Developments in CIE Division 4

Transportation and Exterior Applications

Div 4 publications (1980 - 2003) involving CIE Australia (ANCI)

- CIE 74 Road Signs Technical Report (BL Cole – member)
- CIE 79 A Guide for the Design of Traffic Lights (BL Cole – member)
- CIE 093 Road Lighting as an Accident Countermeasure (AJ Fisher – chairman)
- CIE 107 Review of the Official Recommendations of the International Commission on Illumination for the Colour of Signal Lights (BL Cole – chairman)
- CIE 137 The Conspicuity of traffic Signs in Complex Backgrounds (SE Jenkins – chairman)
- CIE S 004 Colur of Light Signals (BL Cole – chairman)
- CIE 143 International Recommendations for Colour Vision Requirements for Transport (BL Cole – chairman)
- CIE 144 Road Surface and Road Reflection Characteristics (SE Jenkins – member)
- CIE 146 CIE Equations for Disability Glare (BL Cole – member)

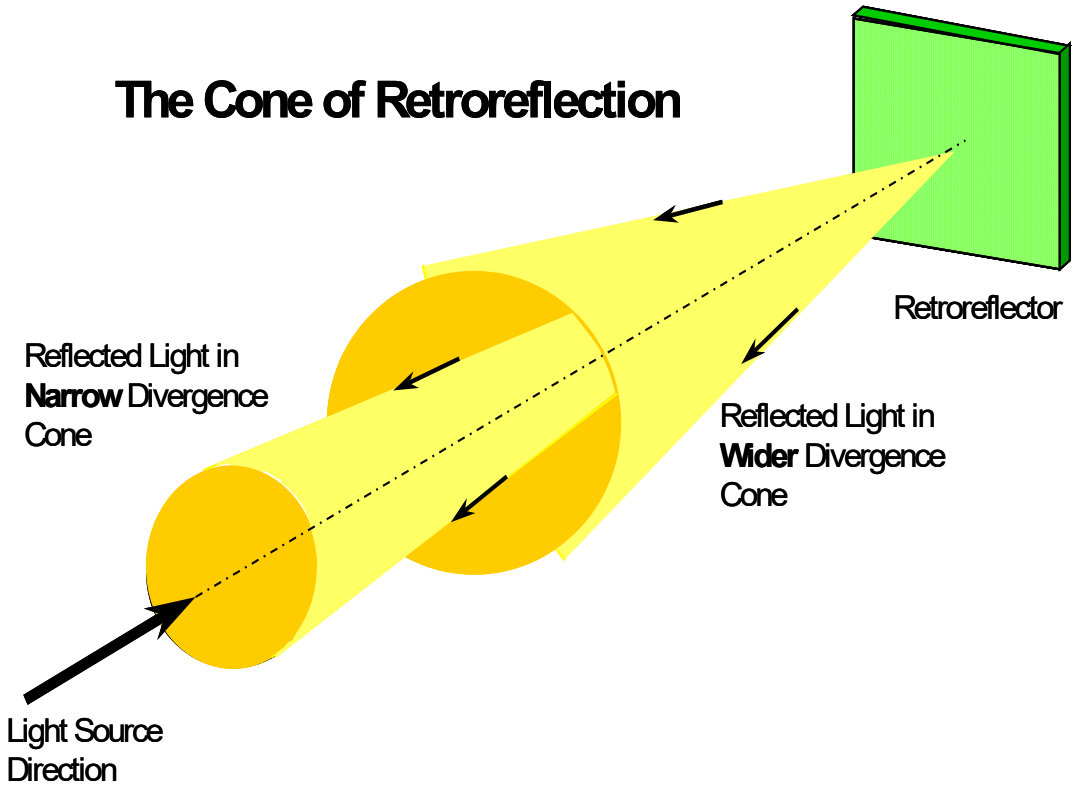
Major Developments in Div 4

- Retroreflective Traffic Signs
- LED Coloured Sources for Signalling, Signing and Advertising
- LED White light Sources for Illumination (road lighting, vehicle lighting)

Technical Committees from about 2000

- With CIE Australia input:
- TC 4-40 Performance Evaluation of Retroreflective Traffic Signs (SE Jenkins – member)
- TC 4-47 Application of LEDs in Transport and Signalling (SE Jenkins – chairman)
- TC 4-60 Road Traffic Lights – Photometric Properties of Roundel Signals (SE Jenkins – member)
- Without CIE Australia input
- TC 4-50 Road Surface Characterisation for Lighting Applications
- TC 4-53 Tunnel Light Evolution
- TC 4-58 Obtrusive Light from Colourful and Dynamic Lighting and its Limitation
- TC 4-62 Adaptive Road Lighting
- JTC 13 (D4/D3) Depreciation and Maintenance of Lighting Systems
- Reportership – Lighting for Cyclists

Retroreflectivity



Advances in Retroreflective Traffic Signs (TC4-40)

- Traffic signs are able to be seen at night because of their retroreflectivity. Up until about the year 2000, the retroreflectivity for signs (and line-marking) was provided by glass beads.
- The photometric performance came in two flavours High Intensity grade and Engineering grade with a sizeable difference between them.
- Then came the advent of Microprismatic sheeting which allowed for much greater freedom in design with the possibility of custom designing retroreflective performance to suit a particular application.
- Fluorescent microprismatic sheeting was developed and marketed. This works particularly well during dusk where there is a greater proportion of short wavelength light.

TC4-40 Performance evaluation of retroreflective traffic signs

- Purpose: To recommend an accepted performance evaluation technique for retroreflective traffic signs

- Goal: To document the required luminance needed by nighttime drivers and demonstrate a systematic methodology that can be used to assess the luminance provided by traffic signs.

Elements considered in the evaluation

Models of visual acquisition

The driving population

Required luminance for legibility, required luminance for conspicuity

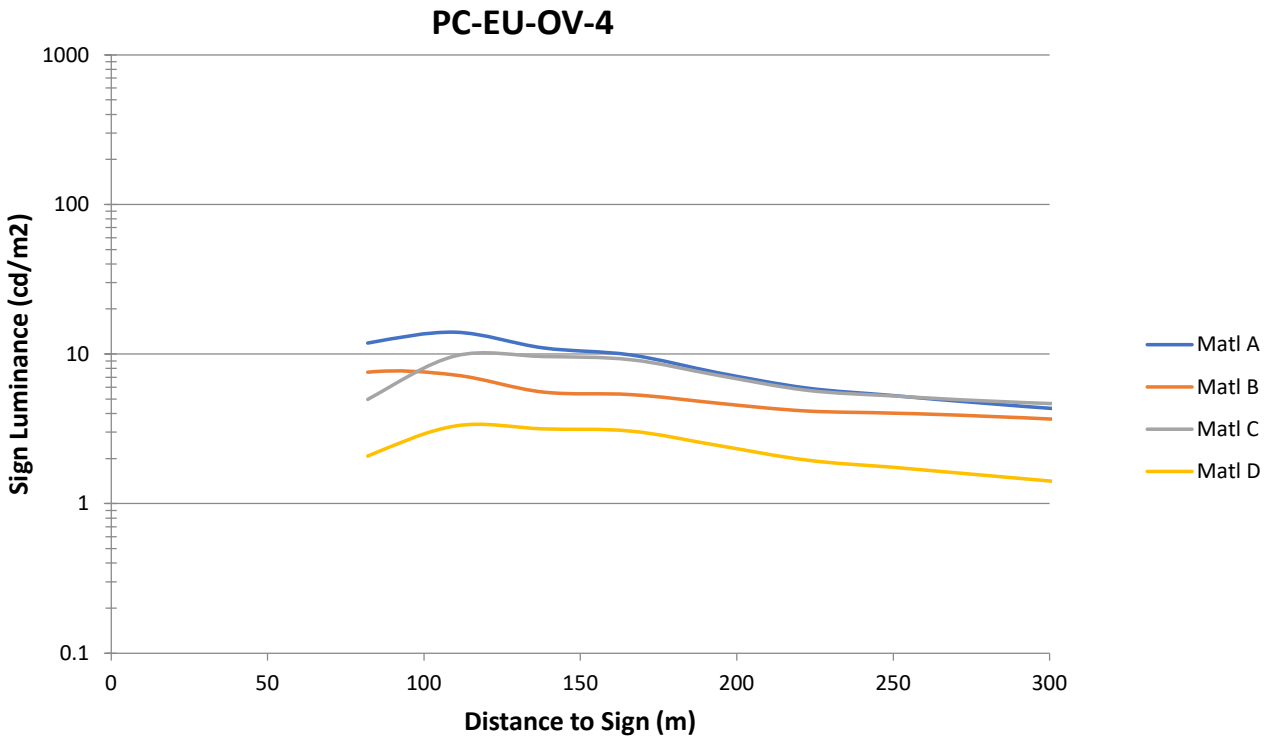
Retroreflective sheeting performance

Vehicle/driver geometry – car/truck

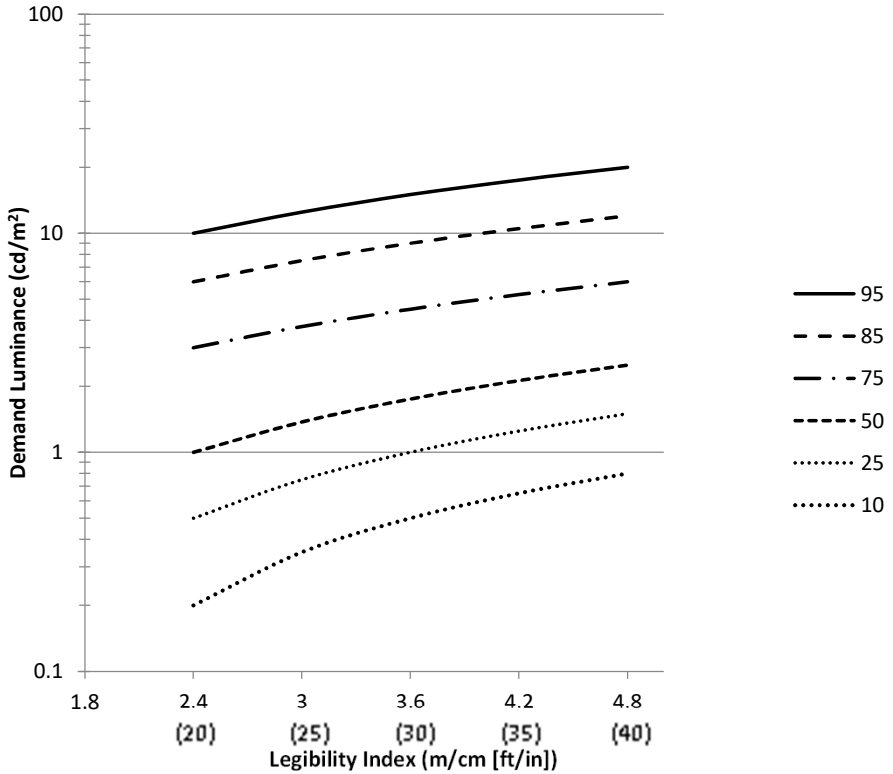
Vehicle headlights (US beam/ European beam)

Sign placement, letter size

Sign Luminance from different materials

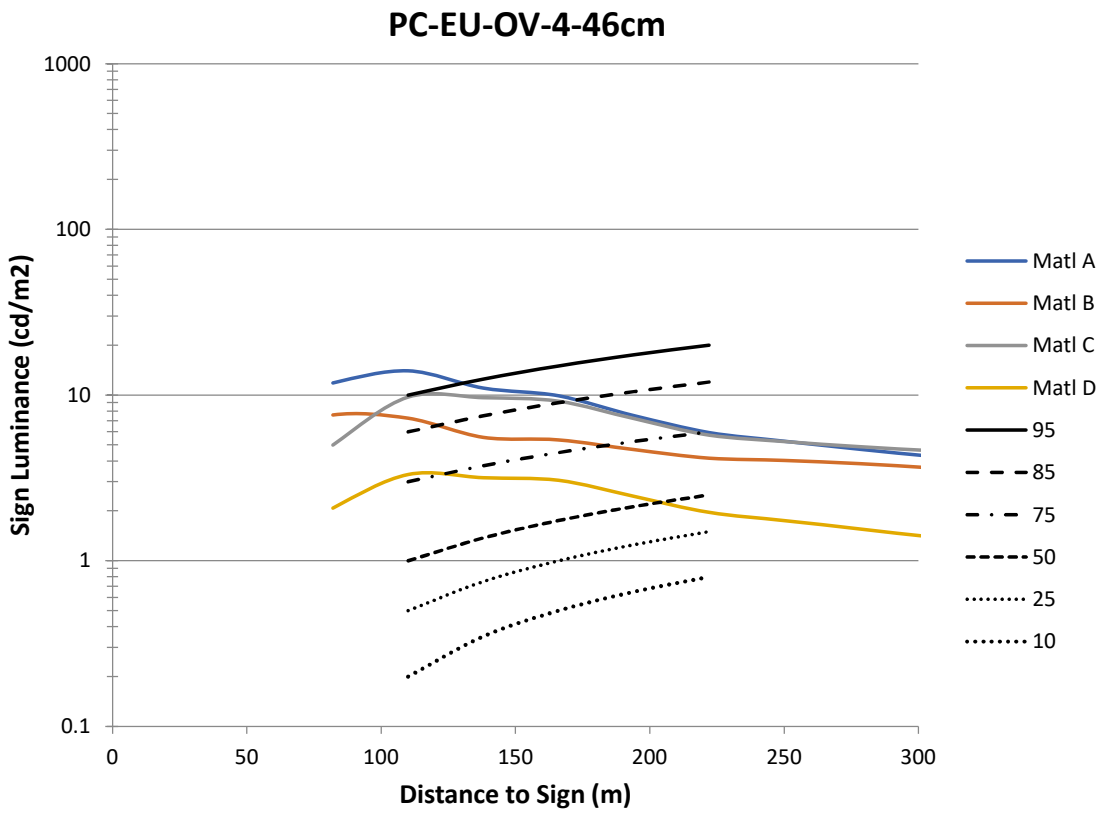


Luminance demand curve for passenger car and overhead sign.



- The performance index is the per cent of older drivers served by the sheeting

Supply and Demand curve for PC-EU-OV-4



LEDs as a source for signalling and illumination

- Signalling generally uses a colour code and was an early adopter of LEDs as they were sufficiently bright with enough of them.
- LEDs were also quickly adopted for Variable Message Signs which allowed rapid changes of the message and eventually extended to advertising signs and dynamic signs
- LEDs for illumination came later with the invention of white LEDs and were used in Vehicle headlighting and Road Lighting

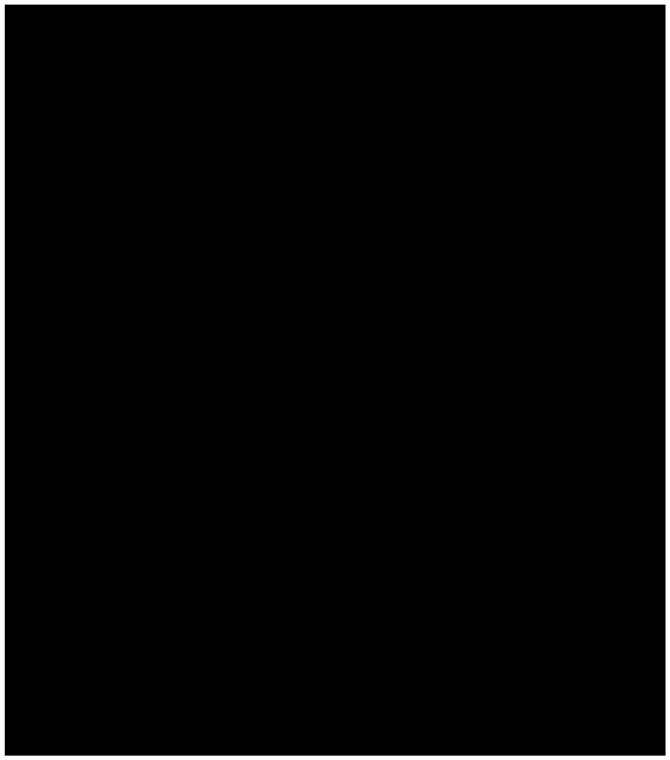
Incandescent Source Traffic Signal

LED Source Traffic Signals

Early LEDS

Later LEDs

Traffic Signals with Surface-mounted LEDs



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Road Lighting Luminaires

- Around 2006 there was a growing interest in energy efficiency in road lighting and a 19 month trial of the newly available luminaires with T5 or compact fluorescent lamps with electronic ballasts was undertaken in Sydney.
- This showed that road lighting could be more efficient in pedestrian environments (Category P roads) with the T5 and CFL lamps being as reliable.
- CFL – 42W, 2xT5 - 30W, HPM – 89W, TF 2x20 – 50W
- A six year program to replace 60,000 obsolescent 2x20W TF luminaires was implemented

Road Lighting Luminaires

- However in 2010 we started seeing prototype LED Luminaires being tested and developed.
- First as Category P replacements and then for Category V road environments.
- One of the major problems was to develop good thermal control for the LEDs in the luminaire
- And the optical control was crude at first.
- Nevertheless it was clear that LEDs would be more energy efficient and have much longer lifetime that any previous source.

Luminous Efficacy of White Light Sources (lm/W)

- Ring Filament 12 lm/W
- QH Lamp 20-25 lm/W
- HPS 110 lm/W
- CFL 70-90 lm/W
- LED Luminaire 120-150 lm/W

Road Lighting Luminaires

- Pedestrian environment
- 12W luminaire 116 lm/W

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- Vehicle environment
- 200W luminaire 115 lm/W

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Example of LED and Lens system

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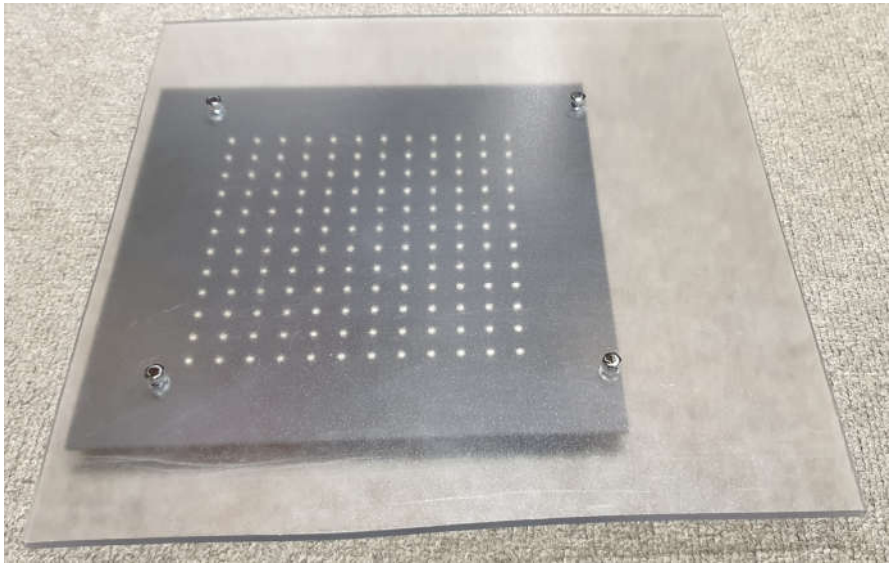
Variable Message Signs

- This is an example of a prototype RC3 ramp control signal displaying only one colour. In production each pixel would contain for example four LEDs (red, yellow, green, white).



Variable Message Signs

- The major problem VMS had was with the sun-phantom test. The Diffusing front cover reflected far too much light greatly reducing the luminance contrast of the message.
- This was ameliorated by allowing the cover to be clear and tilted down slightly.

Advertising Displays

- With the advent of LED screens, it has been possible to construct advertising signs in the road environment that are visible during the day as well as night.
- For daytime viewing the luminance of a white sign is usually set at around 6000-8000 cd/m2.
- This is far too bright for use at night and could cause major glare problems to drivers and annoyance to residents.
- Road controlling authorities have combatted this by placing limits on the Threshold Increment (TI) caused by such advertising signs
- This usually results in luminances around 300 cd/m2

Division 4 Technical Committees

- Without CIE Australia input
- TC 4-50 Road Surface Characterisation for Lighting Applications
- TC 4-53 Tunnel Light Evolution
- TC 4-58 Obtrusive Light from Colourful and Dynamic Lighting and its Limitation
- TC 4-62 Adaptive Road Lighting
- JTC 13 (D4/D3) Depreciation and Maintenance of Lighting Systems
- Reportership – Lighting for Cyclists

Disappointments

- TC 4-40 Performance of Retroreflective Traffic Signs (2003)– the report was never completed, the last draft was Draft 21 dated August 2015. it was a large report and a lot of work went into it. However, the chairman moved on to other employment and there were no takers to finish the report.
- TC 4-47 Application of LEDs in Transport and Signalling – (2008)n the report was completed and endorsed by the TC members in 2022. However, a large number of comments were received at a late stage and have yet to be answered. It seems to be in hibernation
- Nevertheless……

Around the World with the CIE……..

CIE Sessions

- 1991 Melbourne
- 1995 New Delhi
- 1999 Warsaw
- 2003 San Diego
- 2007 Beijing
- 2011 *Sun City*
- 2015 Manchester
- 2019 *Washington*

CIE mid-Sessions or Div 4 meetings

- 2008 Helsinki
- 2009 Budapest
- 2010 Vienna
- 2012 Blacksburg, Virginia
- 2013 Paris
- 2014 Kuala Lumpur
- 2016 Melbourne
- 2017 *Jeju*

….and meet a wide array of great people