adobe Illustrator character spacing, there will be very few necessary changes in the spacing. Whichever code you apply, the current one or the proposed one, you will have to tweak those few pairs of characters.
For instance, in any word with "ROOM," there is not 15 percent space between the two "Os." That is the case even with two inch high characters.

Height	Decimal of 15%	Decimal of 35%	Required (1/8 inch)	Maximum 4x stroke	Use 15%	Use 35%
53/64 inch (.8281)	**.124215**	**.289835**	**.125**	**.33124**	**No**	**Yes**
27/32 inch (.8437)	**.126555**	**.295295**	**.125**	**.33748**	**Yes**	**Yes**
7/8 inch (.875)	**.13125**	**.30625**	**.125**	**.350**	**Yes**	**Yes**
1 1/2 inch (1.500)	**.225**	**.525**	**.125**	**.600**	**Yes**	**Yes**
2 inch (2.00)	**.300**	**.700**	**1.25**	**.800**	**Yes**	**Yes**

Therefore, for every job, the layout artist for the tactile characters may not only have to increase certain spacing to meet the 1/8 inch rule, but may also have to increase additional character spacing to meet the 15 percent rule. On top of that, the 35 percent maximum rule is slightly more restrictive. There will be more "tweaking" rather than less. Where is the benefit? There is none.

The other losers are the plan checker and the inspector. With the 1/8 inch rule, it is very fast and simple to have a tool with a 1/8 inch measurement. When characters appear very tight, the tool can determine in an instant if 1/8 inch space is there or not. With the 15 percent rule, you have to measure the height, determine what 15 percent is, and then devise a measurement tool just for that job. Now, you have to measure for both 1/8 inch and 15 percent. As an inspector, you would have to take a a whole key-chain of measurement tools with you, for every eventuality from 7/8 to 2 inch high characters.

Part of the problem is that many people are not correctly understanding what the current standard requires.

1. It does not require "monospacing." Every letter pair does not require 1/8 inch spacing, no more or less. Variable spacing generally in line with accepted spacing protocols for visual signs is acceptable and possible within this standard.

2. The measurement is between the two closest points, not between two artificial rectangles drawn around all the points of each character.

3. There are several ways to mitigate the visual appearance of the signs:

A. Do not use the smallest possible characters. The minimum size is not really the best size for visual readers, so don't use it except when absolutely necessary. With larger characters, the required spacing will also be more pleasing.

B. Ease, bevel, or provide a "shoulder" for the edges of the raised characters. They will be much easier to read by touch, and the top surfaces of the characters will be slightly further apart, so most normal character spacing will be compliant. As a designer, if you use certain types of materials and an extreme bevel, you can place the characters as close as 1/16 inch to each other.

C. Whenever possible, use the new rule that allows two separate sign sections, one visual and one tactile. The visual characters allow for much tighter spacing, and the tactile characters can be “invisible," so the wide spacing will not have a visual impact on the appearance. Each section can be easier to read for more people with varying types of disability.

D. Be sure you are choosing sans serif font styles. "Simple serif" styles for tactile characters went out with the original ADAAG. If you have to separate the tips of serifs by 1/8 inch, naturally you will get much larger and more unattractive spaces between letter pairs.

Although the requirement for 35 percent space maximum, rather than 4 times the stroke width, makes very little practical difference in character pairs we have looked at, it’s probably easier for an inspector to make a quick measurement on site of four times the stroke width, than it is to calculate 35 percent of the character height. Since thirty-five percent is actually a slightly more limiting standard, at least when calculated using the minimum stroke width of 10 percent of character height, why not just retain it? For instance, for a one inch high character, the range of maximum space allowed would be between 40 and 60 percent of character height, versus 35 percent. Although a plan checker or inspector may need to measure some spaces to determine if they are no more than 35 percent, and that restriction may mean that layout artists have to artificially change spacing of a few characters,that will almost never happen with the current requirement. Allowing more space between characters will not usually be an incentive to designers to widen the spacing, since they almost always prefer tighter spacing.

Following are some slides that I intend to show at the January meeting. They clearly demonstrate the fact that more space “tweaking” is required when you use a standard of 15 percent of character height, than if you retain our original requirement of 1/8 inch.

The only exception is between characters when the characters are between 5/8 inch and 7/8 inches high.

However, since our ANSI project some years ago showed that 1/8 inch was the minimum required between characters if people who are blind can distinguish one letter from the other, the Committee has at this point decided to retain a requirement for 1/8 inch minimum between characters.