ACOUSTIC LIGHTING CASE STUDY

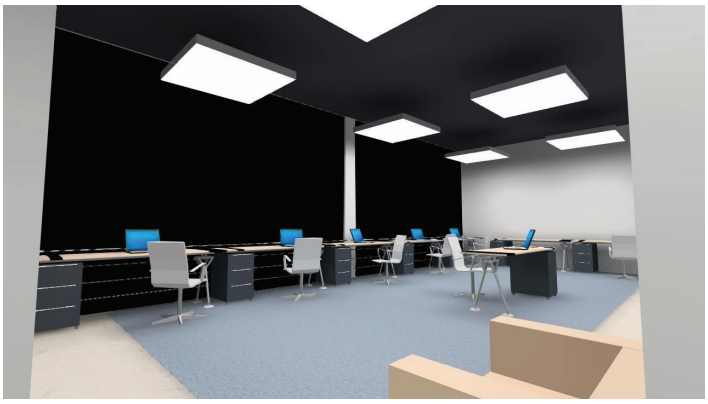
Bello Solar – Open Office

Eight *LumiScapes by Cooledge* FABRICore luminaires provide high quality glare-free illumination and a significant reduction in noise to create a comfortable and productive office environment within this open plan space.

- Luminaire : (8) FABRICore suspended
- Light Output/Flux: 10,000 lm per luminaire
- CCT: 3500K
- CRI: >90

IMMERSIVE ILLUMINATION

Cooledge Luminous Ceiling products deliver “immersive illumination” that includes superior color rendering qualities AND significant levels of comfortable, glare-free light that brings the feeling of the outdoors...inside.



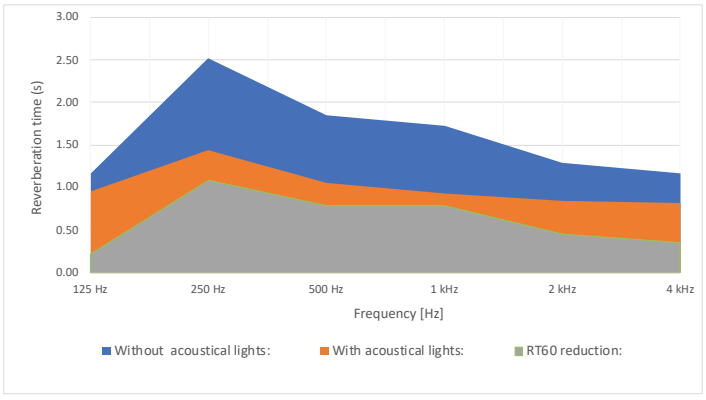
Photometric Rendering

- Illuminance (workplane): 776 lux (72 fc)
- Uniformity: Min/Max = 0.65
- Glare: Max. UGR <19

NOISE REDUCTION

A key measurement of the success of acoustic materials is the effective increase in absorbing area created by their addition and the decrease in reverberation time or time for noise to be reduce by 60dB.

Most critical are the values at the mid-frequencies (500Hz-1000Hz) where speech hearing is most attuned to human speech.



Reverberation Time

For 500Hz – 1000Hz:

- Avg. Decrease in Reverberation Time: ~0.8s
- % Increase in Sabins (Absorption Area): 79%

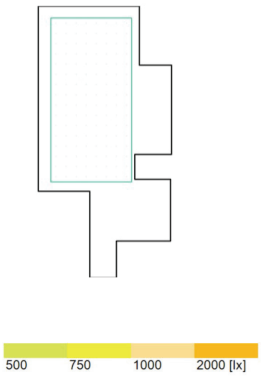
THE DETAILS

ROOM DIMENSIONS & PROPERTIES

Room Dimensions	(m)	(ft)
Length	10.1	33
Width	5.5	18.1
Height	3.5	11.5

Surface	Type	(m^2)	(sqft)
Floor	Tile	14.9	160.4
Floor covert	Carpet	40.4	434.9
Ceiling	Concrete painted	55.3	595.4
Wall	Plaster	39.4	423.9
Glass window	Window glass	6.2	66.8
FABRICore	Suspended	12.8	137.6

LIGHTING PERFORMANCE



Glare evaluation according to UGR

ρ Ceiling	70	70	50	50	30	70	70	50	50	30
ρ Walls	50	30	50	30	30	50	30	50	30	30
ρ Floor	20	20	20	20	20	20	20	20	20	20
Room size X / Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H 2H	15.3	16.7	15.6	16.9	17.1	15.4	16.7	15.7	17.0	17.2
2H 3H	16.9	18.1	17.2	18.4	18.7	17.0	18.2	17.3	18.5	18.8
2H 4H	17.5	18.7	17.9	19.0	19.3	17.7	18.8	18.0	19.1	19.4
2H 6H	18.0	19.1	18.4	19.4	19.7	18.2	19.3	18.6	19.6	19.9
2H 8H	18.2	19.3	18.6	19.6	19.9	18.4	19.4	18.8	19.7	20.1
2H 12H	18.3	19.3	18.7	19.7	20.0	18.5	19.5	18.9	19.8	20.2
4H 2H	16.0	17.1	16.3	17.4	17.7	16.1	17.2	16.4	17.5	17.8
4H 3H	17.8	18.8	18.1	19.1	19.4	17.9	18.9	18.2	19.2	19.5
4H 4H	18.5	19.4	18.9	19.8	20.2	18.7	19.6	19.1	19.9	20.3
4H 6H	19.2	20.0	19.6	20.3	20.7	19.3	20.1	19.8	20.5	20.9
4H 8H	19.4	20.1	19.8	20.5	21.0	19.6	20.3	20.0	20.7	21.1
4H 12H	19.6	20.2	20.0	20.7	21.1	19.7	20.4	20.2	20.8	21.3
8H 4H	18.9	19.6	19.3	20.0	20.4	19.0	19.7	19.4	20.1	20.5
8H 6H	19.7	20.3	20.1	20.7	21.1	19.8	20.4	20.3	20.8	21.3
8H 8H	20.0	20.5	20.4	21.0	21.4	20.1	20.7	20.6	21.1	21.6
8H 12H	20.2	20.7	20.7	21.1	21.6	20.4	20.8	20.9	21.3	21.8
12H 4H	18.9	19.6	19.3	20.0	20.4	19.0	19.7	19.4	20.1	20.5
12H 6H	19.7	20.3	20.2	20.7	21.2	19.9	20.4	20.3	20.8	21.3
12H 8H	20.1	20.5	20.6	21.0	21.5	20.2	20.7	20.7	21.2	21.7

Variation of the observer position for the luminaire distances S

S = 1.0H	+0.1 / -0.1	+0.1 / -0.1
S = 1.5H	+0.2 / -0.3	+0.2 / -0.3
S = 2.0H	+0.3 / -0.6	+0.3 / -0.6
Standard table	BK06	BK06
Correction Summand	2.8	2.9

Corrected glare indices referring to 10287lm Total luminous flux

UGR diagram (SHR: 0.25)

ACOUSTIC PERFORMANCE

Sabin Absorption Area (m^2)

Frequency	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Floor tile area	0.1	0.1	0.3	0.3	0.3	0.3
Floor carpet area	2.0	4.0	10.1	12.1	14.1	16.2
Ceiling area	0.6	1.1	2.2	3.3	4.4	5.5
Wall area	21.7	5.5	3.2	1.6	4.7	4.3
Glass area	2.2	1.6	1.1	0.7	0.4	0.2
Cooledge luminaires	6.0	9.3	12.5	15.2	12.8	11.3
∑Sw	**32.6**	**21.7**	**29.4**	**33.3**	**36.8**	**37.8**

Sabin Absorption Area (sqft)

Frequency	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Floor tile area	1.6	1.6	3.2	3.2	3.2	3.2
Floor carpet area	21.7	43.5	108.7	130.5	152.2	173.9
Ceiling area	6.0	11.9	23.8	35.7	47.6	59.5
Wall area	233.1	59.3	33.9	17.0	50.9	46.6
Glass area	23.4	16.7	12.0	8.0	4.7	2.7
Cooledge luminaires	64.7	100.5	134.9	163.8	137.6	121.1
∑Sw	**350.5**	**233.5**	**316.6**	**358.2**	**396.2**	**407.1**

Absorption Values* per Frequency

Surface	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Floor	0.01	0.01	0.02	0.02	0.02	0.02
Floor covert	0.05	0.10	0.25	0.30	0.35	0.40
Ceiling	0.01	0.02	0.04	0.06	0.08	0.10
Wall	0.55	0.14	0.08	0.04	0.12	0.11
Glass window	0.35	0.25	0.18	0.12	0.07	0.04
FABRICore	0.47	0.73	0.98	1.19	1.00	0.88

Using simplified Sabin's Law formula

(*) Absorbtion value source: 1. Ej Evans and EN Bazley, "Sound Absorbing Materials," HM Stationary Office, London, 1964. ; 2. SM Levy (2012) "Construction calculation manual (p. 528). Waltham, MA, Butterworth-Heinemann; 3. OA Hassan (2009) " Building acoustics and vibration: Theory and practice (pp. 731-740), New Jersey, World Scientific.; 4. PS Acoustics dr. ir. P Schevenels, " Akoestiek in gebouwen-de praktijk" 2019.; 5. Cooledge Lighting Inc., acoustical measurments external laboratory data.