National Construction Code 2019

Education Workshop

CHANGES TO PART J6 – ARTIFICIAL LIGHTING & POWER

Topics

David Crossley	Lighting Council Australia	The Major Changes
Steve Brown	NDYLIGHT	Tips and Tricks for Lighting Designers
Tim Hanson	Gerard Lighting	Getting the most out of the new Code
Simm Steel	Steensen Varming	Everything Old is New again
Andrew Parker	Evolt	Challenges and the Impacts on Products
Mike Dodd	ABCB	The NCC 2019 Update

The Major Changes

David Crossley

Technical Manager,
Lighting Council Australia

Lighting Council AUSTRALIA

IALD

NCC 2019 Part J6 changes

- Background (COAG, ABCB and NCC)
- New energy efficiency deemed-to-satisfy provisions for lighting have been published.
- The new allowances will restrict the power allowed to be used for lighting.
- The new provisions will apply on 1 May 2020 although they can be applied voluntarily between 1 May 2019 and 1 May 2020.

Track lighting

- Track lighting (currently J6.2(b)(iii)(B)) has been simplified and is now reasonable.

Current requirement	New requirement

- Unclear.
- Penalises track lighting.
- Requires:
  - the full rating of the protection device; or
  - ELV tracks, 80% of the power rating of the transformer; or
  - 100W per metre of track.
	- Reasonable.
	- Does not penalise track lighting.
	- Treats track lighting like all other lighting installed when the building is certified and requires only the lighting installed on the track to be included.

Green walls

- Lighting used solely for indoor plant growth (i.e. green walls) is exempt.

Table J6.2a Maximum illumination power density

- Maximum IPD allowances have been reduced

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Auditorium, church, public hall	10	8	20%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m²)	NCC 2019 (W/m²)	Percentage reduction
Board and conference room	10	5	50%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Carpark - general	6	2	67%
Carpark – first 15m, daylight	25	11.5	54%
Carpark – next 4m, daylight	-	2.5	-
Carpark – first 20m, night	-	2.5	-

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Class 2 (multi-res.) common rooms/ corridors	8	4.5	44%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Control/ switch rooms (intermittent monitoring)	9	3	67%
Control / switch rooms (constant monitoring)	9	4.5	50%

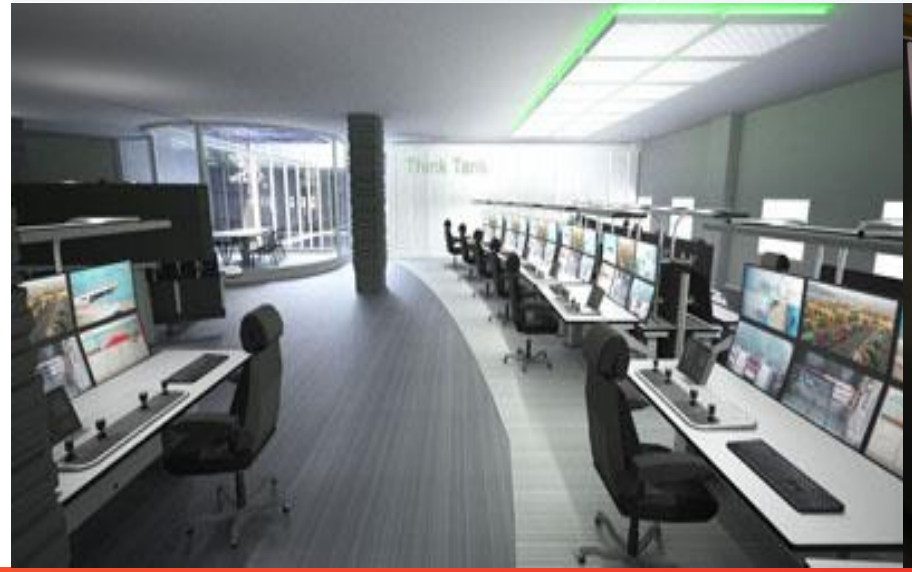


Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Corridors	8	5	37.5%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Courtroom	12	4.5	62.5%

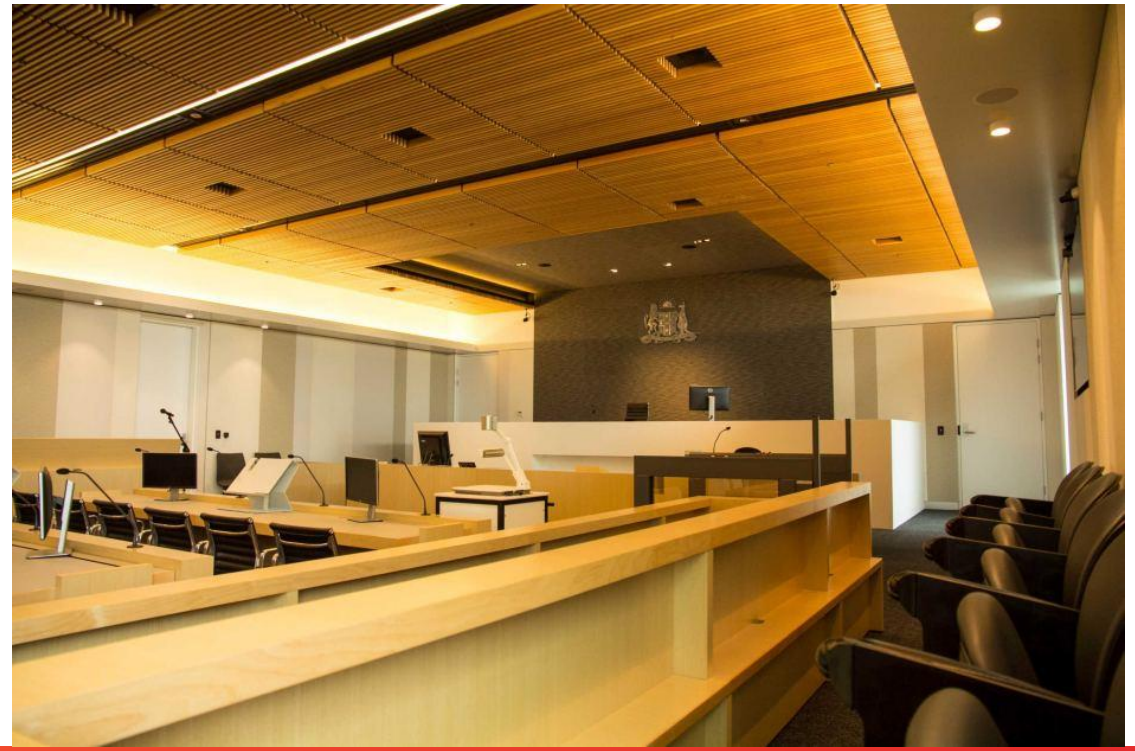


Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Dormitory – sleeping only	6	3	50%
Dormitory – sleeping and study	9	4	56%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Entry lobby	15	9	40%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m²)	NCC 2019 (W/m²)	Percentage reduction
Healthcare - emergency	10	4	60%
Healthcare – examination rm.	10	4.5	55%
Healthcare – intensive care	7	6	14%
Healthcare – wards and corridors	13	2.5	88%

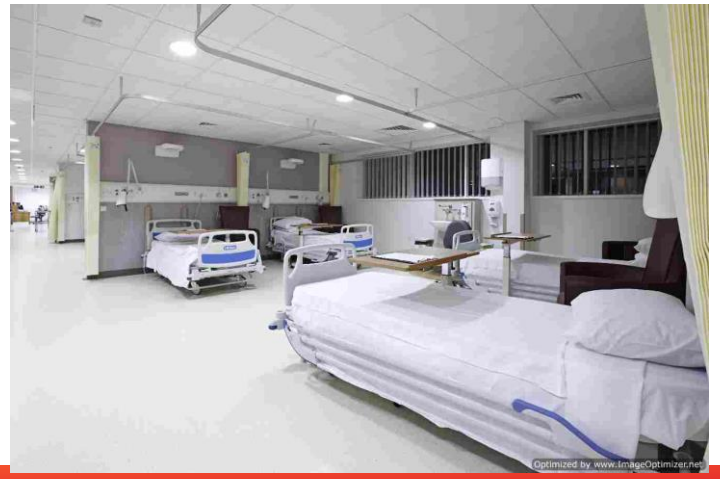


Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Kitchen & food prep.	8	4	50%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Laboratory (>400lx)	12	6	50%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Library (stack area)	12	2.5	79%
Library (reading area)	10	4.5	55%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Museum (circulation & service lighting)	8	2.5	69%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Offices lit to <200lx	7	2.5	64%
Offices lit to > 200lx	9	4.5	50%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Plant room (160lx vertical illuminance)	5	4	20%
Plant room (80lx horizontal illuminance)	5	2	60%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Restaurant, café, bar, hotel etc.	18	14	22%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m²)	NCC 2019 (W/m²)	Percentage reduction
Retail space	22	14	36%

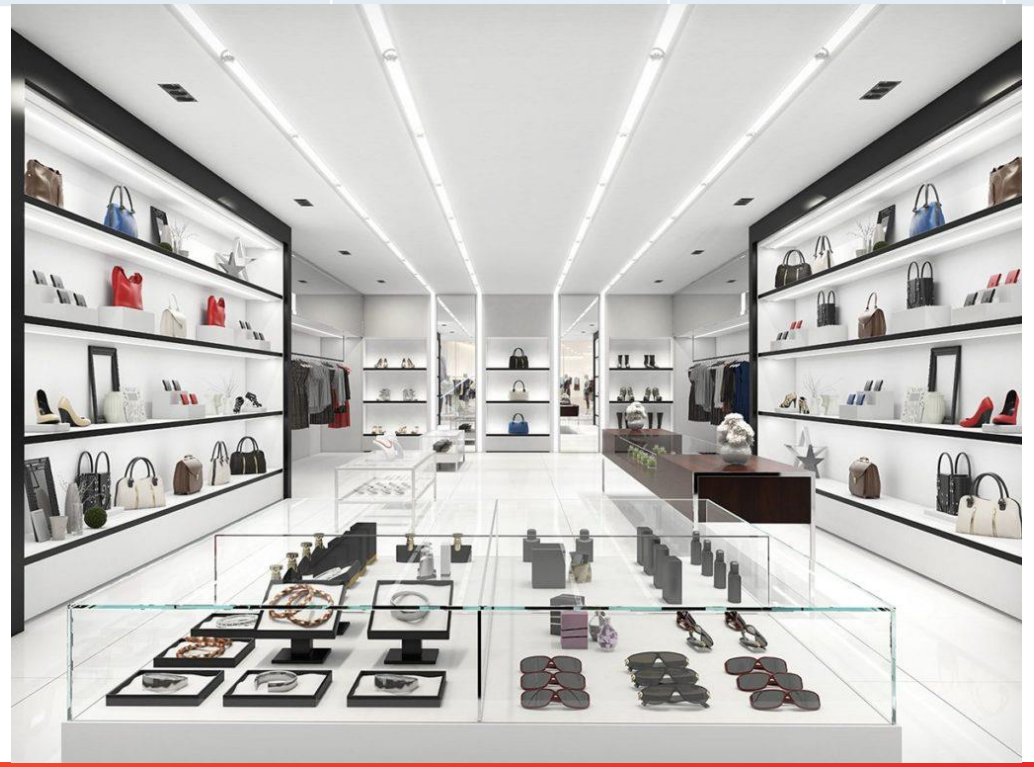


Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
School	8	4.5	44%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Sole occupancy unit (Class 3 or 9c – Aged care)	5	5	0%

Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Toilet, locker/staff room	6	3	50%

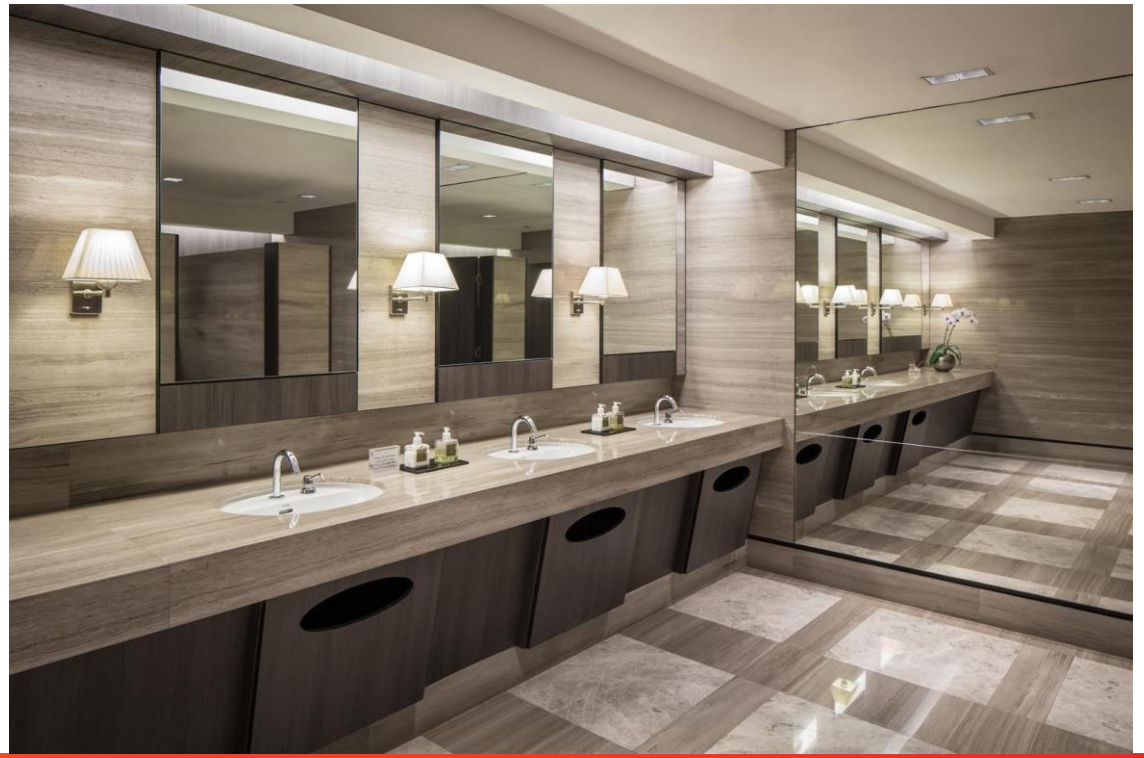
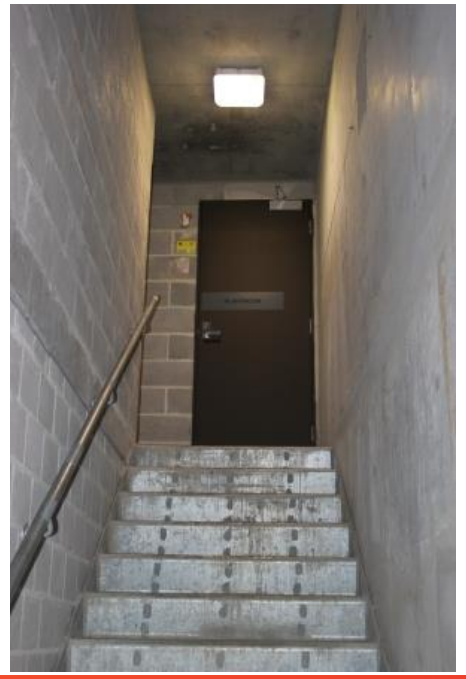


Table J6.2a Maximum illumination power density

Space type	NCC 2016 (W/m²)	NCC 2019 (W/m²)	Percentage reduction
Stairways (incl. fire stairs)	-	2	-
Lifts	-	3	-



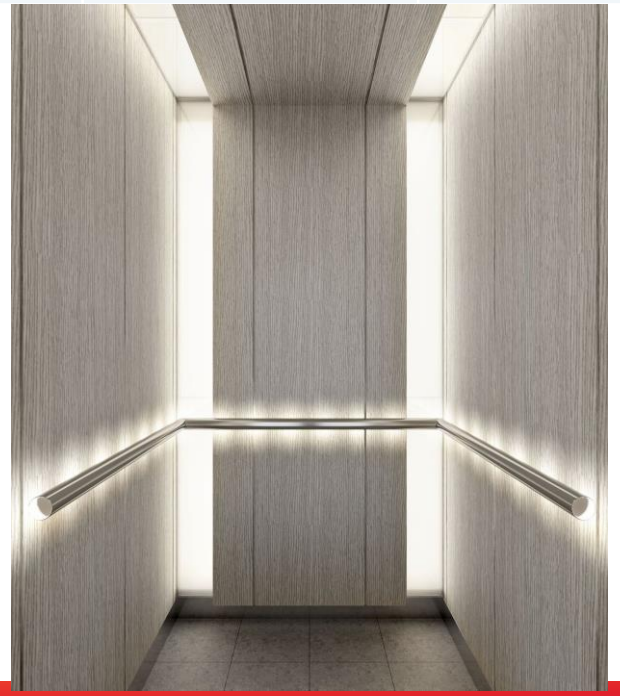


Table J6.2a Maximum illumination power density

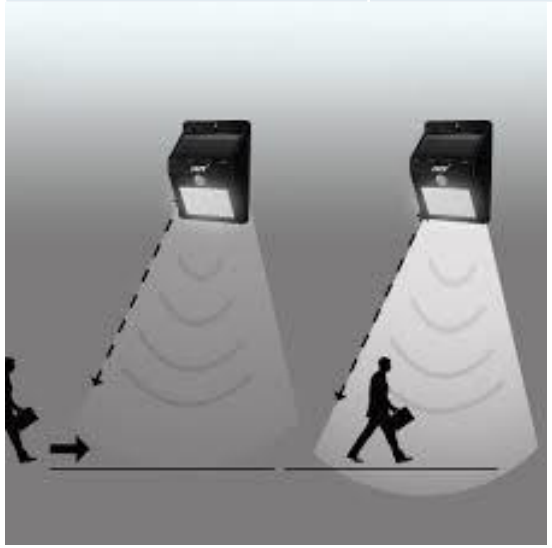
Space type	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
Lounge area (Class 3 or 9c)	10	3	70%
Storage / cleaners room	8	1.5	81%
Wholesale storage area – vertical illuminance target of 160 lx	10	4	60%

IPD for other areas

Illuminance target	NCC 2016 (W/m^2)	NCC 2019 (W/m^2)	Percentage reduction
≤ 80 lx	7.5	2	73%
81 lx – 160 lx	9	2.5	72%
161 lx – 240 lx	10	3	70%
241 lx – 320 lx	11	4.5	59%
321 lx – 400 lx	12	6	50%
401 lx – 600 lx	15	10	33%
600 lx – 800 lx	-	11.5	-

Control allowances – motion detectors (Table J6.2b)

Item	Description	Adjustment factor
Motion det.	Toilet (not public) in a retail building	0.4
Motion det.	Controlling less than 100m^2	0.6
Motion det.	Controlling more than 100m^2	0.7



Control allowances – dimming systems (Table J6.2b)

Item	Description	Adjustment factor
Programmable dimming system	75% of the space is controlled by programmable dimmers	0.85
Fixed dimming	All fitting with fixed dimming	Greater of: • 0.5 • 0.2 + 0.8L
Lumen depreciation dimming	All fittings with lumen depreciation dimming	0.85

Control allowances – Two stage sensor lights (Table J6.2b)

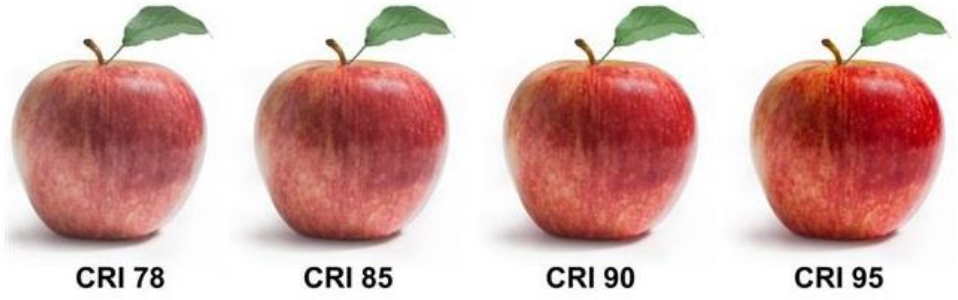
Item	Description	Adjustment factor
Two stage sensor light - Minimum power of 30% of peak power or less.	Fire stairs and other spaces **not used for regular transit.**	0.4
	Transitory spaces in regular use or carpark	0.7

Control allowances – Daylight sensor & dynamic control (Table J6.2b)

Item	Description	Adjustment factor
Daylight sensor & dynamic lighting control device – dimmed or stepped switching of lights adjacent to windows. 8am – 7pm only	In offices, retail shops, carparks, storage, laboratories, health care (Class 9a) or assembly building (Class 9b) – **Adjacent windows**	0.5
	In Class 3 (boarding houses, hostels etc.) and Class 9c (i.e. aged care) – **Adjacent windows**	0.75
	In offices, retail shops, carparks, storage, laboratories, health care (Class 9a) or assembly building (Class 9b) – **Adjacent roof lights**	0.6
	In Class 3 (boarding houses, hostels etc.) and Class 9c (i.e. aged care) – **Adjacent roof lights**	0.8

Lighting qualities – adjustment factors (Table J6.2c)

Light source	Description	Adjustment factor
CRI ≥ 90	High colour rendering lighting	0.9
CCT ≤ 3500K	Warm colour temperature lighting	0.8
CCT ≥ 4500K	Cool colour temperature lighting	1.1



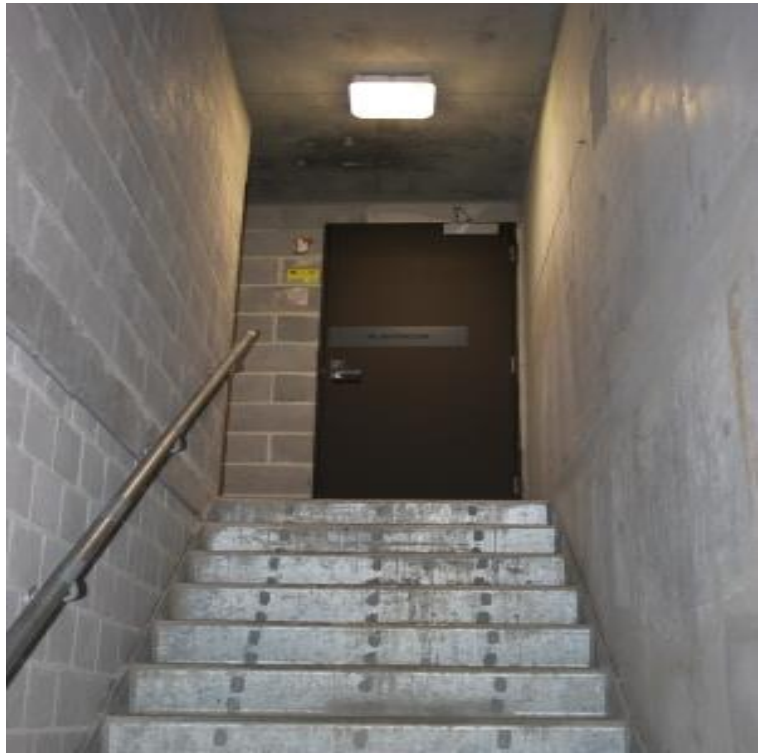
J6.3 – new switch requirement

- **All** artificial lighting must be operated by:
  - Switch; or
  - Control device; or
  - Combination of switch and control device.

- Switches must be located in an **easily accessible** position and where **90%** of the lighting being switched is visible.

J6.3 (f) fire stairs / passageways

- Lighting in fire stairs/passageways/ramps must be controlled by a motion detector.

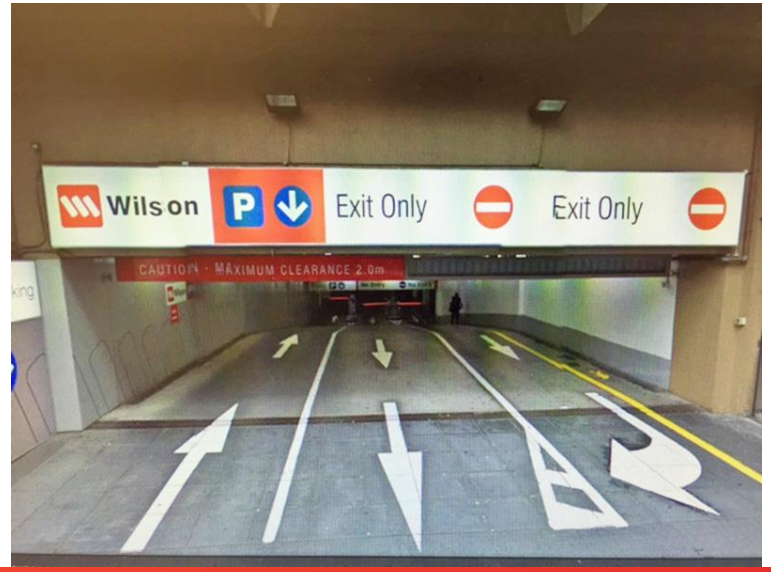


J6.3 (g) foyers / corridors / circulation spaces

- Lighting of more than 250W and adjacent to windows must be controlled by a daylight sensor / dynamic lighting control device.

J6.3 (h) carpark entrances

- Lighting in the first 19m of a carpark must be controlled by a daylight sensor (Specification J6).
  - Possible error - Specification J6 may not cater for 800 lx in the daytime and 160 lx at night time?



J6.3 (j) exemption extension

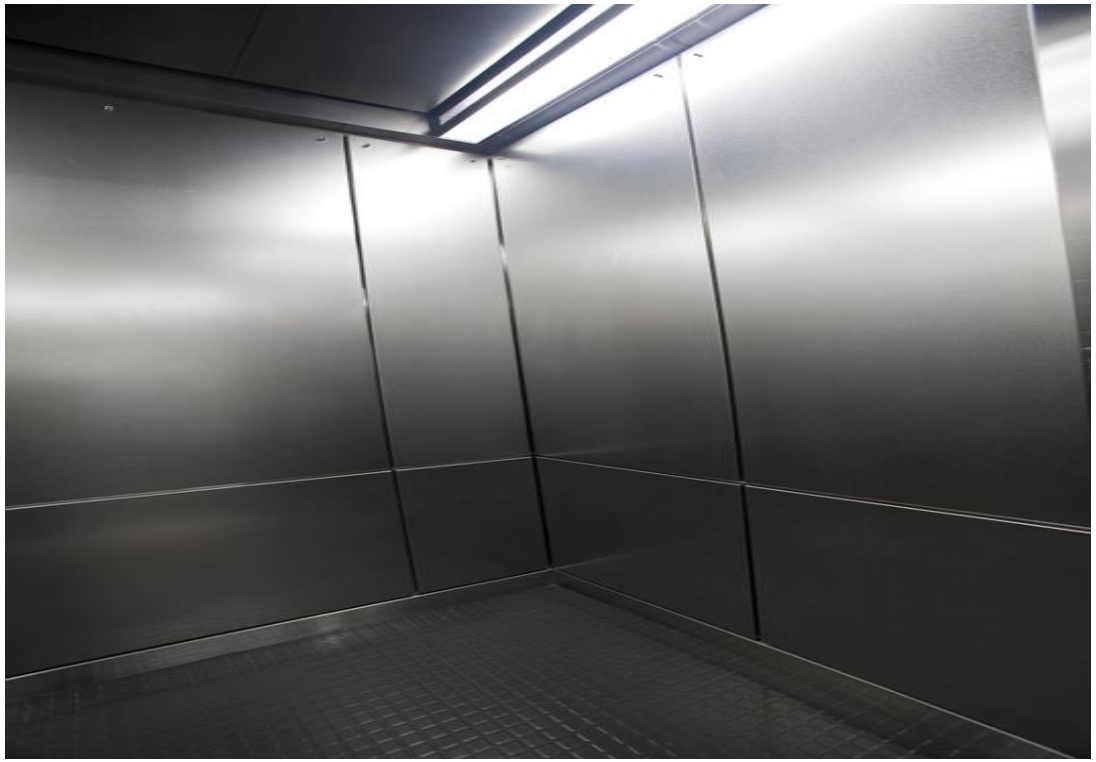
- For areas greater than 250m^2 the exemption to not require timer or motion detector control of 95% of the lighting has been extended to plantrooms and workshops.

J6.5 exterior lighting

- When the total exterior lighting exceeds 100W:
  - Use LEDs for 90% of the load; or
  - Motion detector

J6.7 lift lighting

- Switched off when not used for 15 minutes.



Specification J6

- Lighting timers must not maintain artificial lighting for more than 12 hours if the timer is reset.
- Time switches must be configured so lights are off when the space is designated to be unoccupied.
- Time switch for external lighting capable of being overridden for up to 8 hours.
- Motion detectors
  - Lights off when space unoccupied for 15 minutes
  - Be only capable of being overridden off by a manual switch

Tips and Tricks for Lighting Designers

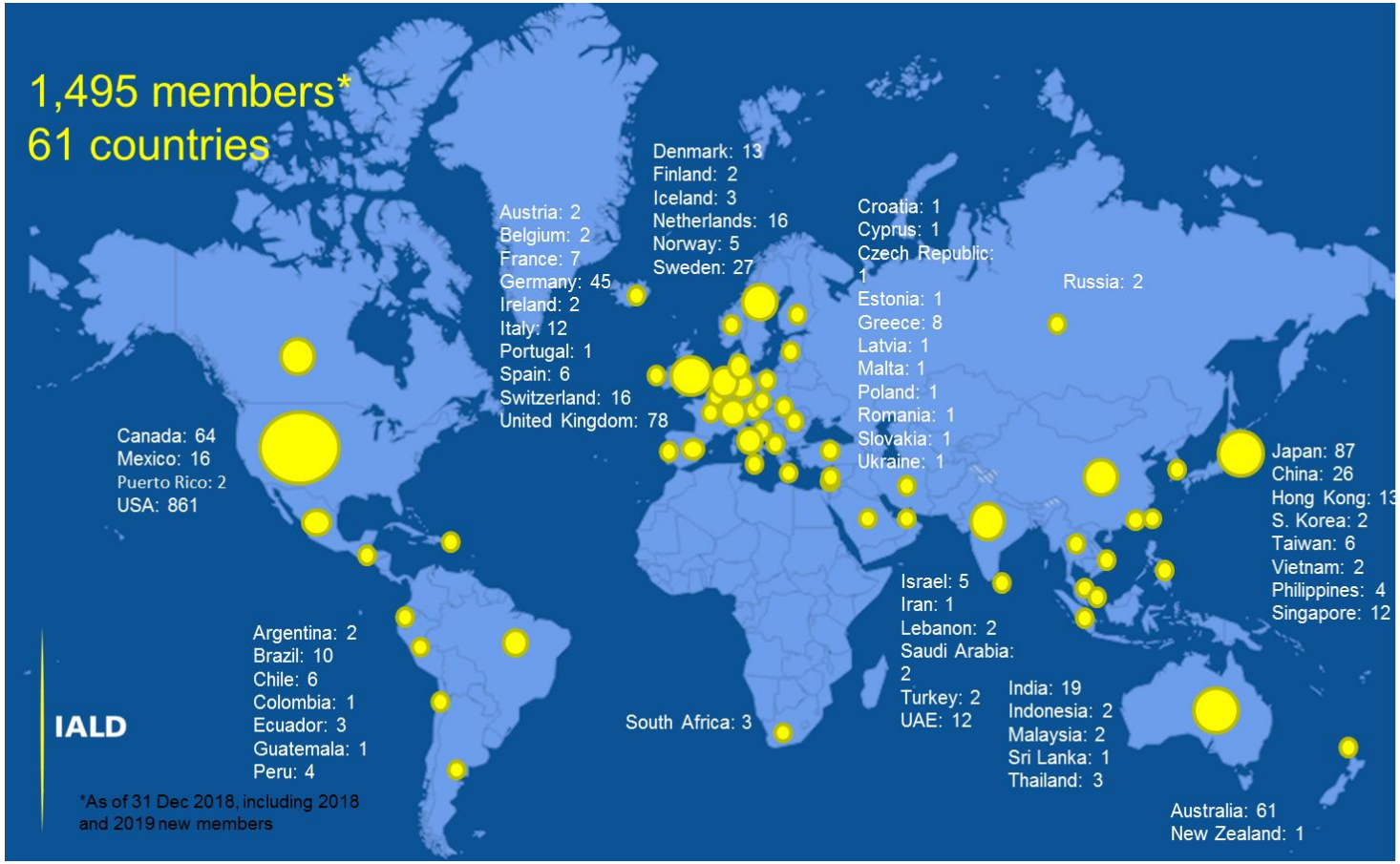
Steve Brown

Director,
NDYLIGHT

Lighting Council AUSTRALIA ™

IALD

IALD


1,495 members*
61 countries
Canada: 64
Mexico: 16
Puerto Rico: 2
USA: 861
Argentina: 2
Brazil: 10
Chile: 6
Colombia: 1
Ecuador: 3
Guatemala: 1
Peru: 4
Austria: 2
Belgium: 2
France: 7
Germany: 45
Ireland: 2
Italy: 12
Portugal: 1
Spain: 6
Switzerland: 16
United Kingdom: 78
Denmark: 13
Finland: 2
Iceland: 3
Netherlands: 16
Norway: 5
Sweden: 27
Croatia: 1
Cyprus: 1
Czech Republic: 1
Estonia: 1
Greece: 8
Latvia: 1
Malta: 1
Poland: 1
Romania: 1
Slovakia: 1
Ukraine: 1
Russia: 2
Israel: 5
Iran: 1
Lebanon: 2
Saudi Arabia: 2
Turkey: 2
UAE: 12
South Africa: 3
India: 19
Indonesia: 2
Malaysia: 2
Sri Lanka: 1
Thailand: 3
Japan: 87
China: 26
Hong Kong: 13
S. Korea: 2
Taiwan: 6
Vietnam: 2
Philippines: 4
Singapore: 12
Australia: 61
New Zealand: 1
IALD
*As of 31 Dec 2018, including 2018 and 2019 new members

Aims

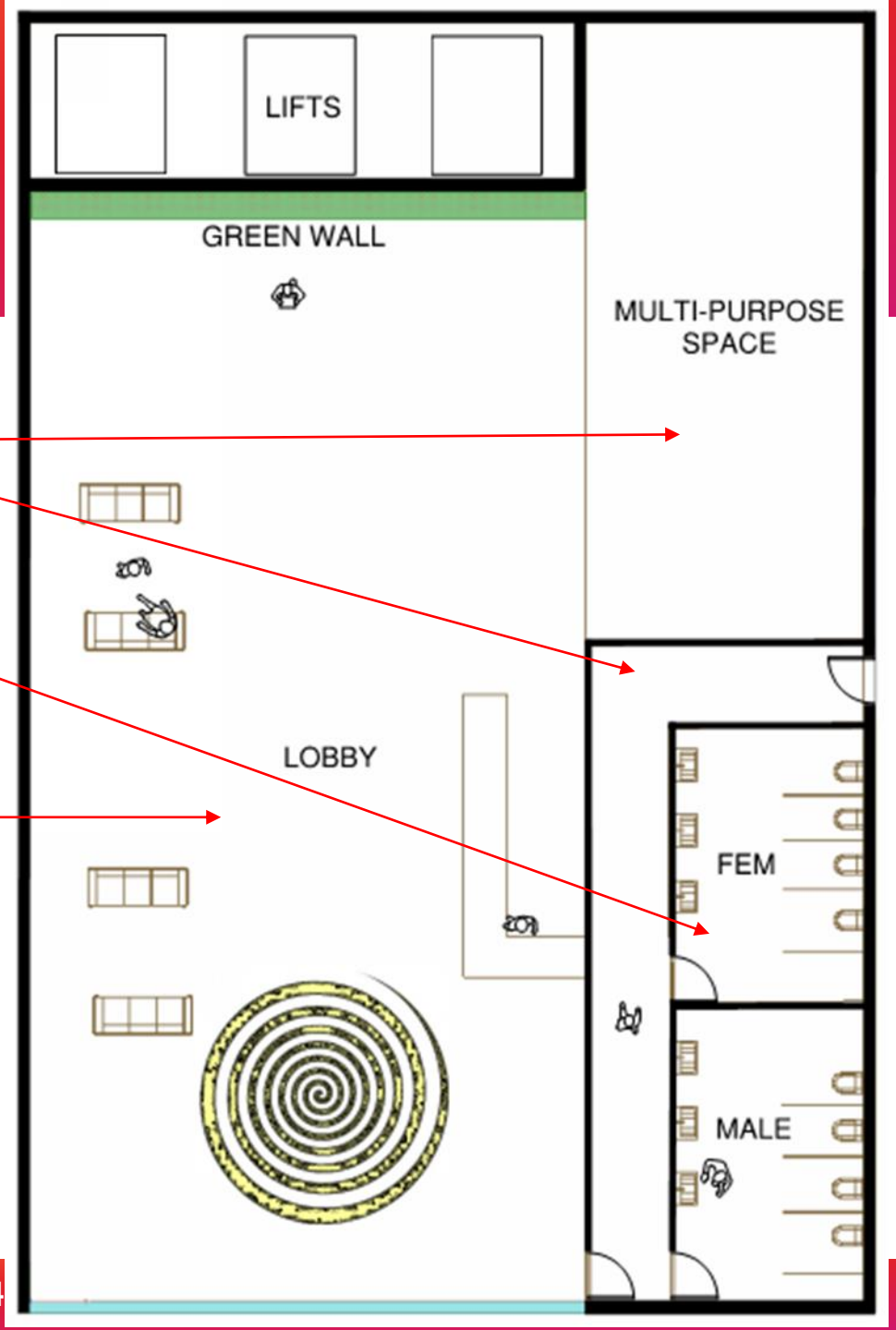
- Using a worked example, show how the new NCC section J6 can be used
- Tips and tricks – using J6 to your advantage

Example

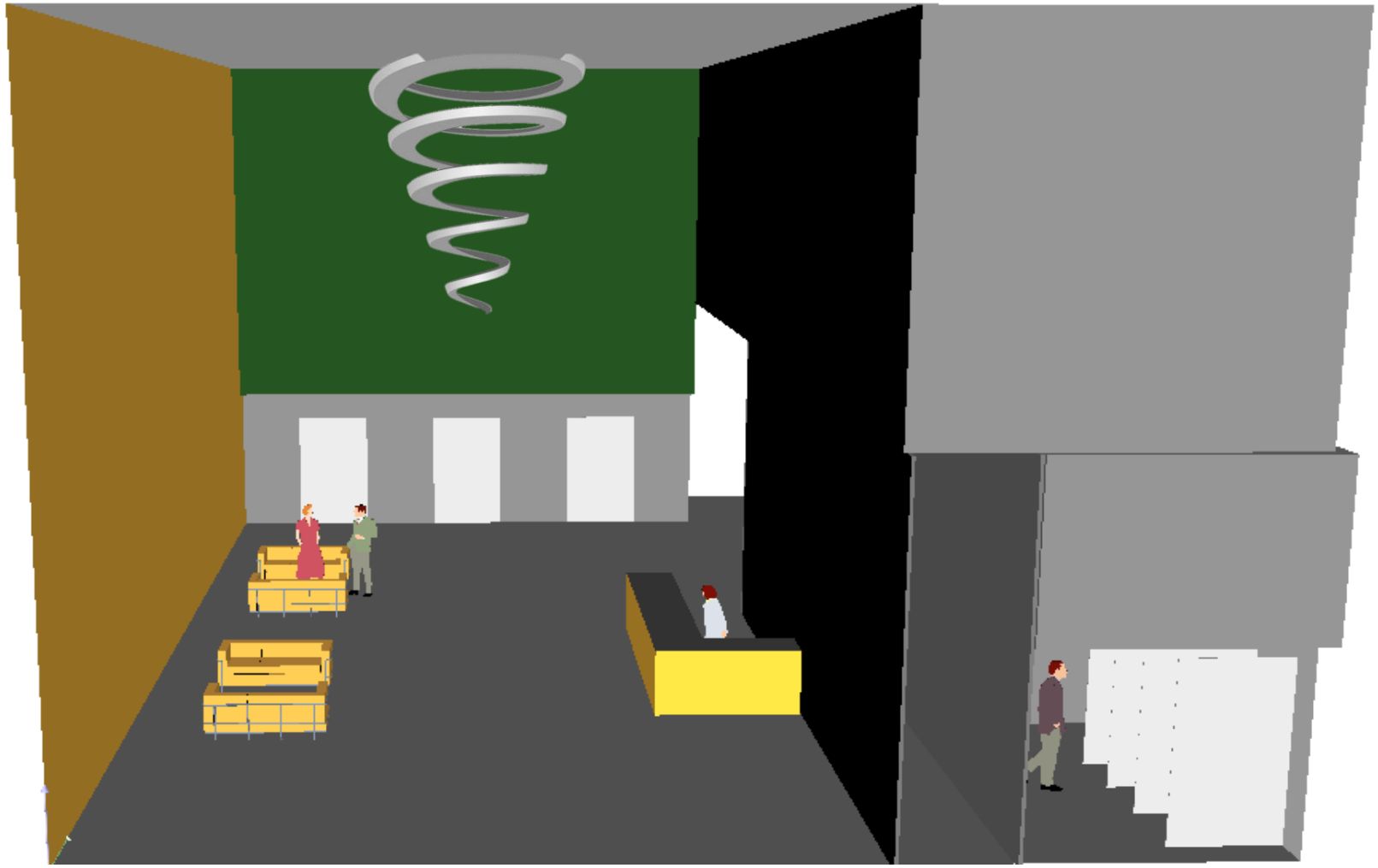
CH = 5m

CH = 2.7m

CH = 10m



Example



What Base IPD gets you

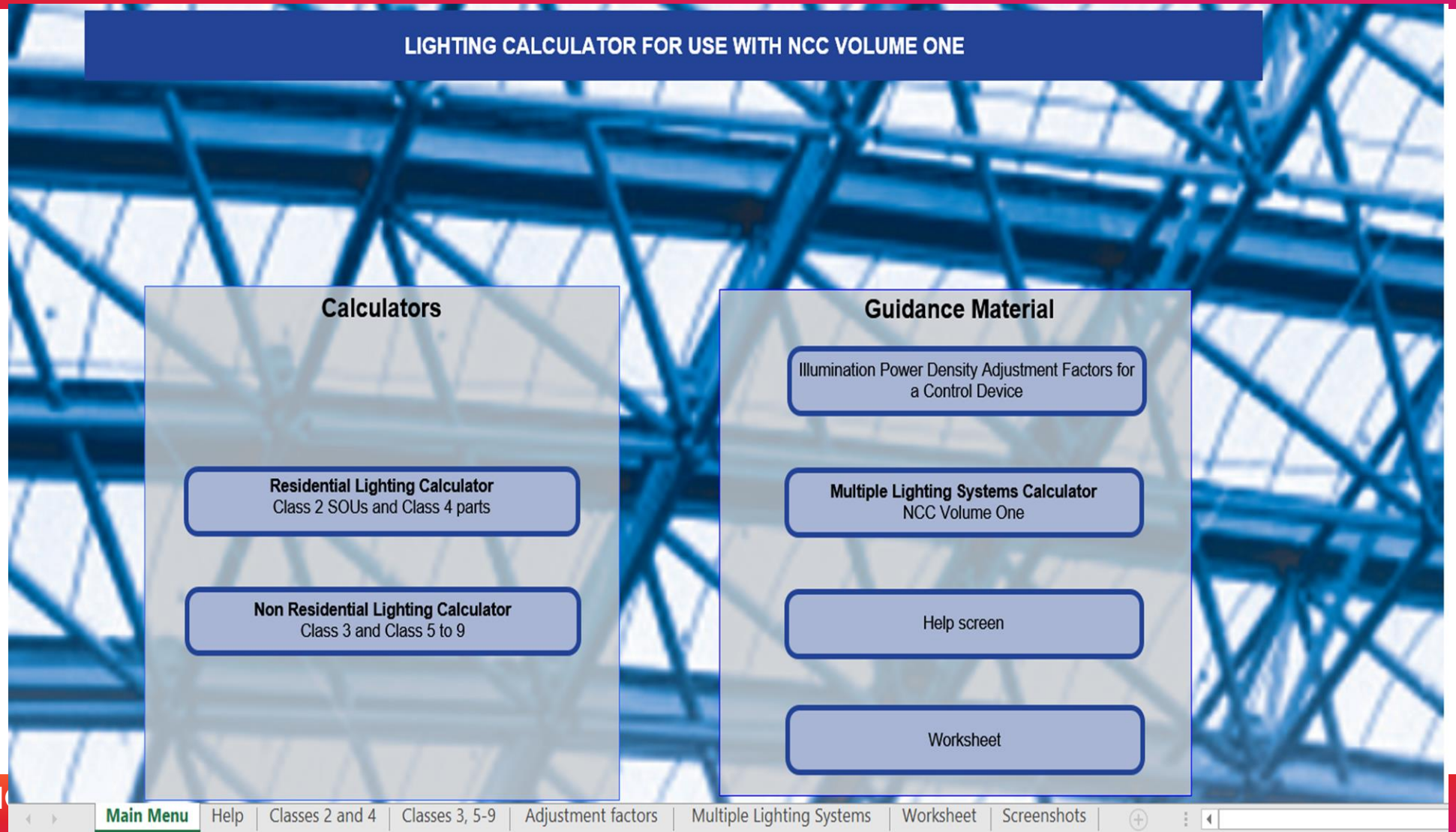
- Foyer – Entry lobby from outside a building – 200 sqm x 9W/sqm = 1800W
- Multi-purpose space – 57.5 sqm x ??? – Using Library/lounge, 4.5W/sqm = 260W
- Corridor – Corridors – 22.5 sqm x 5W/sqm = 112W
- Amenities – Toilet, locker room etc - 35 sqm x 3W/sqm = 105W

- TOTAL = 2277W

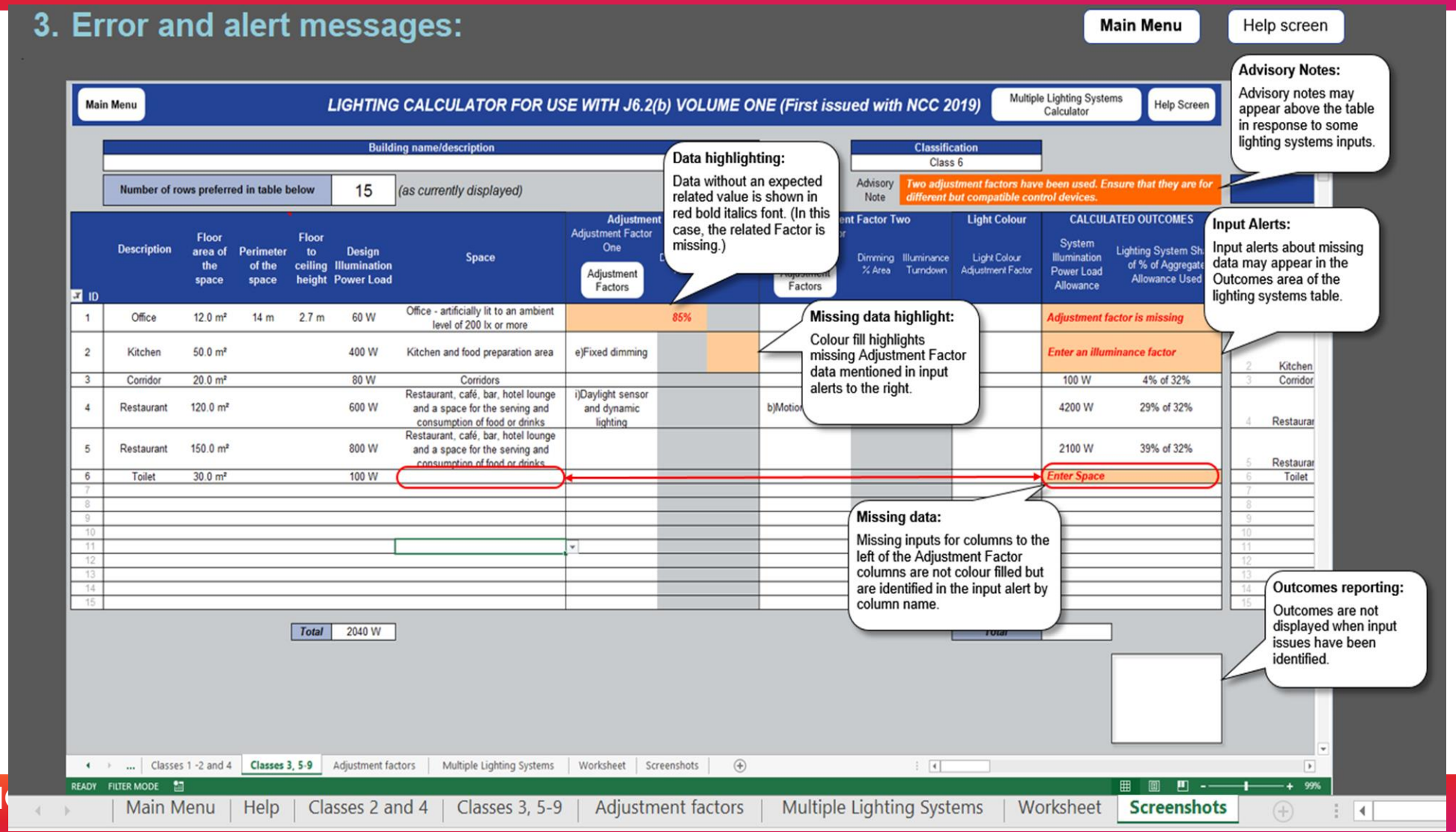
What we actually want

- Foyer
  - General lighting (variable white 3K/4K) – 480W per colour temp
  - Chandelier – 1500W
  - Built-in lighting at Concierge – 225W
  - Green Wall (3000 lux) – 2000W
- Multi-purpose space
  - Track – 33 metres
  - Track spotlights – 400W
  - General downlighting – 200W
- Corridor
  - General downlighting – 210W
- Amenities
  - General downlighting to 400lx (CCTV) – 160W
  - Vanity lighting – 300W
- TOTAL = 5955W!!!

NCC Lighting Calculator



NCC Lighting Calculator



IPD factors applied

- Table J6.2.a Maximum Illumination Power Density
- Notes to Table J6.2a
  - Note 1 – areas not listed
  - Note 2 – RAR <1.5
  - Note 3 – control device adjustments
- Table J6.2b Control device adjustment factors
- Table J6.2c Light colour adjustment factors

Table J6.2a

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m^2)
Auditorium, church and public hall	8
Board room and conference room	5
Carpark - general	2
Carpark - entry zone (first 15 m of travel) during the daytime	11.5
Carpark - entry zone (next 4 m of travel) during the day	2.5
Carpark - entry zone (first 20 m of travel) during nighttime	2.5
Common rooms, spaces and corridors in a Class 2 building	4.5
Control room, switch room and the like - intermittent monitoring	3
Control room, switch room and the like - constant monitoring	4.5
Corridors	5
Courtroom	4.5
Dormitory of a Class 3 building used for sleeping only	3
Dormitory of a Class 3 building used for sleeping and study	4
Entry lobby from outside the building	9
Health-care - infants' and children's wards and emergency department	4
Health-care - examination room	4.5
Health-care - examination room in intensive care and high dependency ward	6
Health-care - all other *patient care areas* including wards and corridors	2.5
Kitchen and food preparation area	4
Laboratory - artificially lit to an ambient level of 400 lx or more	6

Table J6.2b

Motion detector in accordance with Specification J6	**(a)**	In a toilet or change room, other than a public toilet, in a Class 6 building	0.4
	(b)	Where a group of light fittings serving less than 100 m2 is controlled by one or more detectors	0.6
	(c)	Where a group of light fittings serving 100 m2 or more is controlled by one or more detectors	0.7
Programmable dimming system (Note 2)	**(d)**	Where not less than 75% of the area is controlled by programmable dimmers	0.85
Fixed dimming (Notes 2 and 3)	**(e)**	All fittings with fixed dimming	Whichever is greater of: (a) 0.5; or (b) 0.2+0.8L where L= the illuminance turndown for the fixed dimming.
Lumen depreciation dimming (Note 2)	**(f)**	All fittings with lumen depreciation dimming	0.85
Two stage sensor - equipped lights with minimum power of 30% of peak power or less	**(g)**	Fire stairs and other spaces not used for regular transit	0.4
	(h)	Transitory spaces in regular use or in a carpark	0.7
Daylight sensor and dynamic lighting control device - dimmed or stepped switching of lights adjacent windows (Notes 2 and 4)	**(i)**	In a Class 5, 6, 7, 8 or 9b building or a class 9a building, other than a ward area, where the lights are adjacent windows, other than roof lights, for a distance from the window equal to the depth of the floor to window head height	0.5
	(j)	Serving a Class 3 or 9c building, or a Class 9a ward area, where the lights are adjacent windows, other than roof lights, for a distance from the window equal to the depth of the floor to window head height	0.75
	(k)	In a Class 5, 6, 7, 8 or 9b building or a Class 9a building, other than a ward area, where the lights are adjacent roof lights.	0.6
	(l)	In a Class 3 or 9c building, or a Class 9a ward area, where the lights are adjacent roof lights	0.8

Table J6.2c

ILLUMINATION POWER DENSITY ADJUSTMENT FACTOR FOR LIGHT COLOUR (VOLUME ONE)

Light Source		Description	Illumination power density adjustment factor
Light source with CRI ≥ 90	**(a)**	Where lighting with good colour rendering is used	0.9
Light source with CCT ≤ 3500 K (Note 1)	**(b)**	Where lighting with a warm appearance is used	0.8
Light source with CCT ≥ 4500 K	**(c)**	Where lighting with a cool appearance is used	1.1
	Note: 1. Includes luminaires that can adjust their CCT to 3500 K or below.		

Room Aspect Ratio

- The Room Aspect Ratio (RAR) of the enclosed space is determined by the formula of **A/(HxC)**
  - A = Area
  - H = Ceiling Height
  - C = Perimeter
- To find the Room Aspect Ratio, you have to multiply the height of the room by the perimeter and divide it by the total area.
- If the result is less than 1.5, you can then use the following adjustment factor:
- 0.5 + (Room Aspect Ratio result/3) and then divided by the permitted Watts/sqm.

First pass

Main Menu | LIGHTING CALCULATOR FOR USE WITH J6.2(b) VOLUME ONE (First issued with NCC 2019) | Multiple Lighting Systems Calculator | Help

Building name/description	Classification
LCA Roadshow - Worked Example	Class 5

Number of rows preferred in table below: 5 *(as currently displayed)*

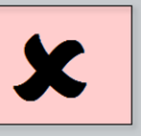
ID	Description	Floor area of the space	Perimeter of the space	Floor to ceiling height	Design Illumination Power Load	Space	Illuminance: Designed Lux Level (These columns do not represent a requirement of the NCC and are suggestions only)	Illuminance: Recommended Lux Level	Adjustment Factor One: Adjustment Factors	Adjustment Factor One: Dimming % Area	Adjustment Factor One: Illuminance Turndown	Adjustment Factor Two: Adjustment Factors	Adjustment Factor Two: Dimming % Area	Adjustment Factor Two: Illuminance Turndown	Light Colour: Light Colour Adjustment Factor	OVERALL DESIGN FAILS: System Illumination Power Load Allowance	OVERALL DESIGN FAILS: Lighting System Share of % of Aggregate Allowance Used
1	Lobby	200.0 m²	60 m	10.0 m	4685 W	Entry lobby from outside the building										*2951 W*	***79% of 159%***
2	Multi-Purpose	57.5 m²	33 m	5.0 m	600 W	Library - reading room and general areas										*418 W*	***10% of 159%***
3	Corridor	22.5 m²	34 m	5.0 m	210 W	Corridors										*209 W*	***4% of 159%***
4	Male WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400									*84 W*	***4% of 159%***
5	Female WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400									*84 W*	***4% of 159%***

Total 5955 W

Total 3746 W

The NCC offers pathways for a building to comply other than the Deemed-to-Satisfy provisions. Consider using a Performance Solution or Verification Method. Verification Method JV3 allows for energy to be traded between services, so it may be possible to release additional energy for lighting from another service. This option should be discussed with other services trades as early in the project's design cycle as plausible.

if inputs are valid



Controls adjustments 1

- Foyer
  - General lighting (variable white 3K/4K) – colour tuning
  - Built-in lighting at Concierge – timer
  - Green Wall (3000 lux) – timer
- Multi-purpose space
  - Track – full range dimming
  - Track spotlights – full range dimming
  - General downlighting – motion sensors, over-ridden by dimmers
- Corridor
  - General downlighting – motion sensors
- Amenities
  - General downlighting to 400lx – motion sensors
  - Vanity lighting – motion sensors

Controls adjustments 2

- Foyer
  - General lighting (variable white 3K/4K) – colour tuning, no control AF but can use light colour adjustment factors
  - Built-in lighting at Concierge – timer, AF = 1.0
  - Green Wall (3000 lux) – timer, AF = 1.0
- Multi-purpose space
  - Track / Track spotlights – full range dimming, AF = 0.85
  - General downlighting – motion sensors, AF = 0.6 (area less than 100sqm controlled by one or more detectors), + over-ridden by dimmers AF = 0.85
- Corridor
  - General downlighting – motion sensors, AF = 0.6 (area less than 100sqm controlled by one or more detectors)
- Amenities
  - General downlighting to 400lx – motion sensors, AF = 0.6 (area less than 100sqm controlled by one or more detectors)
  - Vanity lighting – motion sensors, AF = 0.6 (ditto)

Second pass

Main Menu | LIGHTING CALCULATOR FOR USE WITH J6.2(b) VOLUME ONE (First issued with NCC 2019) | Multiple Lighting Systems Calculator | Help

Building name/description	Classification
LCA Roadshow - Worked Example	Class 5

Number of rows preferred in table below: 5 *(as currently displayed)*

Advisory Note: ***Two adjustment factors have been used. Ensure that they are for different but compatible control devices.***

ID	Description	Floor area of the space	Perimeter of the space	Floor to ceiling height	Design Illumination Power Load	Space	Illuminance: Designed Lux Level	Illuminance: Recommended Lux Level	Adjustment Factor One: Adjustment Factors	Adjustment Factor One: Dimming % Area	Adjustment Factor One: Illuminance Turndown	Adjustment Factor Two: Adjustment Factors	Adjustment Factor Two: Dimming % Area	Adjustment Factor Two: Illuminance Turndown	Light Colour: Light Colour Adjustment Factor	OVERALL DESIGN FAILS: System Illumination Power Load Allowance	OVERALL DESIGN FAILS: Lighting System Share of % of Aggregate Allowance Used
1	Lobby	200.0 m²	60 m	10.0 m	4685 W	Entry lobby from outside the building										*2951 W*	***79% of 137%***
2	Multi-Purpose	57.5 m²	33 m	5.0 m	600 W	Library - reading room and general areas			b)Motion detector			d)Programmable dimming system	100%			753 W	***10% of 137%***
3	Corridor	22.5 m²	34 m	5.0 m	210 W	Corridors			b)Motion detector							349 W	***4% of 137%***
4	Male WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector							*140 W*	***4% of 137%***
5	Female WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector							*140 W*	***4% of 137%***

These columns do not represent a requirement of the NCC and are suggestions only

Total	5955 W

Total	4333 W

The NCC offers pathways for a building to comply other than the Deemed-to-Satisfy provisions. Consider using a Performance Solution or Verification Method. Verification Method JV3 allows for energy to be traded between services, so it may be possible to release additional energy for lighting from another service. This option should be discussed with other services trades as early in the project's design cycle as plausible.

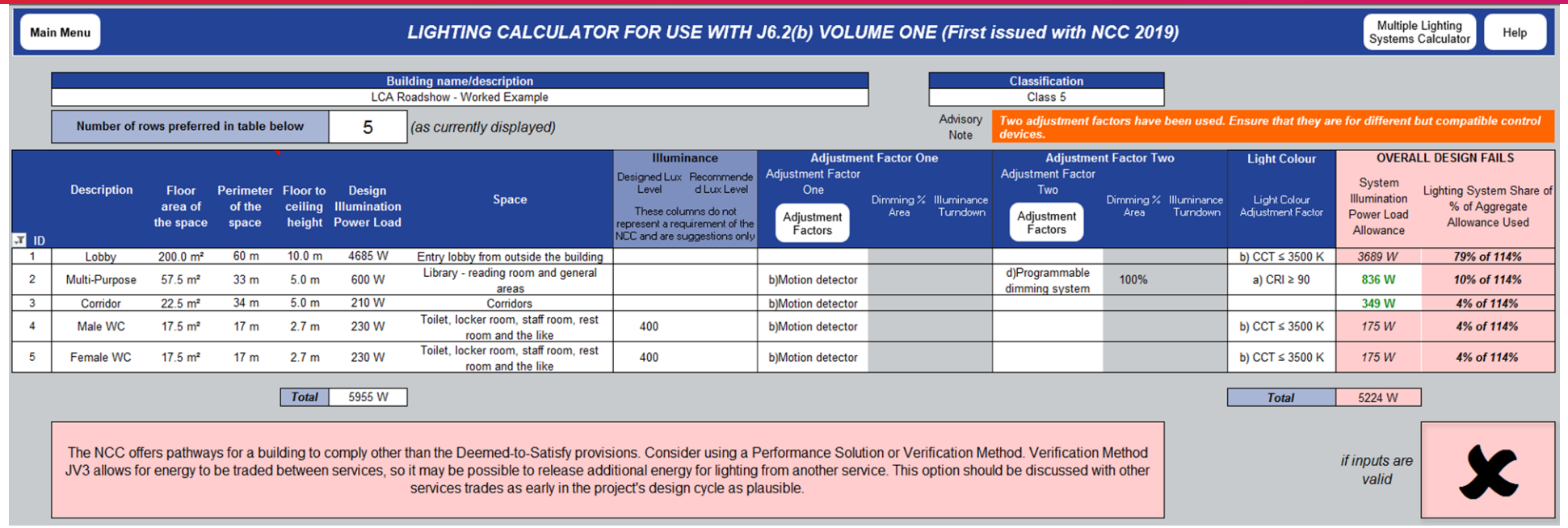
if inputs are valid

Colour temperature adjustments

ILLUMINATION POWER DENSITY ADJUSTMENT FACTOR FOR LIGHT COLOUR (VOLUME ONE)

Light Source		Description	Illumination power density adjustment factor
Light source with CRI ≥ 90	**(a)**	Where lighting with good colour rendering is used	0.9
Light source with CCT ≤ 3500 K (Note 1)	**(b)**	Where lighting with a warm appearance is used	0.8
Light source with CCT ≥ 4500 K	**(c)**	Where lighting with a cool appearance is used	1.1
	Note: 1. Includes luminaires that can adjust their CCT to 3500 K or below.		

Third pass



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LIGHTING CALCULATOR FOR USE WITH J6.2(b) VOLUME ONE (First issued with NCC 2019)

Multiple Lighting Systems Calculator | Help

Building name/description	Classification
LCA Roadshow - Worked Example	Class 5

Number of rows preferred in table below: 5 (as currently displayed)

Advisory Note: *Two adjustment factors have been used. Ensure that they are for different but compatible control devices.*

ID	Description	Floor area of the space	Perimeter of the space	Floor to ceiling height	Design Illumination Power Load	Space	Illuminance: Designed Lux Level	Illuminance: Recommended Lux Level	Adjustment Factor One: Adjustment Factors	Adjustment Factor One: Dimming % Area	Adjustment Factor One: Illuminance Turndown	Adjustment Factor Two: Adjustment Factors	Adjustment Factor Two: Dimming % Area	Adjustment Factor Two: Illuminance Turndown	Light Colour: Light Colour Adjustment Factor	OVERALL DESIGN FAILS: System Illumination Power Load Allowance	OVERALL DESIGN FAILS: Lighting System Share of % of Aggregate Allowance Used
1	Lobby	200.0 m²	60 m	10.0 m	4685 W	Entry lobby from outside the building									b) CCT ≤ 3500 K	*3689 W*	*79% of 114%*
2	Multi-Purpose	57.5 m²	33 m	5.0 m	600 W	Library - reading room and general areas			b)Motion detector			d)Programmable dimming system	100%		a) CRI ≥ 90	836 W	*10% of 114%*
3	Corridor	22.5 m²	34 m	5.0 m	210 W	Corridors			b)Motion detector							349 W	*4% of 114%*
4	Male WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector						b) CCT ≤ 3500 K	*175 W*	*4% of 114%*
5	Female WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector						b) CCT ≤ 3500 K	*175 W*	*4% of 114%*

These columns do not represent a requirement of the NCC and are suggestions only

Total	5955 W

Total	5224 W

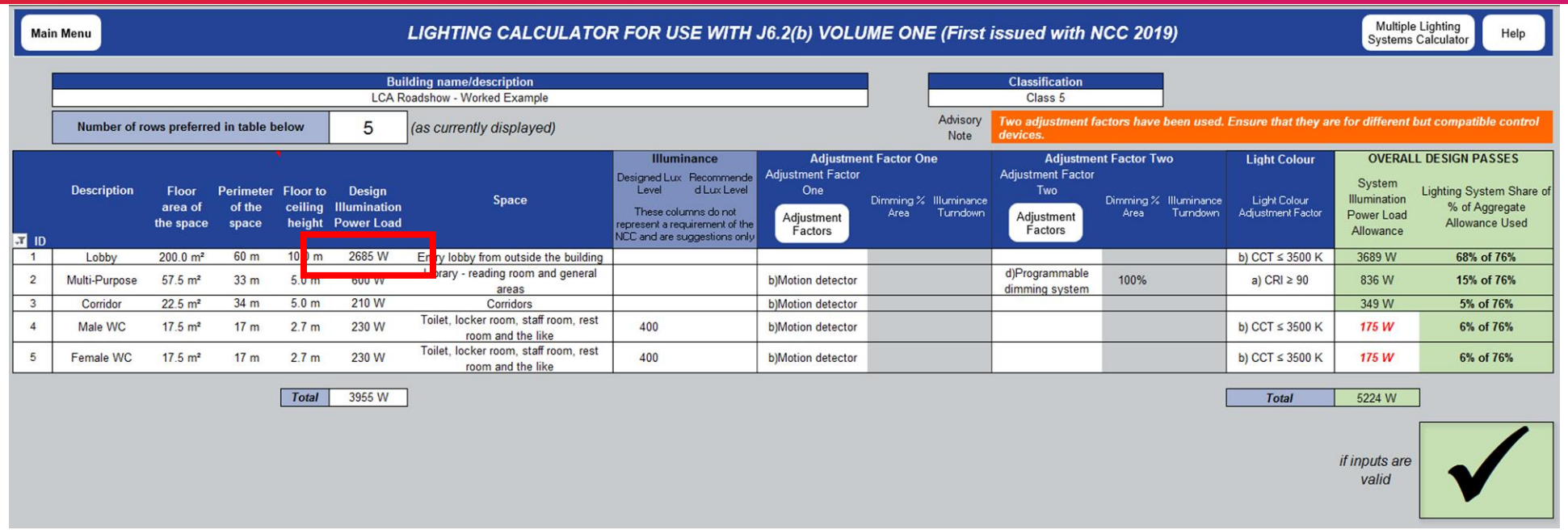
The NCC offers pathways for a building to comply other than the Deemed-to-Satisfy provisions. Consider using a Performance Solution or Verification Method. Verification Method JV3 allows for energy to be traded between services, so it may be possible to release additional energy for lighting from another service. This option should be discussed with other services trades as early in the project's design cycle as plausible.

if inputs are valid

Exemptions! J6.2.c

- Emergency & exit lighting
- Signage
- Fixed display cases
- Light/heaters
- Performance lighting (art or sport)
- Museum/art gallery exhibits
- Lighting for specialist processes (op theatre)
- Lighting purely for plant growth

Exemptions!



Main Menu

LIGHTING CALCULATOR FOR USE WITH J6.2(b) VOLUME ONE (First issued with NCC 2019)

Multiple Lighting Systems Calculator | Help

Building name/description	Classification
LCA Roadshow - Worked Example	Class 5

Number of rows preferred in table below: 5 (as currently displayed)

Advisory Note: *Two adjustment factors have been used. Ensure that they are for different but compatible control devices.*

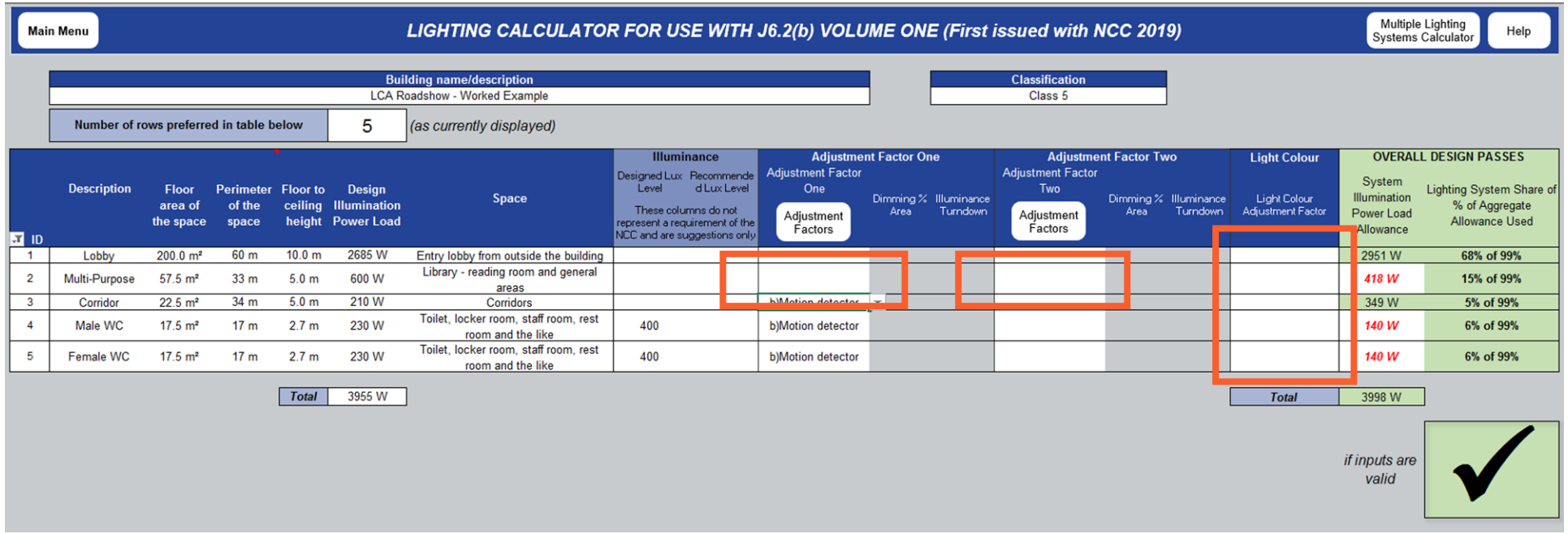
ID	Description	Floor area of the space	Perimeter of the space	Floor to ceiling height	Design Illumination Power Load	Space	Illuminance: Designed Lux Level	Illuminance: Recommended Lux Level	Adjustment Factor One: Adjustment Factors	Adjustment Factor One: Dimming % Area	Adjustment Factor One: Illuminance Turndown	Adjustment Factor Two: Adjustment Factors	Adjustment Factor Two: Dimming % Area	Adjustment Factor Two: Illuminance Turndown	Light Colour: Light Colour Adjustment Factor	OVERALL DESIGN PASSES: System Illumination Power Load Allowance	OVERALL DESIGN PASSES: Lighting System Share of % of Aggregate Allowance Used
1	Lobby	200.0 m²	60 m	10.0 m	2685 W	Entry lobby from outside the building									b) CCT ≤ 3500 K	3689 W	68% of 76%
2	Multi-Purpose	57.5 m²	33 m	5.0 m	600 W	Library - reading room and general areas			b)Motion detector			d)Programmable dimming system	100%		a) CRI ≥ 90	836 W	15% of 76%
3	Corridor	22.5 m²	34 m	5.0 m	210 W	Corridors			b)Motion detector							349 W	5% of 76%
4	Male WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector						b) CCT ≤ 3500 K	*175 W*	6% of 76%
5	Female WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector						b) CCT ≤ 3500 K	*175 W*	6% of 76%

Total: 3955 W

Total: 5224 W

if inputs are valid

Low budget version



Main Menu

LIGHTING CALCULATOR FOR USE WITH J6.2(b) VOLUME ONE (First issued with NCC 2019)

Multiple Lighting Systems Calculator | Help

Building name/description	Classification
LCA Roadshow - Worked Example	Class 5

Number of rows preferred in table below: 5 *(as currently displayed)*

ID	Description	Floor area of the space	Perimeter of the space	Floor to ceiling height	Design Illumination Power Load	Space	Illuminance: Designed Lux Level	Illuminance: Recommended Lux Level	Adjustment Factor One: Adjustment Factors	Adjustment Factor One: Dimming % Area	Adjustment Factor One: Illuminance Turndown	Adjustment Factor Two: Adjustment Factors	Adjustment Factor Two: Dimming % Area	Adjustment Factor Two: Illuminance Turndown	Light Colour: Light Colour Adjustment Factor	OVERALL DESIGN PASSES: System Illumination Power Load Allowance	OVERALL DESIGN PASSES: Lighting System Share of % of Aggregate Allowance Used
							These columns do not represent a requirement of the NCC and are suggestions only										
1	Lobby	200.0 m²	60 m	10.0 m	2685 W	Entry lobby from outside the building										2951 W	68% of 99%
2	Multi-Purpose	57.5 m²	33 m	5.0 m	600 W	Library - reading room and general areas										*418 W*	15% of 99%
3	Corridor	22.5 m²	34 m	5.0 m	210 W	Corridors			b)Motion detector							349 W	5% of 99%
4	Male WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector							*140 W*	6% of 99%
5	Female WC	17.5 m²	17 m	2.7 m	230 W	Toilet, locker room, staff room, rest room and the like	400		b)Motion detector							*140 W*	6% of 99%
				Total	3955 W										*Total*	3998 W	

if inputs are valid

Tips to remember

- Work out exemptions first – be ruthless if you need to be but have a good back-up argument
- Use Note 1 to Table J6.2a as soon as you have an area type not listed
- Use your light colour adjustment factors (can get an extra 20%+)
- Use control credits – don't forget, you can use two
- Use the ABCB excel workbook – it's the officially endorsed one.

Getting the most out of the new Code

Tim Hanson

Design Manager,
Gerard Lighting

Lighting Council AUSTRALIA TM

IALD

Lighting Council Australia, IES, IALD Conference

Gerard Lighting National Construction Code

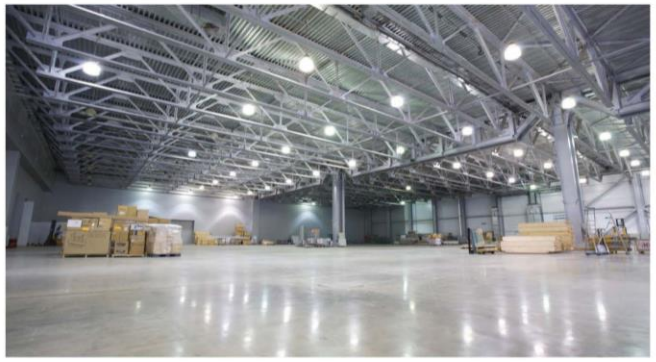
Presenter: Tim Hanson – Gerard Lighting Design Manager

Tuesday 9th - 11th April 2019

GERARD LIGHTING | PIERLITE professional lighting solutions | SYLVANIA | Crompton | DIGINET CONTROL SYSTEMS

Lighting Council AUSTRALIA MEMBER

Gerard Lighting - Brands

ROADWAY AND INFRASTRUCTURE	COMMERCIAL AND INDUSTRIAL	SPECIALTY LIGHTING GROUP
		
SYLVANIA 	siteco 	PIERLITE 
PIERLITE 		Crompton 
		disano illuminazione 
		austube 
		DELTALIGHT 
		Concord 
		PRANDINA 

Tim Hanson – Design Manager

- **Design Manager, Specialty Lighting Group – Gerard Lighting**
- **~25 years experience in the lighting industry as a Lighting Consultant and Design Manager**
- **Daylight integration incl. Museums, Sports, Industrial, Commercial, Retail in Europe and Australasia**

Key Messages

To deter designers from a current TREND of referring to Table J6.2a IPD values as the definitive guide to compliance (due to the current generous IPD values having a relatively minor impact on design freedom).

To 'realise' the intended opportunities for increasing these "Maximum" Illumination Power Density (IPD, Watts/m^2) **values listed in Table J6.2a** ("Maximum" reference misleading)

To ensure designs continue to inspire and promote well-being and visual interest as advised by official lighting design guideline publications - through the realisation of the above.

To beware that continuing the TREND with the more restrictive IPD values would result in the removal of lighting elements not required for compliance but very important for our well-being and future environments

$$\text{IPD (Illumination Power Density)} = \frac{\text{Total Lighting Power (Watts)}}{\text{Total Area (m}^2\text{)}}$$

NCC - SECTION J6 – Overview of updates in 2019 edition

- (“Maximum”) Illumination Power Density (IPD) Table

$$\text{IPD (Illumination Power Density)} = \frac{\text{Total Lighting Power (Watts)}}{\text{Total Area (m}^2\text{)}}$$

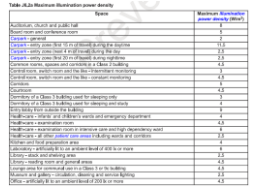
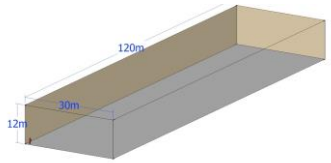


Table J6.2a

- MODIFIED

- J6.2a Adjustment Factor – Room Size and Shape

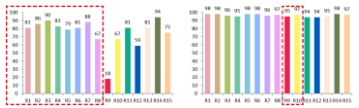
  (includes Room Aspect Ratio)



- NO CHANGE

- J6.2c Adjustment Factor – Light Colour

  (ref Table J6.2c)



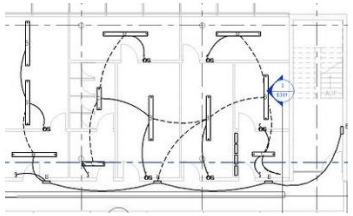
- **NEW**

- J6.2b Adjustment Factor – Lighting Controls

  (Ref Table J6.2b)

- MODIFIED

- J6.3 – Lighting Power (circuiting and switching rules)



- MINOR CHANGES

MAXIMUM IPD TABLE J6.2a (Illumination Power Density)

Sample Location Examples	IPD 2016 (W/m²)	**IPD 2019 (W/m²)**	% reduction in IPD allowance	General Lux level requirements	Watts / 100 Lux / m² requirement (2019)
Retail Stores	22	**14**	36%	Say 800-1000 Lux general	1.4W /100 Lux / m² (e.g. 1000 Lux with 14W)
Schools	8	**4.5**	43%	320 Lux	1.4W /100 Lux / m²
Offices	9 (>200lx amb)	**4.5**	50%	320 Lux* (* 200 lux option available)	1.4W /100 Lux / m²
Healthcare* (* general areas)	13	**2.5**	88%	240 Lux	1W /100 Lux / m²
Library (general)	10	**4.5**	55%	320 Lux	1.4W /100 Lux / m²
Library (shelving)	12	**2.5**	79%	240 Lux	1W /100 Lux / m²
Wholesale Storage (Vertical)	8	**4**	50%	160 Lux vertical	2.5W /100 Lux / m²

Danger of Decorative and Feature lighting becoming ‘superfluous’ with the more stringent requirements and without full consideration of the allowed Adjustment Factors

The Current "Trend" …

	IPD 2016 (W/m²)
Retail Stores	22
Schools	8
Offices	9 (>200lx amb)
Healthcare* (* general areas)	13
Library (general)	10
Library (shelving)	12
Wholesale Storage (Vertical)	8

IPD ESTIMATE : **Date: 4-04-19**

EXAMPLE PROJECT

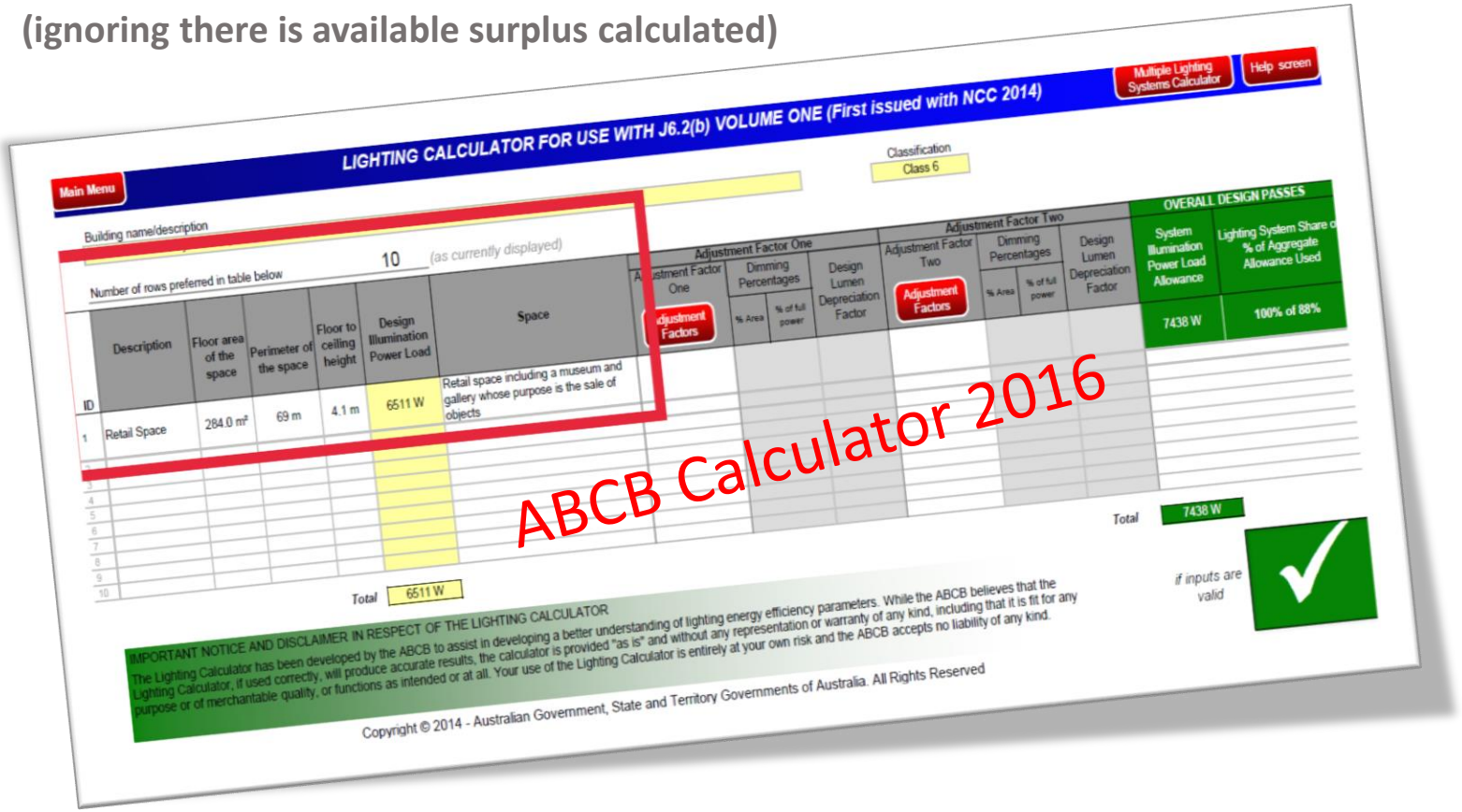
			qty	watts	watts total	
C1	CILINDRO II 65 12W L3 4K 24D W	CI065430112A	15	12	180	
C2	CILINDRO II 65 12W L3 4K 24D W	CI065430112A + CI06536	11	12	132	
W	CILINDRO II 105 40W L3 4K WASHER W	CIW105410140A	10	40	400	
D1	PIERLUX PLUS 14W 4K WH	PLUX43	36	14	504	
D2	VARIOS MIN 15W 4K DG 40D G6 RF WH	VAG074435401A	6	15	90	
DL	Surface Mount Round Downlight 60D WH	SMR150/264K60	3	25	75	
JD	JAX EYE Twin 30W 4K 40D G6 WH	JET3764701A	6	60	360	
HB	ECO HIGH BAY 100W 5K BL	ECOHB100W850G4	5	100	500	
EB	BWP ECO 45W 4K	BWPECO454E4	7	45	315	
P	ECO PANEL 1200X300 28W 4K	ECOPL21234E	22	28	616	
L1	MILLA TRUNKING 1.2M 4K WH	MIL 1.2m length modules	128	40	5120	
ST	THREE CIRCUIT SUSPENDED TRACK WH	34 Metres	34			
					8292	**TOTALS WATTS**
					640	**AREA** m2
					13	**W/m2** IPD

DIRECT COMPARISON TO IPD TABLE VALUES …

The Current “Trend” …

	IPD 2016 (W/m²)
Retail Stores	22
Schools	8
Offices	9 (>200lx amb)
Healthcare* (* general areas)	13
Library (general)	10
Library (shelving)	12
Wholesale Storage (Vertical)	8

… AND THEN FILL IN CALCULATOR FOR ‘THE TICK’ OF APPROVAL
(ignoring there is available surplus calculated)



Current IPD (Illuminance Power Density) allowances are generous for current technology causing a trend for ‘back-of-envelope’ calculations to check compliance – AFTERWHICH filling in the official ABCB calculator to reconfirm the achievement of ‘the green tick’ for compliance.

Applying Adjustments Factors to increase IPD allowance

AF1 - ROOM SIZE AND SHAPE

The following formula can be applied only for spaces with a RAR of LESS than 1.5:

$$\text{AF1} = 0.5 + \frac{(\text{RAR})}{3}$$

RAR = Room Aspect Ratio = A/ (H*C)

Where: **A** Area of the space
H Height of the space measured from the floor to the highest part of the ceiling
C Perimeter of the space

NEW

AF2 - LIGHT COLOUR

Combined AF2 = A x B

Where: A and B represent two factors chosen from Table J6.2c

Table J6.2c Illumination power density adjustment factor for light colour

Light Source	Factor
CRI > 90	0.9
CCT < 3500K`	0.8
CCT > 4500	1.1

Notes: Includes luminaires that can adjust their CCT to 3500 K or below

AF3 - CONTROLS

Note - A maximum of two AF3 can be applied to an area and the following formula must be used:

Combined AF3 = A x (B + [(1 – B) /2])

Where: A is the lowest numeric value of the two chosen factors
B is the second lowest numeric value of the two chosen factors

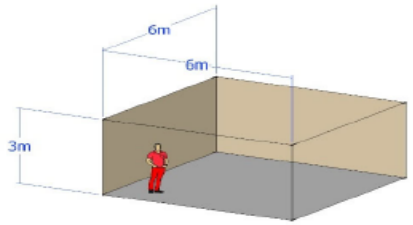
$$\text{Adjusted Maximum IPD} = \frac{\text{Maximum IPD (From Table J6.2b)}}{\text{AF1 (RAR)} \times \text{AF2 (Light Colour)} \times \text{AF3 (Controls)}}$$

AF1 - Room Size and Shape

SMALL ROOM (36m2)

LOW CEILING

SQUARE

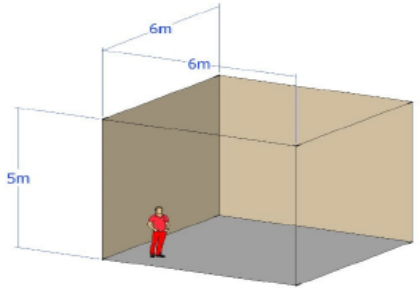


AF

0.67

HIGH CEILING

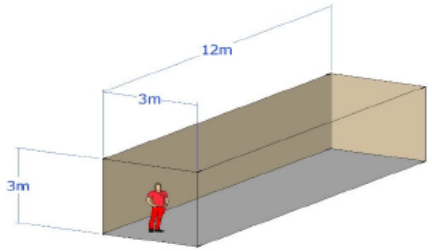
SQUARE



AF

0.60

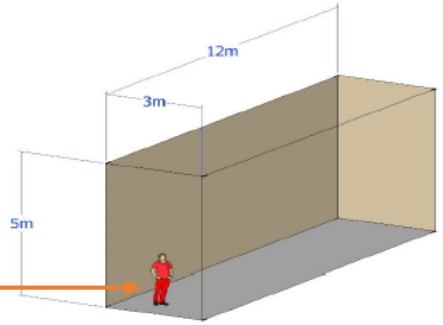
RECTANGULAR



AF

0.63

RECTANGULAR



AF

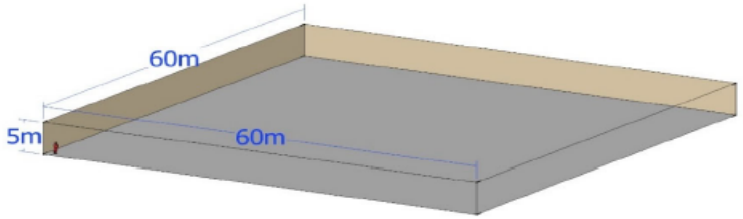
0.58

AF1 - Room Size and Shape

LARGE WAREHOUSE (3600m2)

LOW CEILING

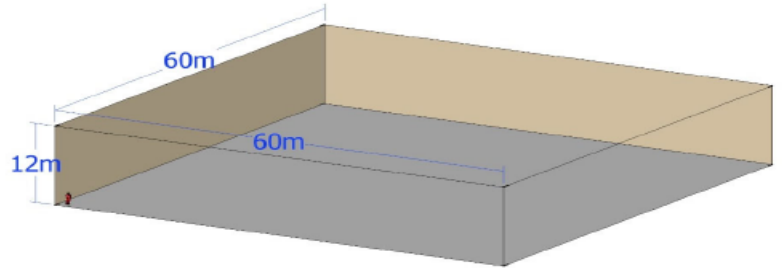
SQUARE



AF 1.00 (default if RAR >1.5m)

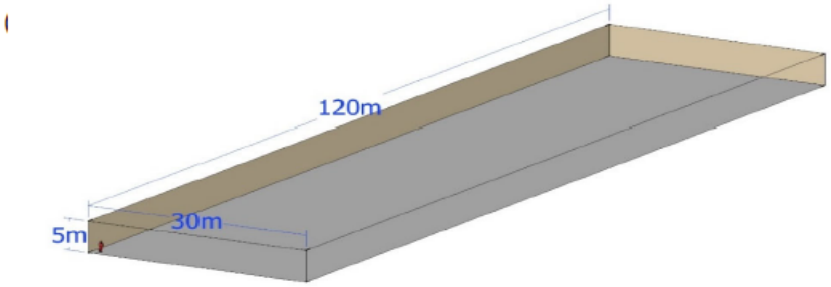
HIGH CEILING

SQUARE



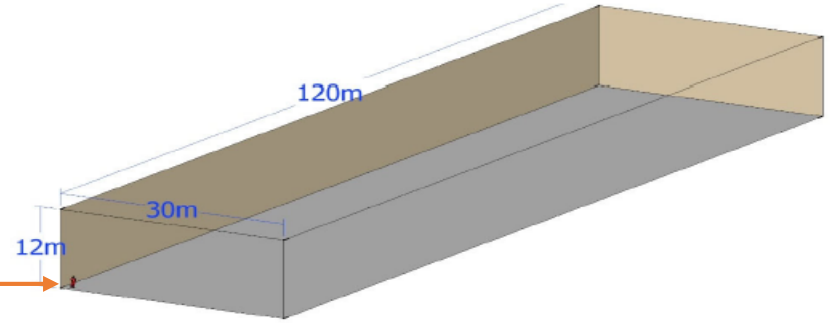
AF 0.92

RECTANGULAR



AF 1.00 (default if RAR >1.5m)

RECTANGULAR



AF 0.83

AF1 - Room Size and Shape

1. SKINNY ROOM (rectangular): up to 10% increase in IPD allowance over a square room

2. HIGH CEILING: up to 20% increase in IPD allowance over a std ceiling height

3. ROOMS with AREA LESS THAN $350m^2$ (e.g. 18m x 18m) with 2.7m-3.5m ceiling

   - OR -

   WAREHOUSES with AREA LESS THAN $3500m^2$ (e.g. 60m x 60m) with 5m-10m ceiling

10% TO 60%+ increase in IPD allowance

AF1 - Room Size and Shape (Trends relating to Commercial Sectors)

MEDIUM RETAIL STORE (TYPICAL)

22m x 7m x 4m (H)

AF
0.72

TRADITIONAL CLASSROOM

10m x 5m x 3m (H)

AF
0.69

LARGE OFFICE

50m x 25m x 3m (H)

AF
1.00
(default if RAR >1.5m)

MEDIUM OFFICE (TYPICAL)

17m x 10m x 3m (H)

AF
0.85

Adjustment Factor vs IPD % increase

THE LOWER THE FACTOR,
THE HIGHER THE IPD ALLOWANCE

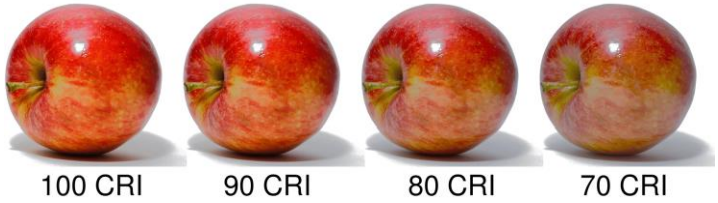
$$\text{Adjusted Maximum IPD} = \frac{\text{Maximum IPD (From Table J6.2b)}}{\text{AF}}$$

(e.g. large warehouse)	AF = 0.8	$\frac{100}{0.8} = 125$	25% increase in IPD allowance
(e.g. typical Retail or Classroom)	AF = 0.7	$\frac{100}{0.7} = 143$	43% increase in IPD allowance
(e.g. standard room)	AF = 0.6	$\frac{100}{0.6} = 166$	66% increase in IPD allowance

AF2 – Light Colour – CRI and CCT

NEW

*** CRI = Colour Rendering Index**



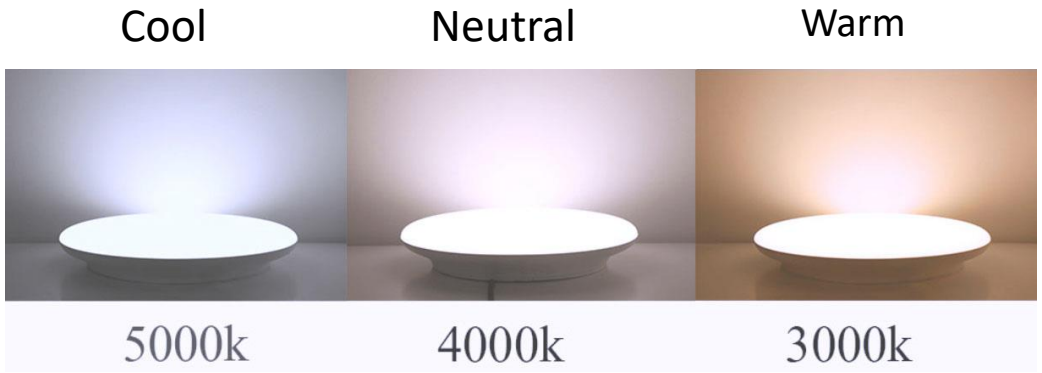
*** CCT = Correlated Colour Temperature**

AF2 – Light Colour – CCT (Correlated Colour Temperature)

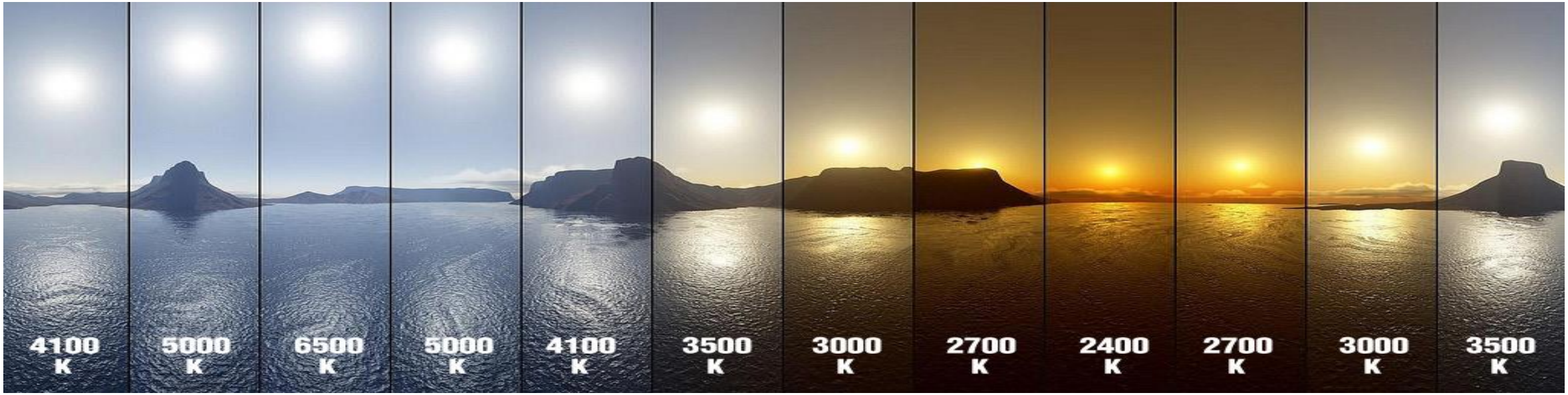
The variations in shades of white light.

Unit – Kelvin (K)

3000K – "Warm" White
4000K – "Neutral" White
5000K – "Cool" White



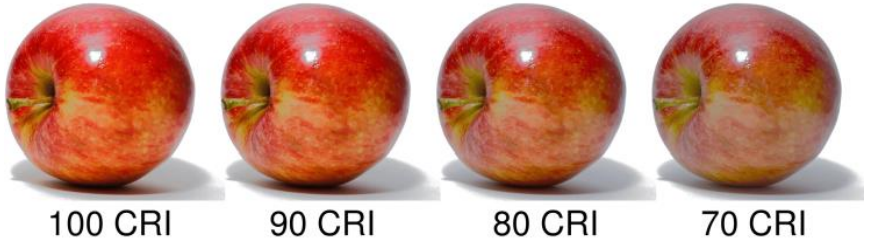
Tunable White light sources can assist Circadian Rhythms in the mind to relate to the time of day



AF2 – Light Colour – CRI

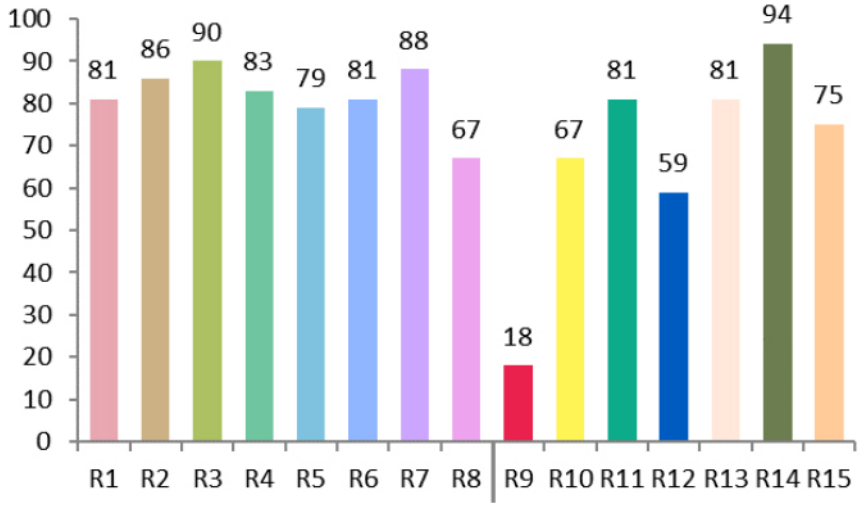
The ability of a light source to reveal the true colours as they would appear under natural daylight.

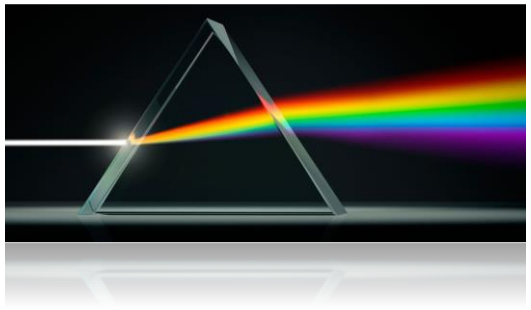
The higher the CRI of a light source, the better and more natural colours appear.



CRI 80 (sample)

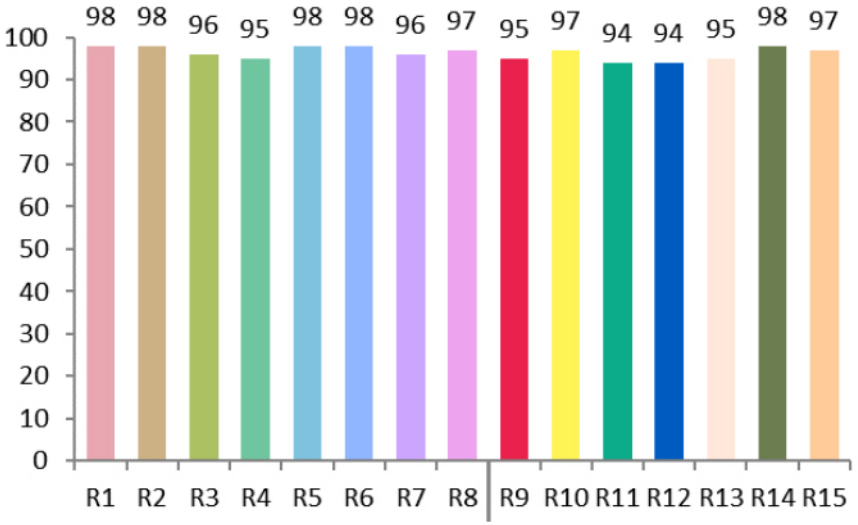
AN INCOMPLETE SPECTRUM OF COLOURS





CRI 90 (sample)

A MORE COMPLETE SPECTRUM OF COLOURS



AF2 – Light Colour

NEW

*** CRI = Colour Rendering Index**

*** CCT = Correlated Colour Temperature**

Table J6.2c Illumination power density adjustment factor for light colour

Light source	Description	*Illumination power density* adjustment factor
CRI ≥ 90	Where lighting with good colour rendering is used	0.9
CCT ≤ 3500 K Note	Where lighting with a warm appearance is used	0.8
CCT ≥ 4500 K	Where lighting with a cool appearance is used	1.1

Note to Table J6.2c: Includes luminaires that can adjust their CCT to 3500 K or below.

Light Colour – CCT & CRI – OVER-COMPENSATION AND THEREFORE DESIGN INFLUENCE?

Standard Quality Light Source NO APPLICABLE ADJUSTMENT FACTORS		Higher Quality CRI and Alternative CCT Light Source	Adjustment Factor (and % increase in IPD allowance)		Change in Light Output (efficacy) due to higher quality light source	Over/Under-Compensation of Adjustment Factor
CRI 80		**CRI 91**	0.9	**+11%** in IPD allowance	-15% in light output	-4%* reduced benefit in overall energy allowance
CCT 4000K		**CCT 3000K**	0.8	**+25%** in IPD allowance	-7% in light output	**+18%*** increased benefit in overall energy allowance
CCT 4000K		**CCT 5000K**	1.1	**-9%** in IPD allowance	+7% in light output	Similar (-2%)*

* Noting %-increase on a value followed by identical %-decrease mathematically does not result in regaining original value - % shown are approximate

Example of LED Chip Data (high-power for reference – however, data above based on broader average range of low thru' to high power LED chips)

Manufacturer	LED Package	LED Current	LED Wattage (W)	LED Ts	CCT	CRI	Flux Bin	LED Lumen (lm)	CRI	Flux Bin	LED Lumen (lm)
Samsung	LH351B	350mA	1	55°C	3000K	80	N1	156	90	K1	136
					4000K	80	P1	167	90	M1	146
					5000K	80	Q1	177	90	N1	156

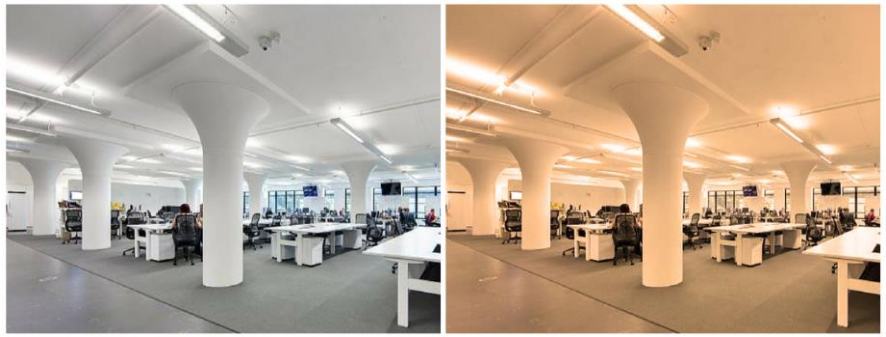
Example LED Dataset

Design Influence? Choose 3000K to gain ~18% extra IPD allowance

Clerical or General Ambient Diffuse Lighting
(emphasised with a reference to daylight or cool white in vicinity)

4000K 3000K

Office (esp. deep spaces with high level lighting)
(emphasised with a reference to daylight or cool white in vicinity)



4000K 3000K

3000K potentially reduces alertness during daytime (ref. Circadian Rhythms)

Jewellery Store
(emphasised with a reference to daylight or cool white in vicinity)

4000K 3000K

Industrial (?)
(emphasised with a reference to daylight or cool white in vicinity)

4000K 3000K

NCC - SECTION J6 – Covered so far …

- ("Maximum") Illumination Power Density (IPD) Table 

- J6.2a Adjustment Factor – Room Size and Shape

  (includes Room Aspect Ratio) 

- J6.2c Adjustment Factor – Light Colour

  (ref Table J6.2c) 

FINAL SLIDE …

- Adjustment Factor Trends relating to specific commercial sectors

Comparison of Commercial Sectors with ‘typical’ room sizes

TYPICAL MEDIUM RETAIL 1000 Lux

(22m x 7m room)

** HIGH CRI **

** 3000K *

NCC 2019

$$\frac{14\ \text{W/m2}}{0.7 \times (0.8^{*} \times 0.9^{**})}$$

RAR Formula — 3000K — > 90 CRI — AF2

= 27 W/m2 | W/100 Lux/m2: 2.7 (for 1000lx) | GENERAL LIGHTING (1000 Lux)

NOTING A DECREASE IN EFFICACY OF 22%:
~15% for High CRI and ~7% for 3000K
(compared with benchmark CRI 80 and 4000K)

TYPICAL SCHOOL ROOM 320 Lux

(10m x 5m room)

STD CRI

4000K CCT

NCC 2019

$$\frac{4.5\ \text{W/m2}}{0.7}$$

RAR Formula

= 6.4 W/m2 | W/100 Lux/m2: 2 (for 320lx) | GENERAL LIGHTING (320 Lux) (Task Lighting not practical to impliment)

TYPICAL MEDIUM OFFICE 320 Lux

(17m x 10m room)

STD CRI

4000K CCT

NCC 2019

$$\frac{4.5\ \text{W/m2}}{0.85}$$

RAR Formula

= 5.3 W/m2 | W/100 Lux/m2: 1.65 (for 320lx) | GENERAL LIGHTING (320 Lux)

Comparison of Commercial Sectors with ‘typical’ room sizes

TYPICAL MEDIUM RETAIL 1000 Lux

(22m x 7m room)

** HIGH CRI **

** 3000K *

NCC 2019

$$\frac{14\ \text{W/m2}}{0.7 \times (0.8^{*} \times 0.9^{**})}$$

RAR Formula

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= 27 W/m2 | W/100 Lux/m2: 2.7 (for 1000lx) | GENERAL LIGHTING (1000 Lux)

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NCC 2019

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RAR Formula

= 6.4 W/m2 | W/100 Lux/m2: 2 (for 320lx) | GENERAL LIGHTING (320 Lux) (Task Lighting not practical to impliment)

Simple examples above emphasise the significance of designing to the ADJUSTED IPD values …
… and not Table J6.2a alone.

THANK YOU

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Lighting Council AUSTRALIA MEMBER

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A Holistic Approach

1. Credit Where Credit is Due?
2. What About Bluetooth?
3. Zone Division and Interpreting Use
4. Multifunction Lighting

Credit Where Credit is Due?

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m²)
Auditorium, church and public hall	8
Board room and conference room	5
Carpark - general	2
Carpark - entry zone (first 15 m of travel) during the daytime	11.5
Carpark - entry zone (next 4 m of travel) during the day	2.5
Carpark - entry zone (first 20 m of travel) during nighttime	2.5
Common rooms, spaces and corridors in a Class 2 building	4.5
Control room, switch room and the like - intermittent monitoring	3
Control room, switch room and the like - constant monitoring	4.5
Corridors	5
Courtroom	4.5
Dormitory of a Class 3 building used for sleeping only	3
Dormitory of a Class 3 building used for sleeping and study	4
Entry lobby from outside the building	9
Health-care - infants' and children's wards and emergency department	4
Health-care - examination room	4.5
Health-care - examination room in intensive care and high dependency ward	6
Health-care - all other *patient care areas* including wards and corridors	2.5
Kitchen and food preparation area	4
Laboratory - artificially lit to an ambient level of 400 lx or more	6
Library - stack and shelving area	2.5
Library - reading room and general areas	4.5
Lounge area for communal use in a Class 3 or 9c building	4.5
Museum and gallery - circulation, cleaning and service lighting	2.5
Office - artificially lit to an ambient level of 200 lx or more	4.5

Interpretating Spaces

- Auditorium is wide open to interpretation
- Entry lobby (9W/m²) is an opportunity to interpret a space that bleeds into another space but does not indicate a specific purpose.

Credit Where Credit is Due?

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m^2)
Auditorium, church and public hall	8
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Corridors	5
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Entry lobby from outside the building	9
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Library - reading room and general areas	4.5
Lounge area for communal use in a Class 3 or 9c building	4.5
Museum and gallery - circulation, cleaning and service lighting	2.5
Office - artificially lit to an ambient level of 200 lx or more	4.5

Interpreting Spaces

- The difference between ”corridor” (5W/m^2) and ”Museum and Gallery Circulation” (2.5W/m^2) allowances is not clear and arguably not sensible.

Credit Where Credit is Due?

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m²)
Auditorium, church and public hall	8
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Library - stack and shelving area	2.5
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Lounge area for communal use in a Class 3 or 9c building	4.5
Museum and gallery - circulation, cleaning and service lighting	2.5
Office - artificially lit to an ambient level of 200 lx or more	4.5

Interpreting Spaces

- Offices are now lower W/m² than corridors
- Lounge area's for communal may have highly defined eating areas within high contrast spaces, yet this does not allow for interesting lit spaces that provde visual recreation

Credit Where Credit is Due?

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m²)
Office - artificially lit to an ambient level of less than 200 lx	2.5
Plant room where an average of 160 lx vertical illuminance is required on a vertical panel such as in switch rooms	4
Plant rooms with a horizontal illuminance target of 80 lx	2
Restaurant, café, bar, hotel lounge and a space for the serving and consumption of food or drinks	14
Retail space including a museum and gallery whose purpose is the sale of objects	14
School - general purpose learning areas and tutorial rooms	4.5
Sole-occupancy unit of a Class 3 or 9c building	5
Storage	1.5
Service area, cleaner's room and the like	1.5
Toilet, locker room, staff room, rest room and the like	3
Wholesale storage area with a vertical illuminance target of 160 lx	4
Stairways, including *fire-isolated stairways*	2
Lift cars	3

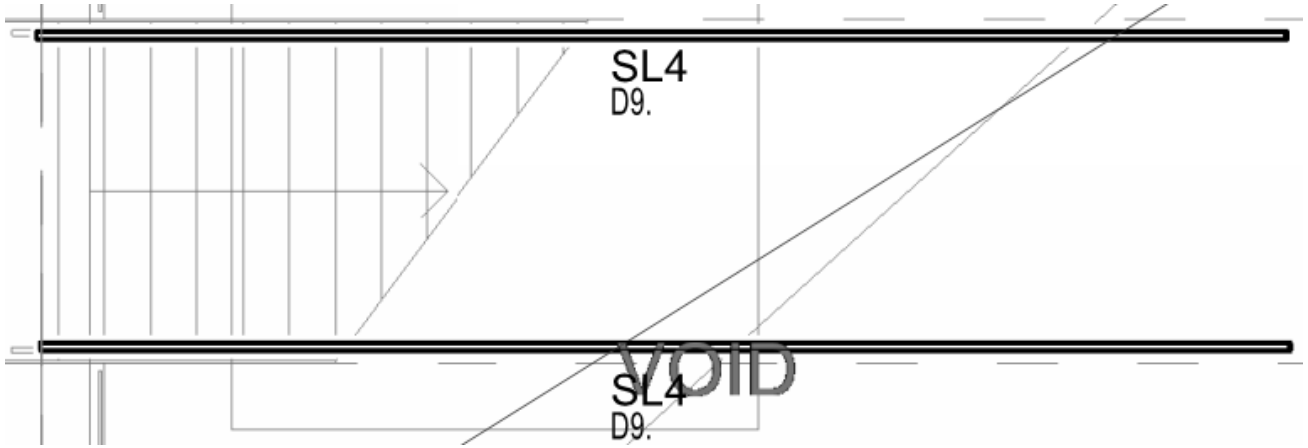
Interpreting Spaces

- ”Restuarant, cafe, bar, hotel lounge and a space for the serving and consumption of food and drinks” has the potential to be used in other environments
- The item under ”... museum and gallery whose purpose is the sale of objects.” doesn't seem to understand the role of institutions versus commercial galleries

Credit Where Credit is Due?

Table J6.2a Maximum illumination power density

Space	Maximum *illumination power density* (W/m²)
School - general purpose learning areas and tutorial rooms	4.5
Sole-occupancy unit of a Class 3 or 9c building	5
Storage	1.5
Service area, cleaner's room and the like	1.5
Toilet, locker room, staff room, rest room and the like	3
Wholesale storage area with a vertical illuminance target of 160 lx	4
Stairways, including *fire-isolated stairways*	2
Lift cars	3



Interpreting Spaces

Not all stairs are purely functional

- Integration into hadnrails on larger stairs can push past the limits of the W/m² allowance
- Doesn't consider stairs that aren't enclosed

Credit Where Credit is Due

Table J6.2c Illumination power density adjustment factor for light colour

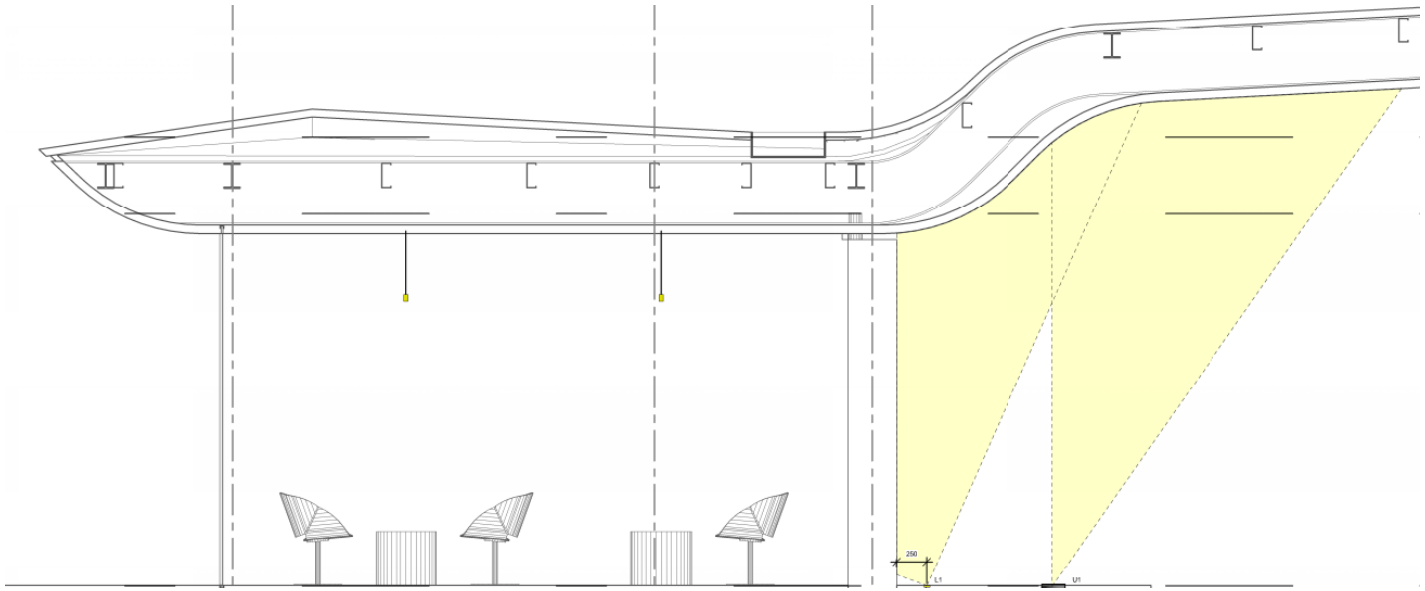
Light source	Description	*Illumination power density* adjustment factor
CRI ≥ 90	Where lighting with good colour rendering is used	0.9
CCT ≤ 3500 K Note	Where lighting with a warm appearance is used	0.8
CCT ≥ 4500 K	Where lighting with a cool appearance is used	1.1

Interpreting Spaces

These additions to the adjustment factors are a positive change

- Support a high standard of light quality
- Supports the use of colour tunable lighting
- Think holistically in its supports of

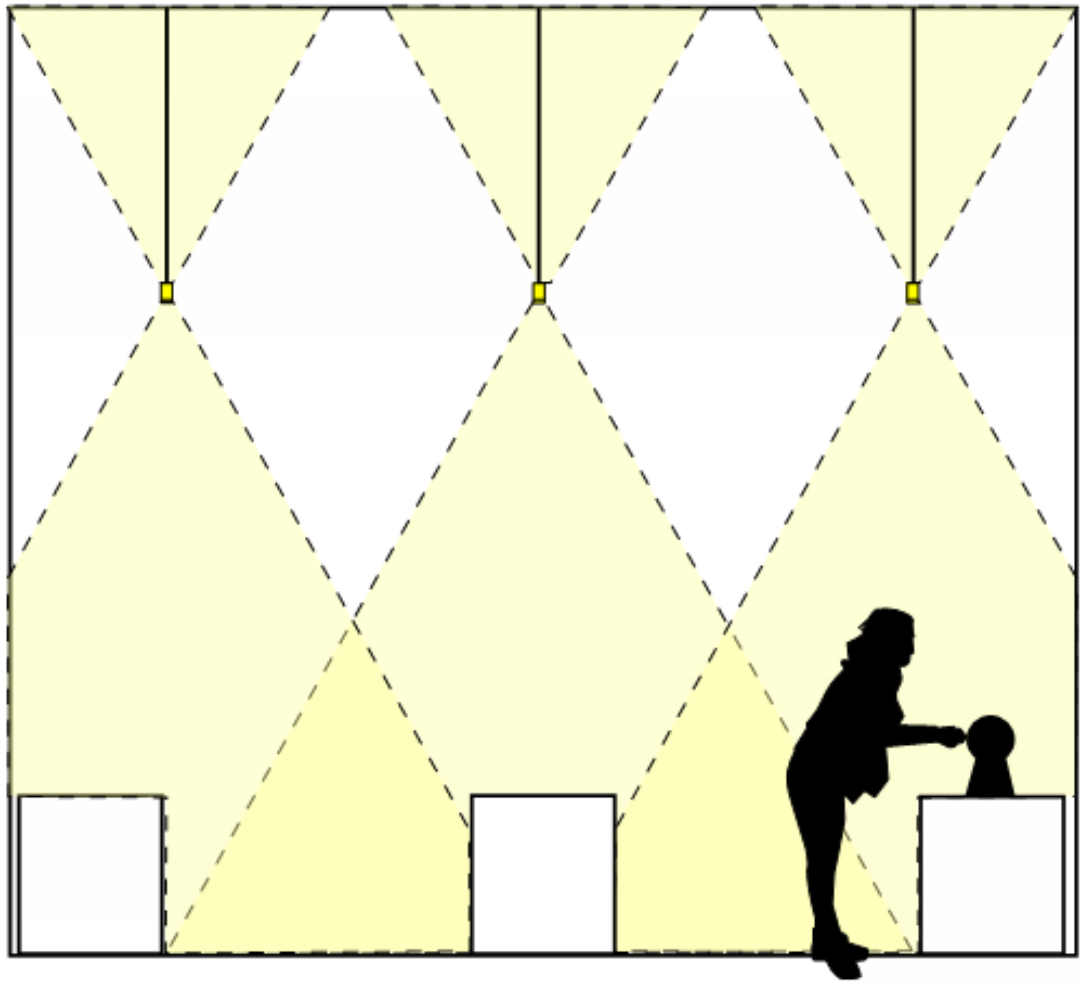
Credit Where Credit is Due?



Oppotrunities to Move Away from Homogenisation?

But there is still no discernable allowance for indirect lighting often used as an enhancer of interior architectures that are not designed to take lighting integrations.

Credit Where Credit is Due

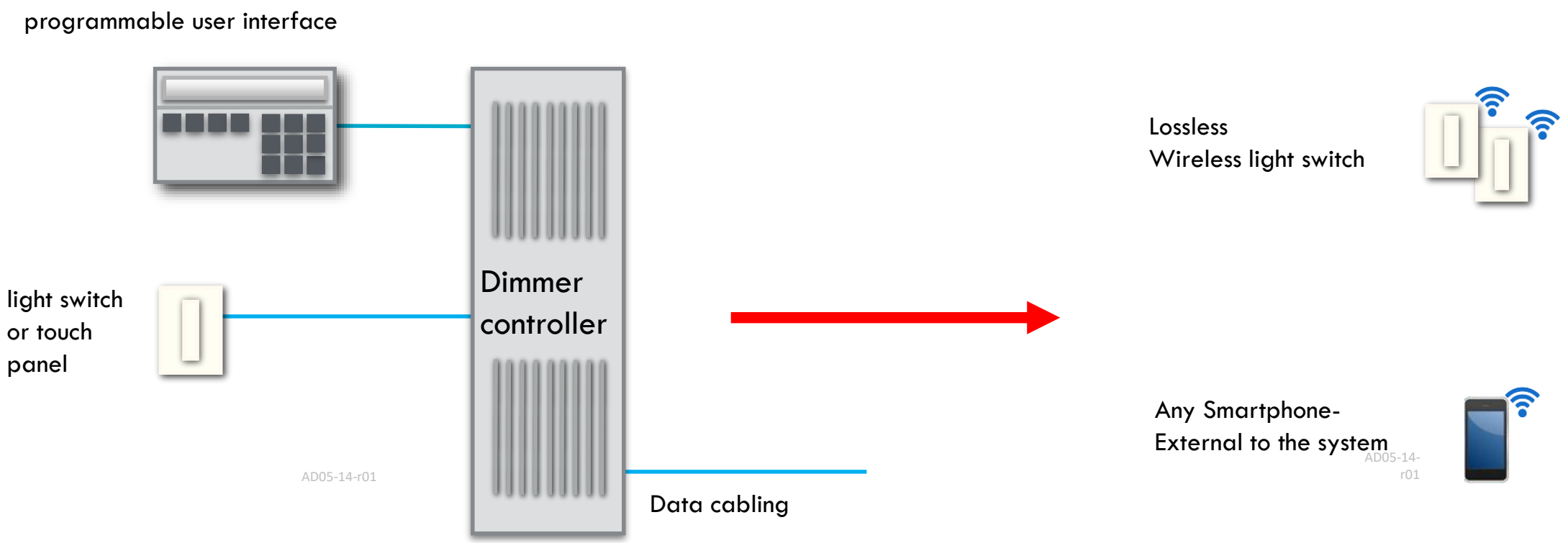


Oppotrunities to Move Away from Homogenisation?

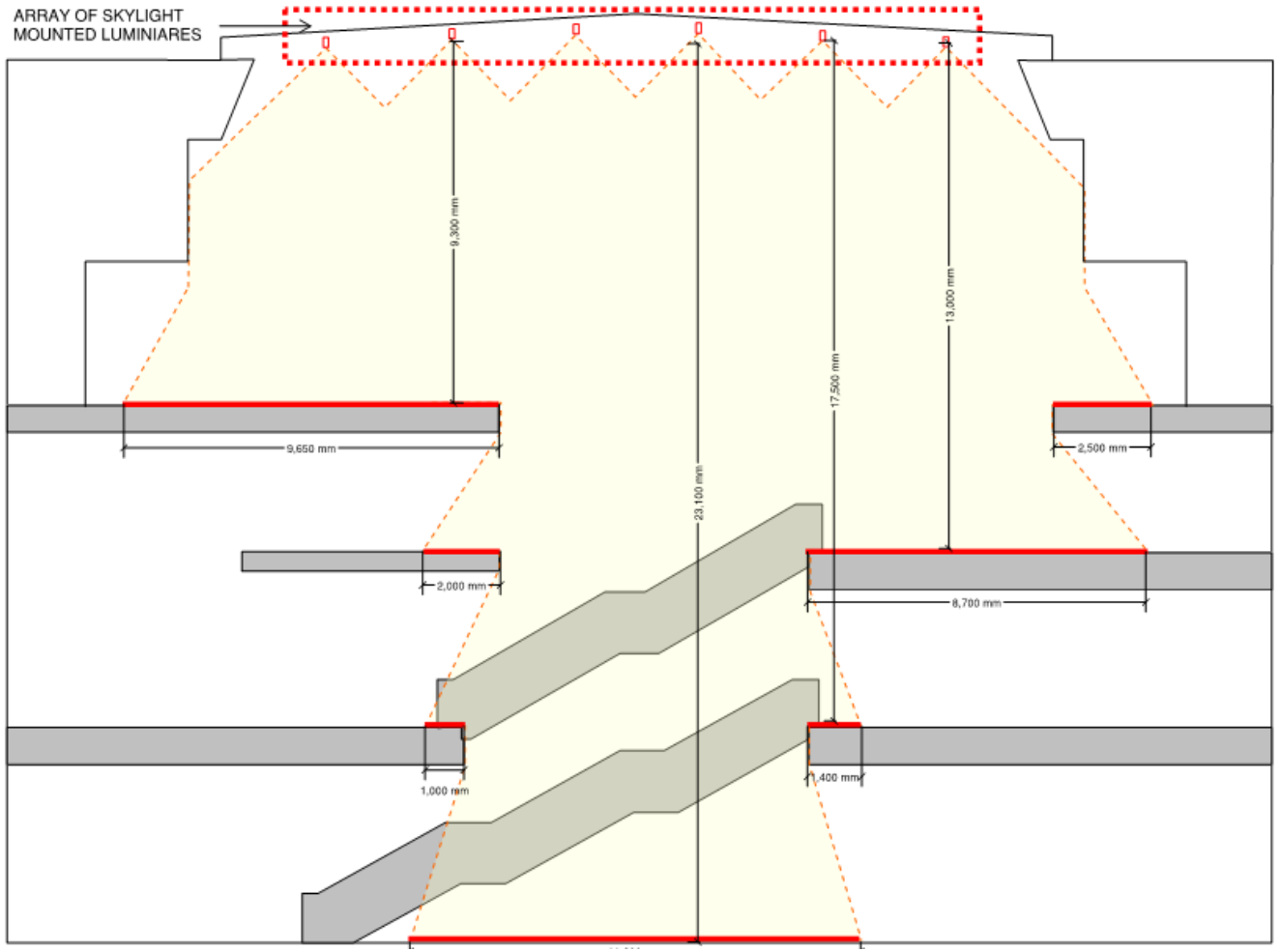
Some situations have greater demands that are out of the lighting designers control such as:

- Client standards more rigorous than AS1680
- Conditions that inlcude the enhancement of the enhancement of the arhcitecture itself
- Dangerous conditions

And what about Bluetooth?



Dividing Zones and Interpretating Use

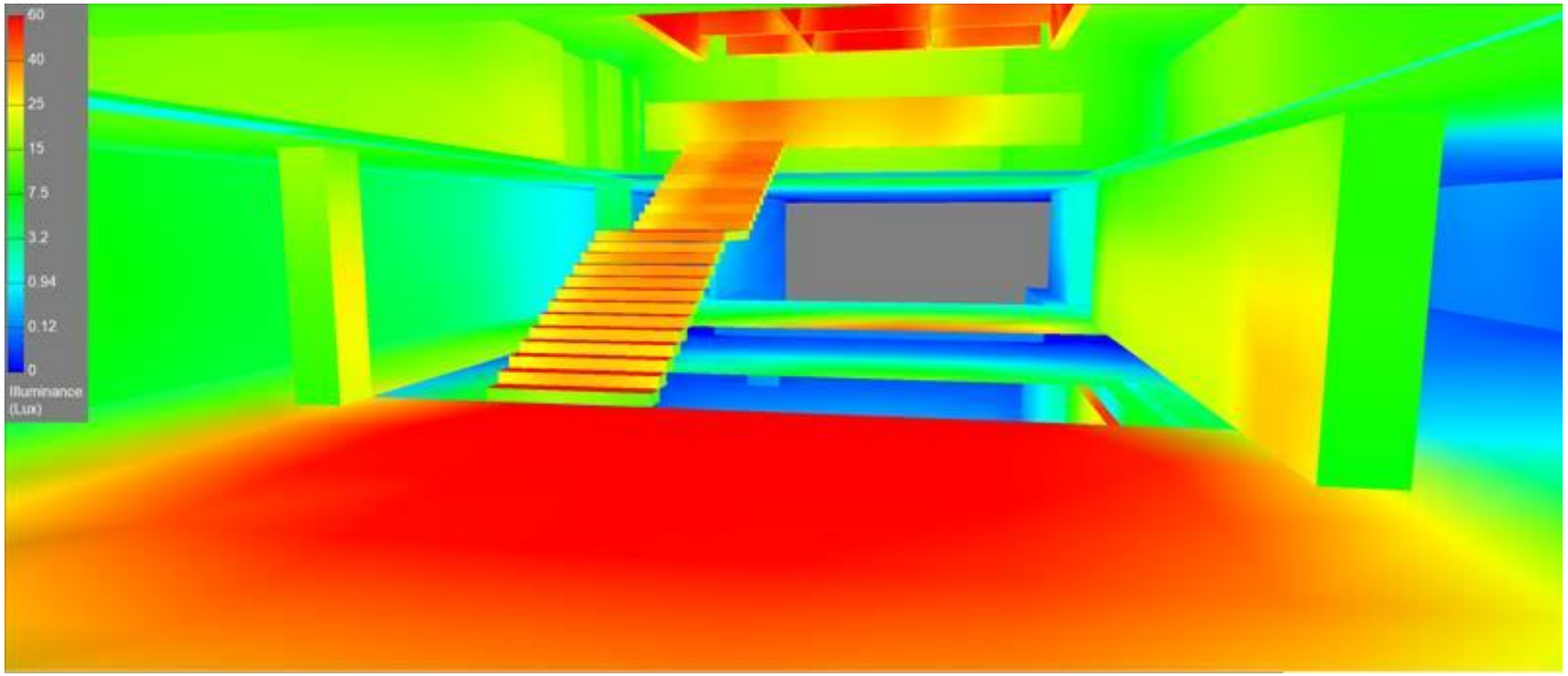


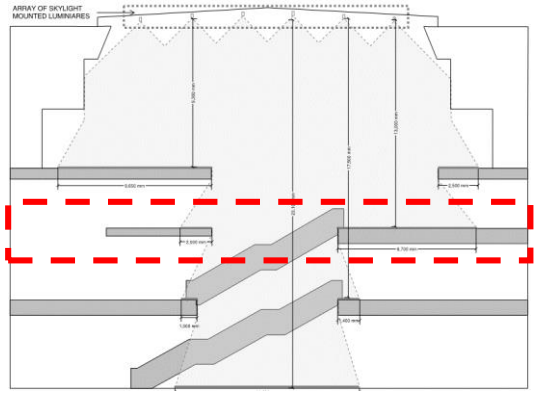
One array supply multiple levels

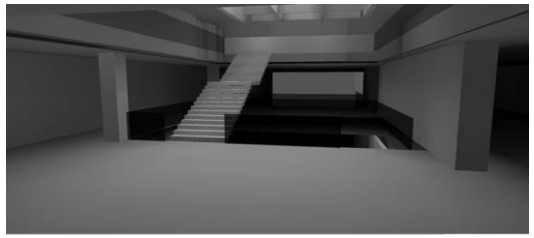
Each are:

- Has a different height from the array and therefore different RAR
- Requires an assumption as to the percentage of the total lumen package used to light each area
- Has additional energy consumption from other sources and arrays of luminaires
- Has the potential to be used as more than a circulation space

Dividing Zones and Interpretating Use







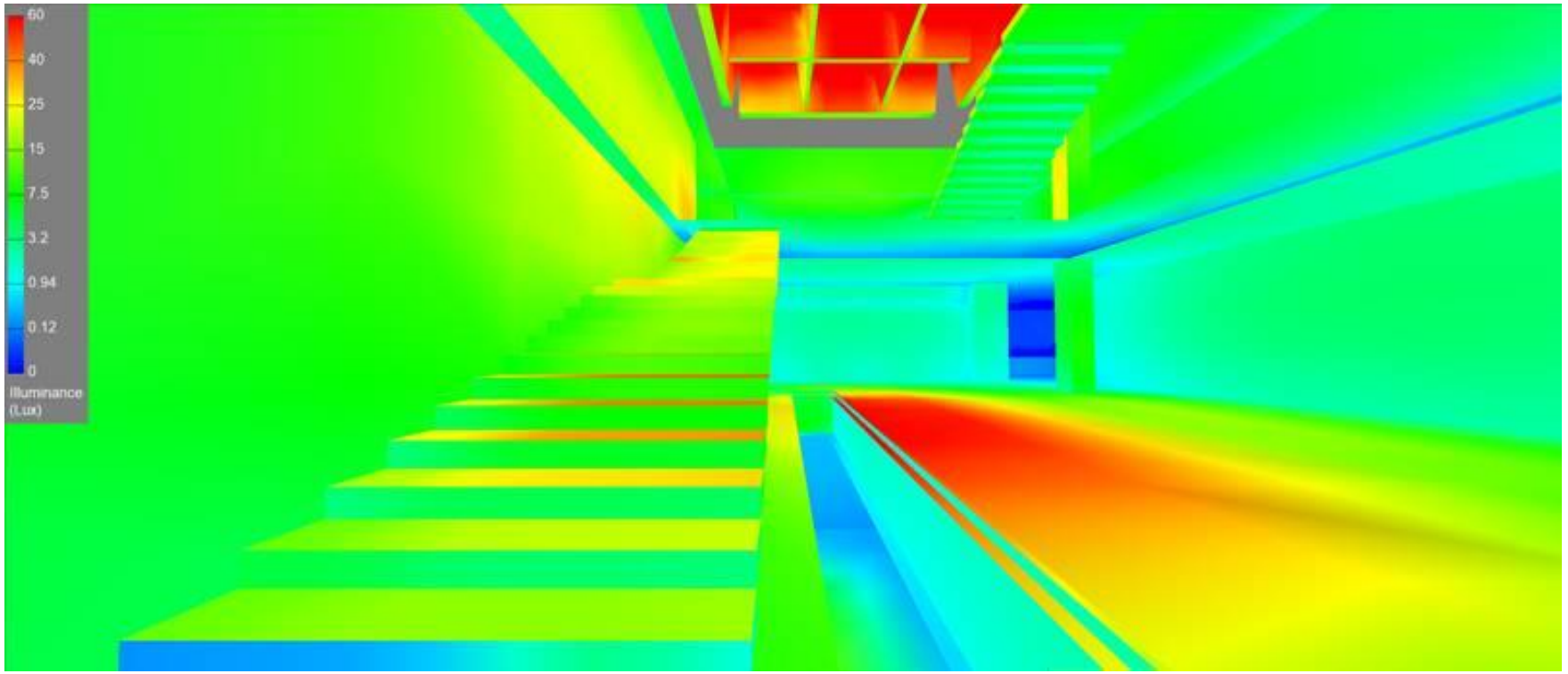
Level 3

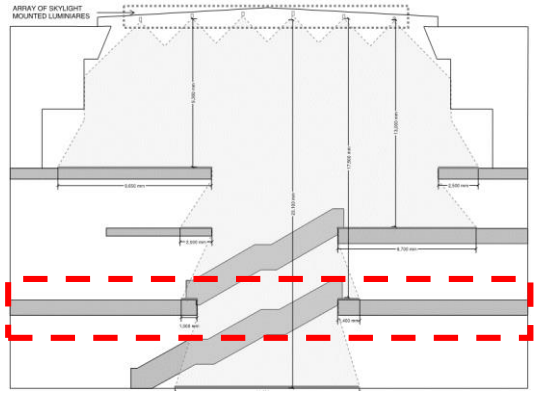
- A=114.5 / (13 x 42.8 = 556)
- RAR = .2

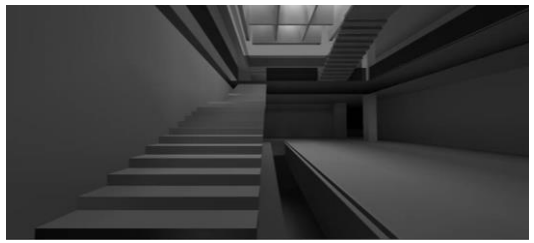
+ Note 2

- .05 + (RAR/3)
- = .56

Dividing Zones and Interpretating Use







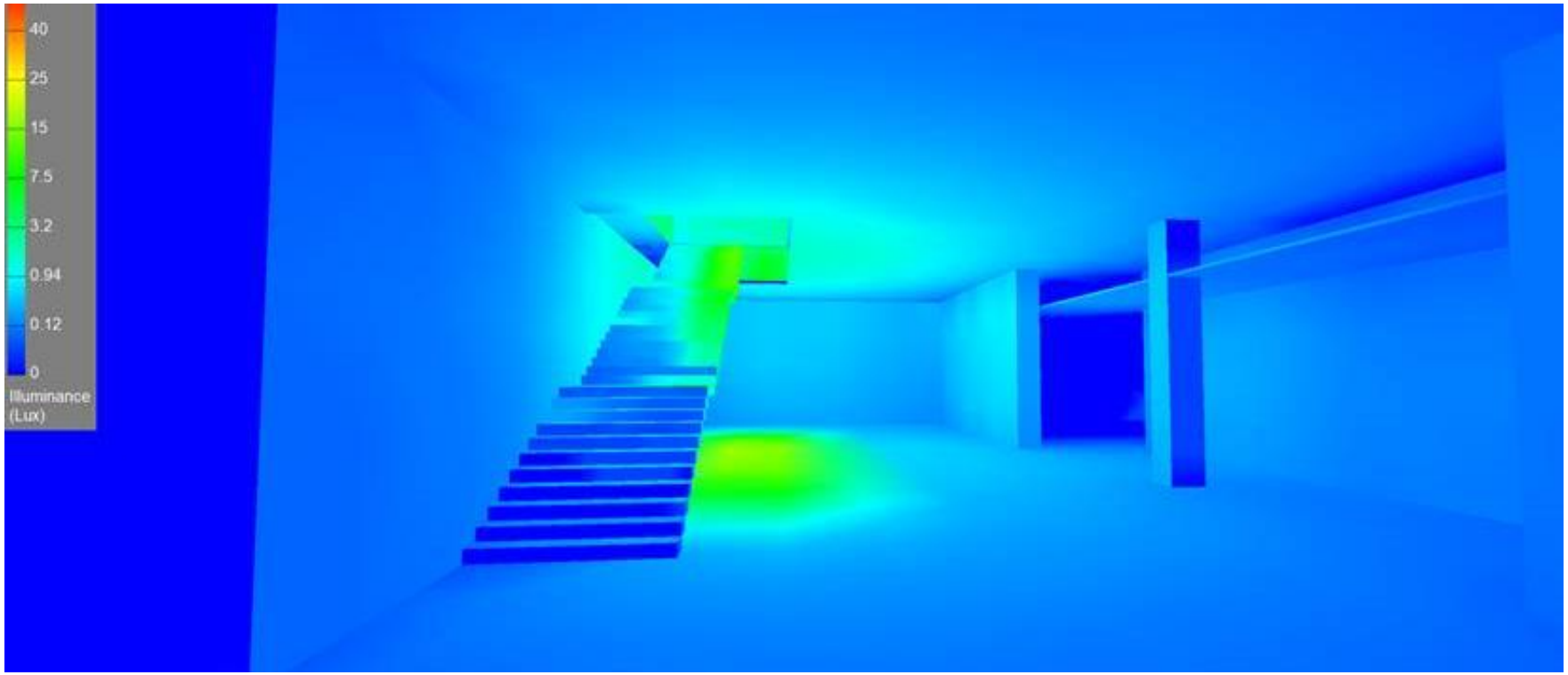
Level 2

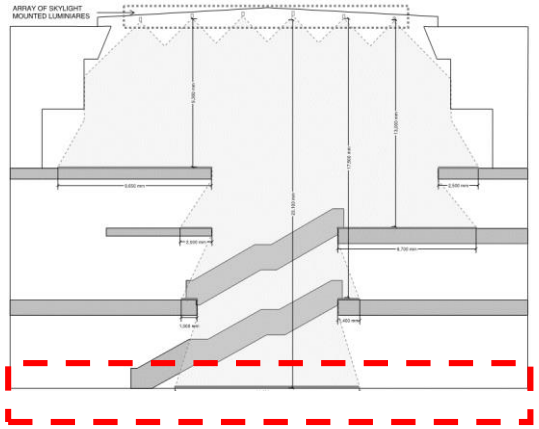
- A=537.6 / (17.5 x 9.6 = 168)
- RAR = .22

+ Note 2

- .05 + (RAR/3)
- = .57

Dividing Zones and Interpreting Use





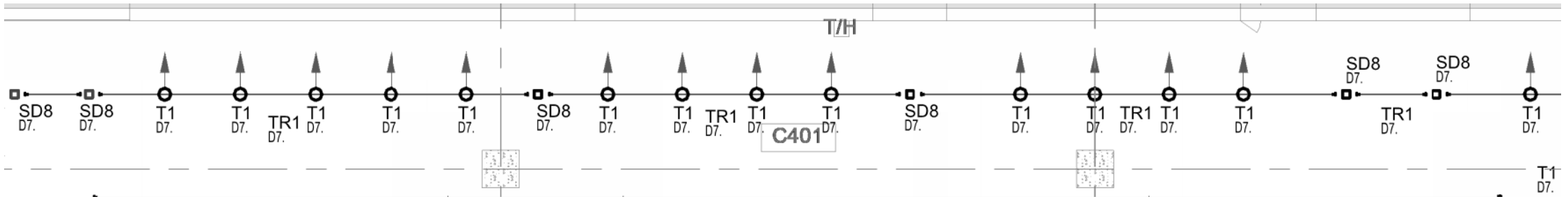
Level 1

- A=20 / (24x23.1 = 554.4)
- RAR = .036

+ Note 2

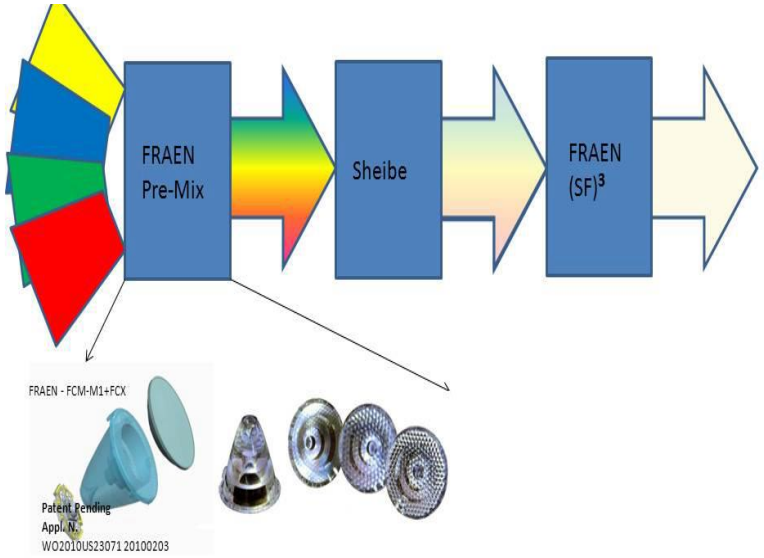
- .05 + (RAR/3)
- = .51

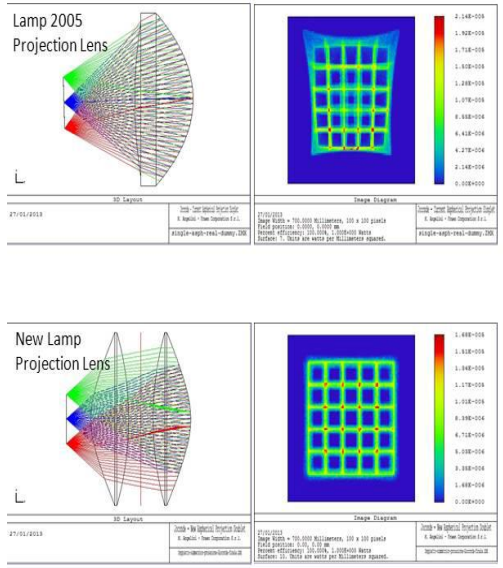
Multi-functional Lighting

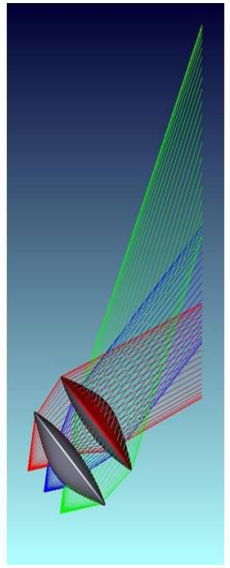


With DALI or Bluetooth controls it is possible to utilise display lighting as general circulation lighting to minimise energy consumption with the benefit to J6.2 and also satisfying J6.4 (i) control separately from other artificial lighting

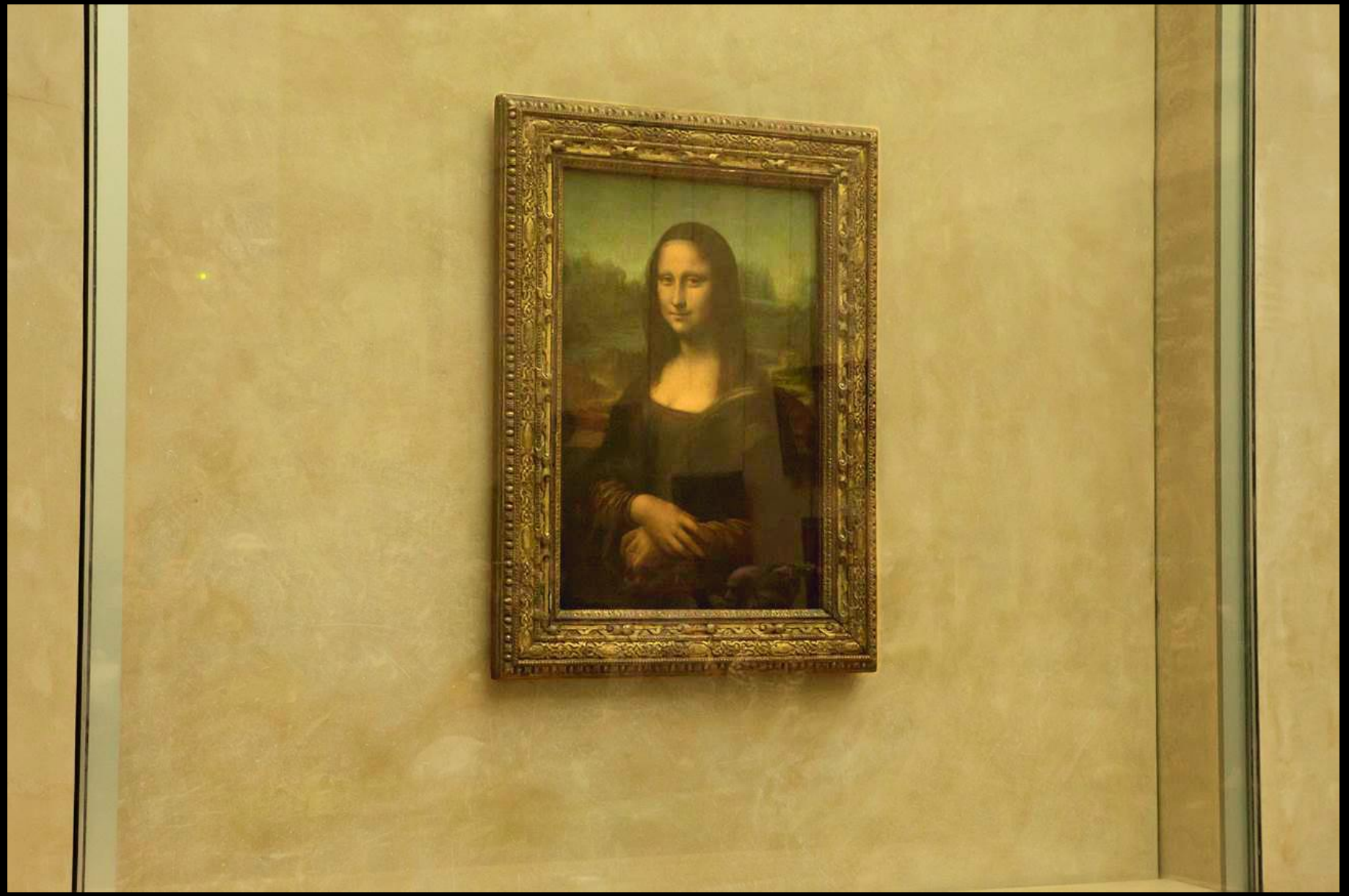
Challenges to Manufacturers and R&D





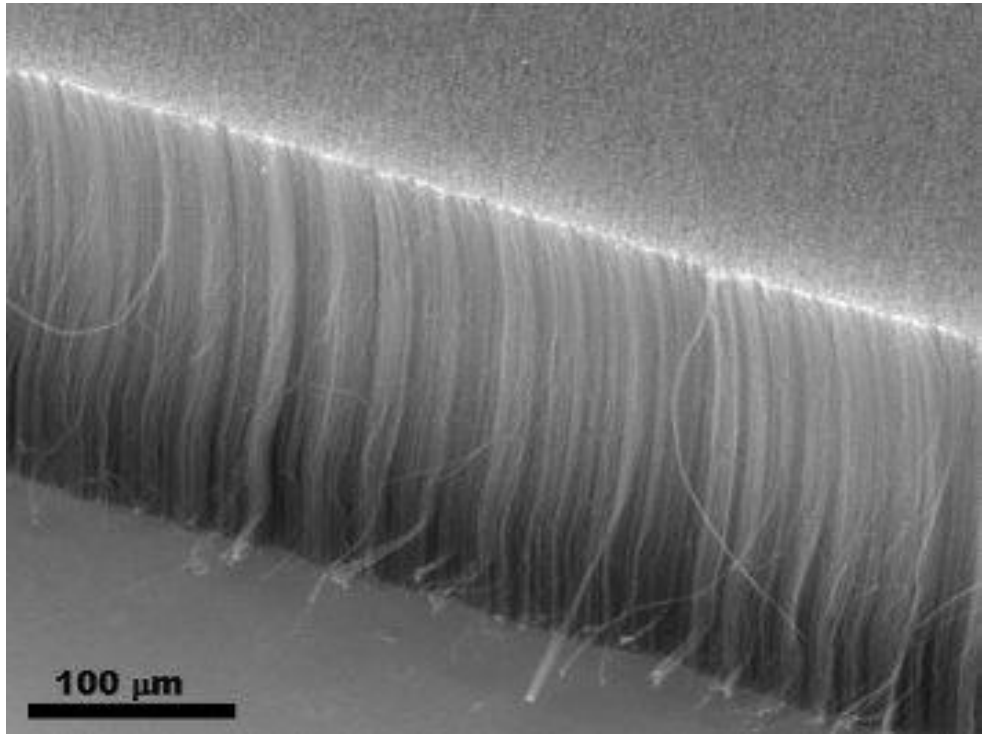


Lighting Mona Lisa with LEDs: details concerning innovating techniques (TOSHIBA Lamp–2013), 2013.



Muesee du Louvre, Paris

Challenges to Manufacturers and R&D



Vertically aligned nanotubes. Image courtesy Beilstein Journal of Nanotechnology. https://www.beilstein-journals.org/bjnano/single/articleFullText.htm?vt=f&publicId=2190-4286-4-14&tpn=0&bpn=singleVolume&vn=4

- Advancement research into the uses of nanotubes in display technologies and solar panels could play a part in CCT control.

- Ability to redirect single photons has potential for more efficient distribution technologies.

Everything Old is New Again

steensenvarming.com

Challenges and the impacts on products

Andrew Parker

Strategy and Innovation

Evolt

Lighting Council AUSTRALIA ™

IALD

Intent

- To provide an energy efficient lighting solution.
- To provide the right amount of light, at the right colour, in the required place, at the appropriate time.

Desired outcomes and levers

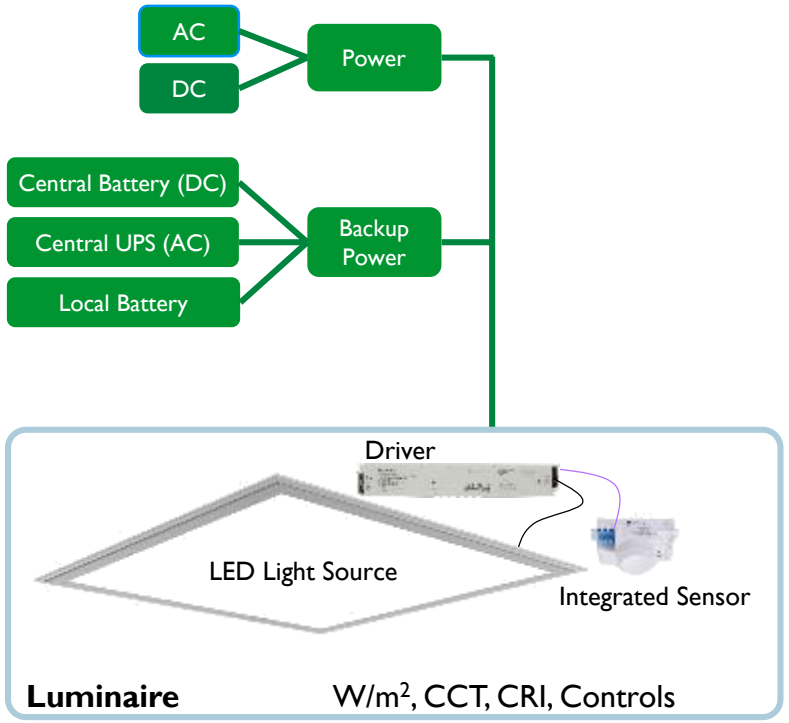
- Energy Efficiency
- Comfort
- Well-being
- Flexibility
- Economic Viability

- Illumination Power Density
  - for AS 1680 lux levels
- Adjustment Factors
  - CCT
  - CRI
  - Control Devices
- Min. requirements for switches & controls

Challenges creating Codes & Standards

- Keeping pace with technology
  - LEDs from 2017
- Economic viability
  - Benefit Cost Ratio; 1.0x to 1.5x
- Over-simplification
  - Multi-function
  - Convergence
  - Alternate power sources; solar
- Confusion from overlapping Codes & Standards
  - Vested interests of lobby groups
  - Overlap of Lighting (TC34) & Electrical (TC23) devices in the IEC

Lighting & Controls breakdown



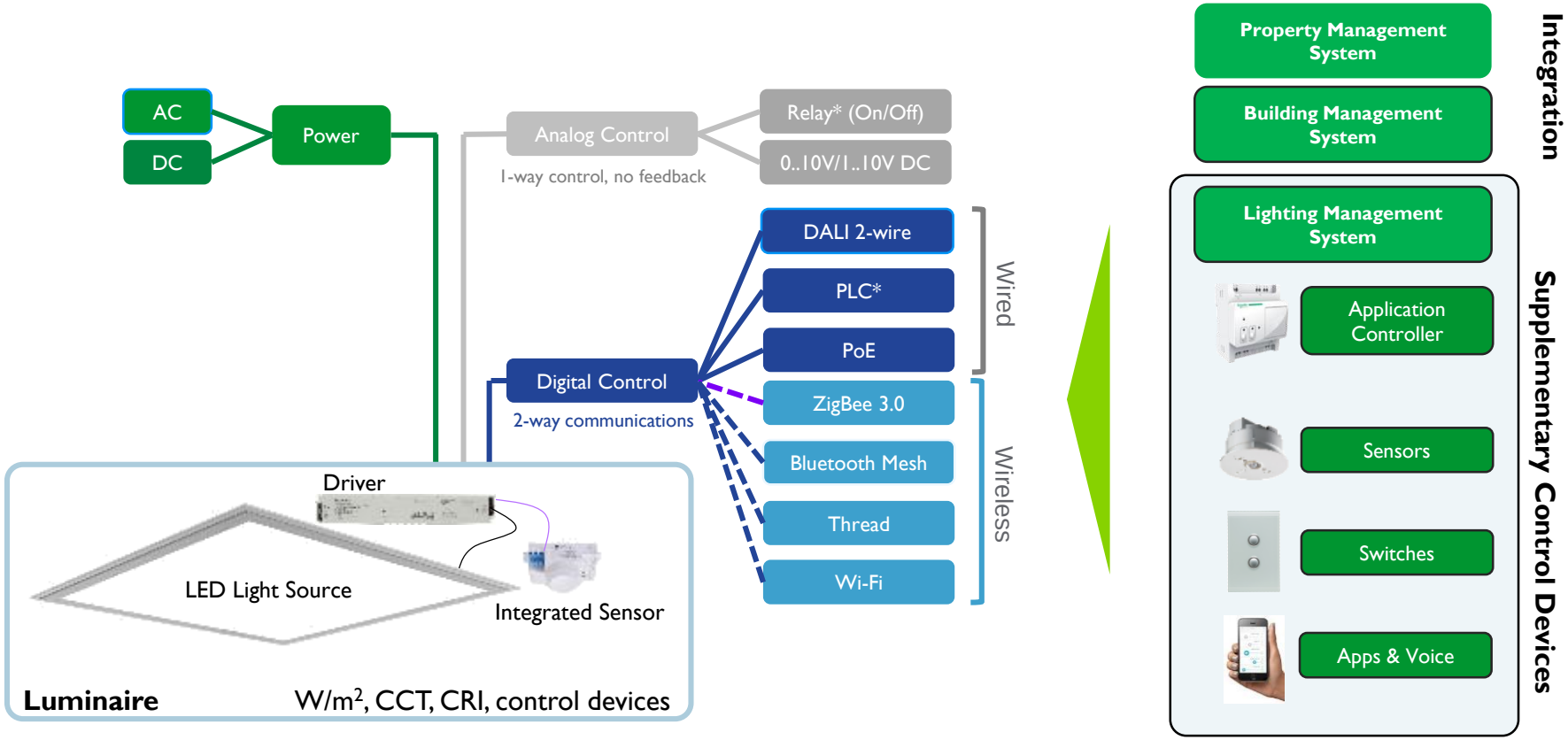
When do we convert to DC?

- Luminaire (Driver)
- Room
- Switchboard

How do we handle solar energy?

Fire Stairs, dual level
Carpark Portals, 800 lx, vacancy

Lighting & Controls breakdown



Other wired: DMX (entertainment venues)
Other wireless: < 1 GHz, cellular

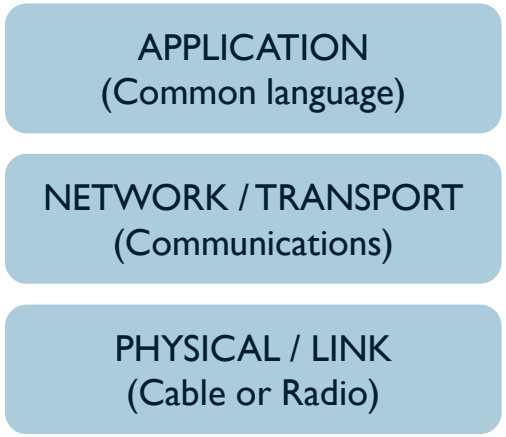
Key Points

- Luminaires have local intelligence providing better quality light & more functionality
- Digital communications provides configuration, group control, status & historical data
- Switches, sensors and luminaires can speak the same language providing full lighting control capabilities and removing the need for a legacy field bus

Making everything work together

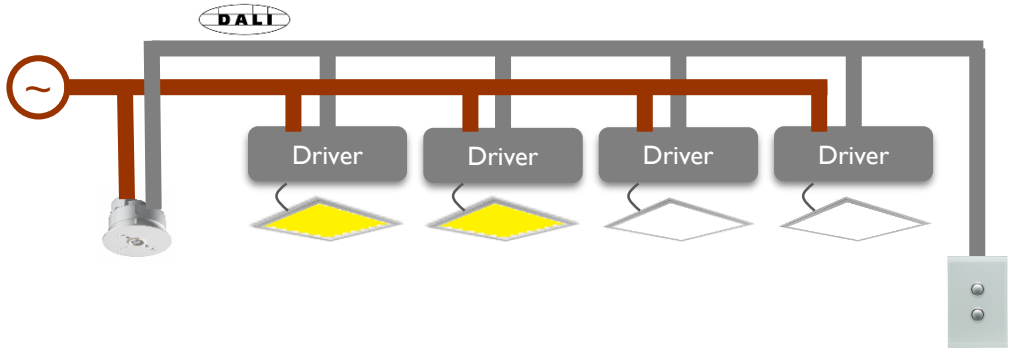
Collecting & Making Sense Of Data

- **Virtualised Data Models and Protocol Abstraction**
  - Improved cooperation on IoT Standards
  - **OCF** - Open Connectivity Foundation now includes (almost) everyone
  - **DALI2** - expanded lighting, emergency lighting & lighting control
  - **APIs** – structured data transfer between applications
- **Wireless Standards strengthening**
  - **IP networks**; Wi-Fi & mesh routers, Thread, Cellular 4G/5G
  - Mesh networks; Bluetooth & ZigBee but require hub

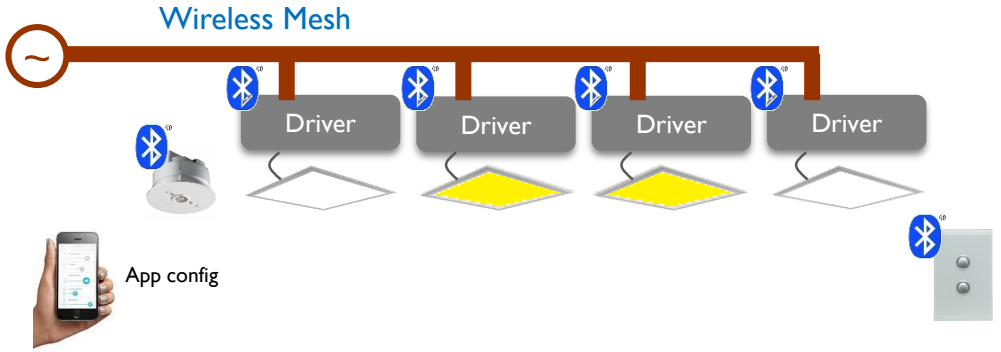


Simple Group Control, sensor & switch

Digital Dimming – occ/light sensor, switchplate

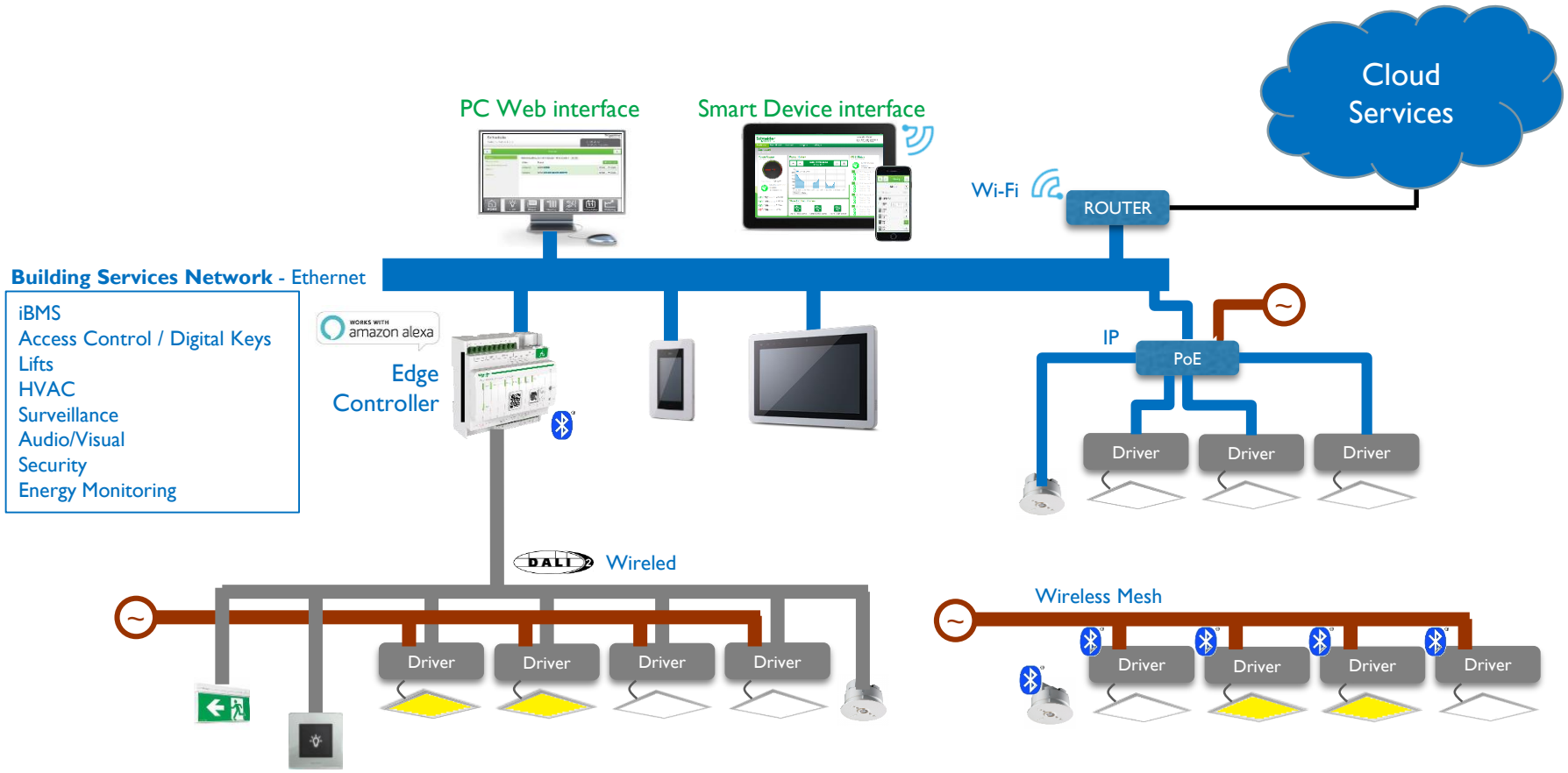


Digital Dimming – wireless occ/light sensors, switchplate



Smart Lighting – wired & wireless

Smart Lighting - IP integration



As the analogy goes…

The Stone Age didn't end because we ran out of stones.

It ended because we invented something better.

The NCC 2019 Update

Mike Dodd

Senior Project Officer
Australian Building Codes Board

Lighting Council AUSTRALIA ™

IALD

National Construction Code

NCC 2019 Update

11 April 2019

Agenda

- About the ABCB and the National Construction Code
- Development of NCC 2019
- Performance Solutions
- Support Materials

The ABCB

The Board is a joint initiative of all nine Australian governments and exists by way of an Inter-governmental Agreement (IGA).

The Board’s Mission under the IGA is to address issues of safety and health; amenity and accessibility, and sustainability in the design, construction and performance of buildings.

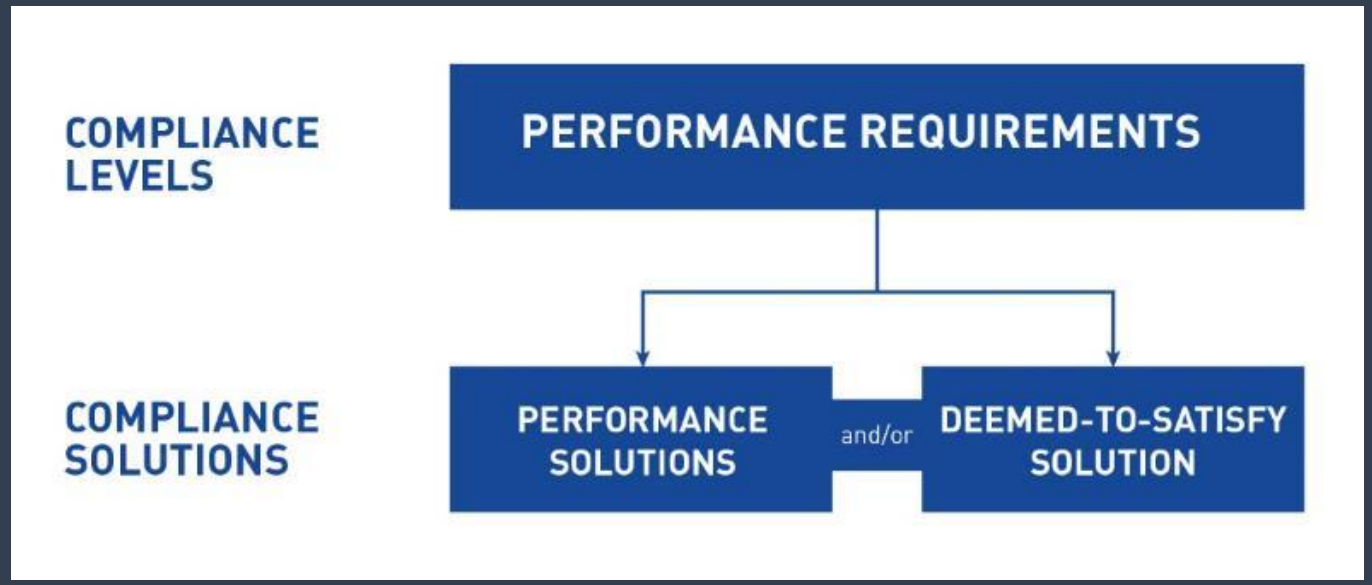
Develop Codes and standards that accord with strategic priorities and have regard to societal needs.

Seek national administrative consistency.

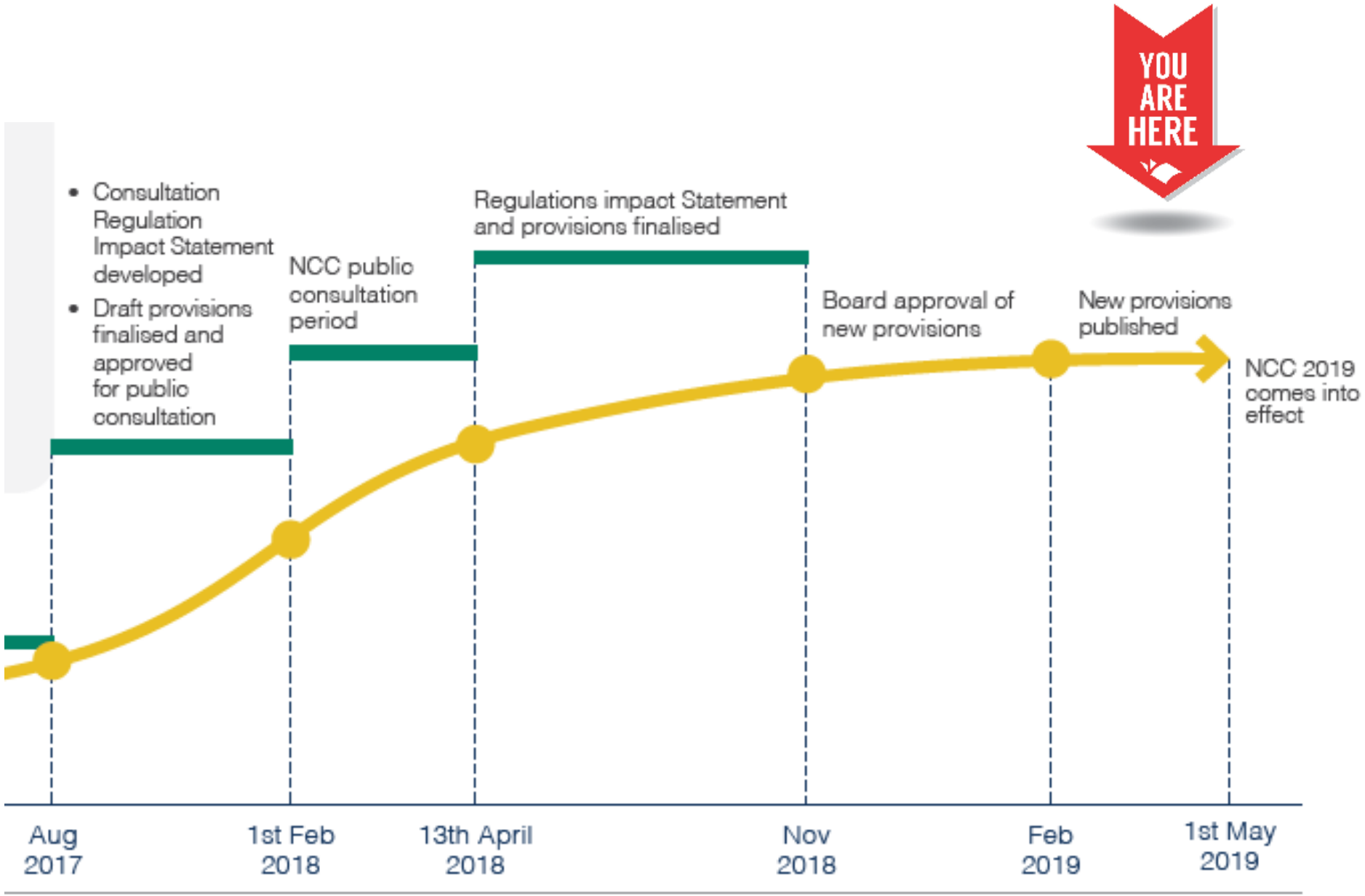
Board consists of 16 members - comprising reps from the 9 Governments, 5 industry, 1 Local Government and an independent Chair.

The National Construction Code

The Mandatory Requirements



Development of Section J 2019


YOU ARE HERE
Consultation Regulation Impact Statement developed
Draft provisions finalised and approved for public consultation
NCC public consultation period
Regulations impact Statement and provisions finalised
Board approval of new provisions
New provisions published
NCC 2019 comes into effect
Aug 2017
1st Feb 2018
13th April 2018
Nov 2018
Feb 2019
1st May 2019

Section J Energy efficiency transition period

Until 30 Apr 2020

NCC 2019 Section J

OR

NCC 2016 (Amdt 1) Section J

From 1 May 2020

NCC 2019 Section J

Using Performance

(2) A *Performance Solution* must be shown tc *ance Requirements* through one or a combination of the following *Assessment Methods*:

(a) Evidence of suitability in accordance w material, product, *plumbing* and *drainage product*, form of construction or design meets the .

(b) A *Verification Method* including the follc

(i) The *Verification Methods* provided in

(ii) Other *Verification Methods*, accepte show compliance with the relevant *Performance Requirements*.

(c) *Expert Judgement* .

(d) Comparison with the *Deemed-to-Satisfy*

Scope the proposed solution

↓

Communicate with key stakeholders

↓

Document data relevant to:

- The subject building
- The scope and basis of the proposal
- Applicable Performance Requirements
- Applicable assessment process
- Scope of supporting evidence
- Agreed acceptance criteria
- Format and content of a final report

↓

Stakeholders sign off on agreed PBDB

Lighting Calculator Performance Example

	LOAD VALUES		
Maximum Illumination Density (W/sqm) Adjusted	Permitted Load (W)	Actual Load (W)	Balance (W)
8.41	[illegible]	[illegible]	[illegible]
5.24	1608.34	2204 W	-595.7
12.96	907.42	410 W	497.4
5.59	447.14	220 W	227.1
11.89	214.04	40 W	174.0
11.41	639.15	505 W	134.1
12.44	186.60	65 W	121.6
11.78	247.47	165 W	82.5
12.61	126.06	65 W	61.1
31.37	298.00	30 W	268.0
13.79	151.65	50 W	101.6
14.36	186.70	60 W	126.7
14.52	87.10	20 W	67.1
	7261 W	5674 W	
BALANCE		1587 W	

JV3 Performance Example

Table 4.2 Collins Arch Commercial – Simulation Results Comparison

	GREEN STAR DESIGN & AS-BUILT RESULTS		NCC 2019 JV3 RESULTS			FUEL TYPE
	PROPOSED Annual Consumption	STANDARD Annual Consumption	PROPOSED Fabric + DTS Services Annual Consumption	NCC 2019 DTS Fabric + Services Annual Consumption	Percentage Difference	
HVAC – Heating *(simulated)*	3,673,771 MJ/yr	4,148,693 MJ/yr	3,540,237 MJ/yr	3,540,095 MJ/yr	-0.004%	Natural gas
HVAC – Cooling *(simulated)*	138,195 kWh/yr	489,182 kWh/yr	105,313 kWh/yr	98,259 kWh/yr	-7%	Electricity
Lighting *(Internal and External)*	377,329 kWh/yr	825,730 kWh/yr	134,082 kWh/yr	184,465 kWh/yr	+27%	Electricity
Domestic Hot Water *(hand calculation)*	671,761 MJ/yr	756,743 MJ/yr	Not assessed	Not assessed		Natural gas
Mechanical exhaust *(hand calculation)*	208,204 kWh/yr	277,254 kWh/yr	Not assessed	Not assessed		Electricity
Lifts *(hand calculation)*	269,427 kWh/yr	217,412 kWh/yr				Electricity
TOTAL	4,345,532 MJ/yr 1,370,484 kWh/yr	4,905,436MJ/yr 2,635,308kWh/yr	3,540,237 MJ/yr 239,395 kWh/yr	3,645,550 MJ/yr 282,724 kWh/yr		Natural gas Electricity
TOTAL – GHG Emissions kgCO2	676,184,984	1,122,428,757	259,093,784	278,055,078	7% improvement	Natural Gas / Electricity

Potential Lighting Performance Areas

Where ASS 1680 recommends illumination increases due to

- providing for the needs of the aged;
- in rooms with low surface reflectance;
- where luminaires with low cut off angles are required; and,
- when highly detailed, rapid or focused tasks need to be performed,

Notes to Table J6.2a:

1. In areas not listed above, the maximum *illumination power density* is—

   (a) for an illuminance not more than 80 lx, 2 W/m²; and

   (b) for an illuminance more than 80 lx and not more than 160 lx, 2.5 W/m²; and

   (c) for an illuminance more than 160 lx and not more than 240 lx, 3 W/m²; and

   (d) for an illuminance more than 240 lx and not more than 320 lx, 4.5 W/m²; and

   (e) for an illuminance more than 320 lx and not more than 400 lx, 6 W/m²; and

   (f) for an illuminance more than 400 lx and not more than 600 lx, 10 W/m²; and

   (g) for an illuminance more than 600 lx and not more than 800 lx, 11.5 W/m².

Education Materials

Lighting Specific Support Materials

- 2019 Calculator
- Retro-fit case study
- Performance Based Design Solution
- Updated Section J Handbook
- Seminars

Section J Seminars

QLD	7 & 8 May
ACT	10 May
VIC	15 May
TAS	16 May
NSW	21 May
SA	28 May
WA	29 May

thanks

michael.dodd@abcb.gov.au