

Achieving visual contrast in built, transport, and information environments

everyone, everywhere, everyday

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Vision - Dominant sense

- process of deriving meaning from what is seen
- Half the human brain is devoted directly or indirectly to vision
- About 80% percent of our perception, learning, cognition, and activities are mediated through vision



Vision - Dominant sense





- Generates appropriate motor, and/or cognitive responses to the world around us
- Visual contrast sensitivity is a crucial part of this process
 - allowing detection of objects and
 - discriminating objects or details from their background.

Vision - Visual contrast



- Part of how people experience and interact with the world around them
- Poor visual contrast affects everyone, but especially people with a vision impairment, and older people
- Visual contrast often referred to as luminance contrast

Luminance contrast (LC)

- Worldwide recognised in standards and codes as the most relevant measure of how a person visually perceives their environment.
- Mainstream issue, crucial for
 - safety, amenity and accessibility.



https://news.bitcoin.com/countries-imfglobal-standards-crypto-regulation/

But, is a tiny fraction of compliance requirements. Assessed by:

- Measuring luminance reflectance values (LRV) of adjoining surfaces, and
- Calculating their contrast using a formula

Luminance contrast

Compliance standards

Measurement - prescribed equipment

<u>Lab/site</u> Colorimeter placed on a surface Controlled light source

<u>Site</u> Photometer on tripod Ambient light conditions



Konica Minolta - Precise Color



FIGURE E3(A) POSITION FOR MEASURING THE LUMINANCE OF THE TACTILE INDICATOR MEASURED BY THE LUMINANCE METER

From AS1428.4.1

Quick physics

Controlled light v ambient light

Colorimeter - measures 'pure' colour

- Not reflect ambient lighting, or
- how an environment is experienced by users.

Photometer - measures reflected light

- Are sensitive to surface conditions and ambient light,
- better reflect how users are experiencing the environment.
 - eg pools of light and dark, glare, effect of texture and reflectiveness of surfaces.



Konica Minolta - Precise Color



Quick physics

Perception of colour, light and contrast:

- Light source
- Shading
- Texture
- Wet and dry etc



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Research



https://www.clipartkey.com/view/iihoJm_data-clipart-research-study-research-and-studies-png/

The problem

Prescribed equipment

- expensive \$\$\$\$ barrier to use
- bulky photometer plus tripod

As built LC not measured

- A survey of access practitioners (n = 84) revealed 66% relied on 'by eye' judgement to determine luminance contrast compliance with the NCC.
- LC not achieved on site
 - Ambient conditions

Is there a better way? - more available and more accessible tools to support practitioners to achieve better outcomes?

Research



Objective to provide a readily available tool that could

measure LRVs

- representative of user experience
- Representative LRVs could then be used to calculate the luminance contrast experienced by users.
- Research hypothesis
 - based on the premise that a camera captures the scene, 'as seen'.

Research



- Image analysis algorithms from print, web and photographic technology brought together and tested.
- With known lux and luminance values, the LRV results from each algorithm were compared against the LRV obtained using the ISO 21542 formula:

Best algorithm

- Interestingly:
 - Australian Standard AS 1428.4.1 clause E3.3(e)

"A <u>more accurate</u> calculation [of LRV] might be based on the relative proportions of each colour (where these proportions might be determined by image analysis techniques)".





LC Calculation methods

There are 4 main methods which provide very different answers! There is no consensus worldwide.

- 1. Simple difference
- 2. Bowman-Sapolinski
- 3. Proportional difference (Weber)
- 4. Michelson



Simple difference Bowman Sapolinski Weber Michelson

Galbraith and Bowman paper at the IEA conference, Vancouver 2021 discusses a variety of issues, including the extent of research underpinning the development of standards and the need to reflect user experience

Application - Get Luminance

Free iOS and android App utilising:

- Verified image analysis algorithm
- 4 main calculation methods

Portable and affordable (free!) tool

Key benefits: Measuring LRV that reflects user experience including:

shadowing, glare, gloss and uneven surfaces.



Application - Get Luminance

- The research demonstrated how image analysis techniques can be used and incorporated into a smart phone App to provide portable, affordable on-site measurement tool that reflects user experience.
- However, further research is required to provide a consistent luminance contrast calculation to reflect human visual experience.
- Both are required to achieve safe and accessible outcomes in the built environment.

Universal design - everyone, everywhere, everyday



Questions



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