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NB-Rail Association

RECOMMENDATION FOR USE

NB-RAIL COORDINATION GROUP

Administrative Decision according to Interoperability Directive
(EU) 2016/797 art. 30.6



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RFU-PRM-053

Issue 02

Date 17/06/2021

TITLE

ASSESSMENT OF CONFORMITY CONCERNING CONTRAST - ALTERNATIVE MEASURE FOR
CONTRAST IDENTIFICATION

ORIGINATOR

TÜV SÜD NEDERLAND B.V. (RAILCERT B.V.)

SUBJECT RELATED TO

TSI PRM 1300/2014

AMENDMENT RECORD:

Issue 02: amendment of some values about the calculation examples given

DESCRIPTION AND BACKGROUND EXPLANATION

This RFU covers conformity assessment concerning contrast as defined by TSI PRM.

Introduction

TSI PRM 1300/2014 often refers to the requirement relating to the assessment of contrast of an object against its background. According to ERA/GUI/02-2013/INT Appendix 2, contrast of the two adjacent surfaces is maintained by different values of the diffused light reflectance (LRV) or luminance but can be enhanced by variation in hue and chroma.

TSI PRM 1300/2014 does not clearly define requirements related to contrast, as it is a parameter of the second category. When it is required in the TSI PRM to provide a contrast, this can be achieved by applying the standards listed in chapter 5, index A of ERA/GUI/02-2013/INT. In addition, the methodology provided in the RFU-PRM-053 Issue 01 can be used, referring to the so-called Michelson algorithm.

$$K = \frac{(L_0 - L_h)}{(L_0 + L_h)}$$

where K = contrast

L_0 = the diffused light reflectance value of the object

L_h = the diffused light reflectance value of the background or adjacent surface.

ERA/GUI/02-2013/INT Appendix 2 Section 1.1 describes the method of establishing LRV values when the colour specification is known and the method of measuring the LRV values when the colour specification is not known.

Until the TSI defines the situation more precisely, different approaches are possible. One is described in the PRM TSI Application Guide and another is proposed in this RFU.

RFU PROPOSAL

During the assessment stage the following alternative assessment approach can be employed.



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As was defined by the PRM TSI 2008/164/EC: “When contrast is specified in this TSI there shall be a minimum value of $K = 0.3$.”, this value is understood as an absolute value $|K| \geq 0.3$.

This RFU defines a comparative assessment approach which satisfies the formula above based on the specific light reflectance value (Y_1) as defined by the NCS Colour System. This system is widely employed in the industry, and transposition tables to other systems (e.g. RAL) are available. The light reflectance values given in the NCS are absolutely precise and were detected in labs under optimal conditions.

References:

- 1 - NCS Translation Key NCS – RAL, Scandinavian Colour Institute AB, Edition 7, 2005
- 2 - NCS Translation Table Lightness, Scandinavian Colour Institute AB, Edition 3 2007.



1. Single coloured surfaces

(examples are based on selection of visually clearly distinguishable colours)

Example 1:

Zinc yellow object (e.g. hand rail): RAL 1018



NCS Sample according to reference 1, page 9:S 0570-Y

Light reflectance value according to reference 2, page 11: $Y_1 = 67,12 (L_0)$

Grey blue background (e.g. back panel): RAL 5008



NCS Sample according to reference 1, page 9:S 8010-R90B

Light reflectance value according to reference 2, page 21: $Y_1 = 5,48 (L_h)$

According to formula on the first page: **Contrast $K = 0,85$**

Example 2:

Maize yellow object (e.g. hand rail): RAL 1006

NCS Sample according to reference 1, page 9: S 2070-Y20R

Light reflectance value according to reference 2, page 12: $Y_1 = 33,55 (L_0)$



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Graphite grey background (e.g. floor): RAL 7026

NCS Sample according to reference 1, page 10: S 8005-B20G

Light reflectance value according to reference 2, page 23: $Y_1 = 6,91$ (L_h)

According to formula on the first page: **Contrast K = 0,66**

Example 3:

Traffic orange object (e.g. hand rail): RAL 2009

NCS Sample according to reference 1, page 9: S 1080-Y60R

Light reflectance value according to reference 2, page 15: $Y_1 = 25,79$ (L_0)

Violet blue background (e.g. seat cushion): RAL 5000

NCS Sample according to reference 1, page 9: S 6020-R80B

Light reflectance value according to reference 2, page 21: $Y_1 = 10,51$ (L_h)

According to formula on the first page: **Contrast K = 0,42**

2. Patterned surfaces (percentage composition)

For patterned surface (multi coloured), e.g. floor, seat cushions, each separate colour shade can be identified by the colour chart. According to the related surface percentage, the representative shade for the patterned surface can be defined.

Example 1:

50 % Violet blue background (e.g. seat cushion): RAL 5000



NCS Sample according to reference 1, page 9:S 6020-R80B

Light reflectance value according to reference 2, page 21: $Y_1 = 10,51$ (L_{01})

50 % pastel blue (e.g. seat cushion): RAL 5024



NCS Sample according to reference 1, page 9:S 3030-B

Light reflectance value according to reference 2, page 22: $Y_1 = 27,36$ (L_{02})

$L_0 = L_{01}(10,51) + L_{02}(27,36)$ divided by 2 = 18,94

Graphite grey background (e.g. floor): RAL 7026





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NCS Sample according to reference 1, page 10: S 8005-B20G
Light reflectance value according to reference 2, page 23: $Y_l = 6,91 (L_h)$

According to formula on the first page: **Contrast K = 0,47**

3. Colours not defined in the NCS range

Based on engineering judgement it is possible to define for any surface colour, which is not defined within the NCS or any related colour system (e.g. RAL), the closest matching colour that is defined in one of the systems.

4. Metallic surfaces (comparison with colour charts)

The above-mentioned descriptions cannot simply be applied for metallic surfaces. By using colour charts, a similar colour shade can be found by expert judgement and close matching. This shade can then be a basis for the calculation to formula on the first page. The expert judgment shall be considering effects such as direction of brushing.

Example 1:

Brushed chrome object (e.g. hand rail): Comparable to RAL 7044 (silk grey)



NCS Sample according to reference 1, page 10: S 2502-Y
Light reflectance value according to reference 2, page 11: $Y_l = 49,72 (L_0)$

Grey blue background (e.g. back panel): RAL 5008



NCS Sample according to reference 1, page 9: S 8010-R90B
Light reflectance value according to reference 2, page 21: $Y_l = 5,48 (L_h)$

According to formula on the first page: **Contrast K = 0,80**

Example 2:

Chrome Object (e.g. hand rail): Comparable to RAL 9002 (grey white)

NCS Sample according to reference 1, page 10: S 1502-Y

Light reflectance value according to reference 2, page 11: $Y_l = 64,66 (L_0)$

Quartz grey background (e.g. floor): RAL 7039



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NCS Sample according to reference 1, page 10: S 6502-Y

Light reflectance value according to reference 2, page 11: $Y_l = 15,83 (L_h)$

According to formula on the first page: **Contrast K = 0,61**

5. Correction factor when using comparative assessment

The above approach is expected to produce unavoidable small deviations in comparison to a precise measurement of the light reflectance of the “as built situation”. In order to always receive a conservative result in relation to the PRM TSI 2008 limit of 0.3, it is proposed to use a correction factor of 1.1 which gives an enlarged limit value of $K_{enl} = 0.33 = 0.3 * 1.1$.

If this enlarged value cannot be demonstrated by the comparative assessment approach, measurement of the “as built situation” can be performed and this must demonstrate compliance with the PRM TSI 2008 limit value of 0.3.

The calculations contained above prove that a contrast of a minimum value of $K_{enl} = 0.33$ can easily be achieved when selecting appropriate light-coloured objects in contrast with darker colours for the backgrounds.

Visually clearly distinguishable light and dark colours typically have a contrast value of about 0.4 – 0.8 and higher (see analysis below). Insofar this correction factor will not pose an insurmountable burden.

6. Contrast against an undefined background

At various points the PRM TSI 2014 requires assessment of contrast against the background against which they are viewed. In many cases it will not be possible to define this background (e.g. 4.2.1.5 for transparent obstacles, 4.2.2.3.3 for interior doors, 4.2.1.7 for furniture and free-standing devices). An example for a case where the background cannot be clearly defined is the view into a passenger vehicle saloon which is largely dependent on the colour and pattern of the passengers clothing and their luggage as well as the actual internal and outside ambient lighting which will differ significantly between day and night. Likewise, the background for free-standing furniture cannot be readily defined if this background includes moving passengers, trains of various external colours and the day-night ambient lighting changes.

In these cases, it is recommended to place the required contrast directly into the “bands” to be applied on transparent obstacles or in case of solid obstacles into the surface colours / pattern of the solid obstacle. E.g. in case of transparent interior doors, the bands which are required according to the TSI should include two contrasting colours.



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In such a case the contrast requirement is deemed to be fulfilled, irrespective of the background.

THIS RFU WAS AGREED ON

PLENARY MEETING 62

THIS RFU ENTERS INTO FORCE ON

21/06/2021

FROM THIS DATE ON THIS RFU CAN BE APPLIED INSTEAD OF THE PREVIOUS MANDATORY VERSION.

RFU APPLICATION IS MANDATORY STARTING FROM

21/06/2021

AT THIS DATE ANY PREVIOUS VERSIONS OF THIS RFU WILL BE WITHDRAWN.

RFUS SHALL BE APPLIED BY ALL NOBOS. PLEASE REFER TO RFU-STR-702, CHAPTER 3 OF THE SECTION "DESCRIPTION AND BACKGROUND EXPLANATION", FOR THE LEGAL BASIS SUPPORTING THIS OBLIGATION.

ERA COMMENTS

PLE 62 – 17/06/2021: NO COMMENTS - OR SPECIFY IF ANY
ERA DISCLAIMER WILL BE INCLUDED