

# Wellness and Environmental Sustainability in Healthcare Buildings

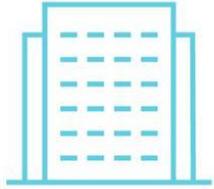
Caimin McCabe

September 2019



# About Cundall

---



**21**

OFFICES GLOBALLY

---



ESTABLISHED IN

**1976**

---



**950+**

PEOPLE WORLDWIDE

---



**500+**

AWARDS WON

---



PROJECTS DELIVERED IN

**50+**

COUNTRIES

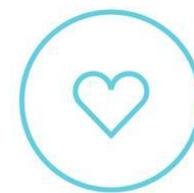
---



**35+**

LANGUAGES

---



**1<sup>st</sup>**

ONE PLANET COMPANY

---



**2020**

ZERO CARBON BY

---

# Cundall Sustainability Cornerstones | One Planet Living

## We practice what we preach

Our One Planet Strategy's key mission is to contribute to a world in which people enjoy happy, healthy lives with their fair share of the earth's resources, leaving space for wildlife and wilderness.

This is something which we all fundamentally help to deliver, through industry leadership, in our project, at our workplace, and in our homes and communities



# Our Services – Cundall Australia



**Building Services Engineering (MEHF&VT)**



**Sustainable Design Consulting (ESD)**



**Acoustics Consulting**



**Environmental Benchmarking & Ratings**



**Specialist Lighting Design**



**Security Consulting**



**Building Information Modelling (BIM)**

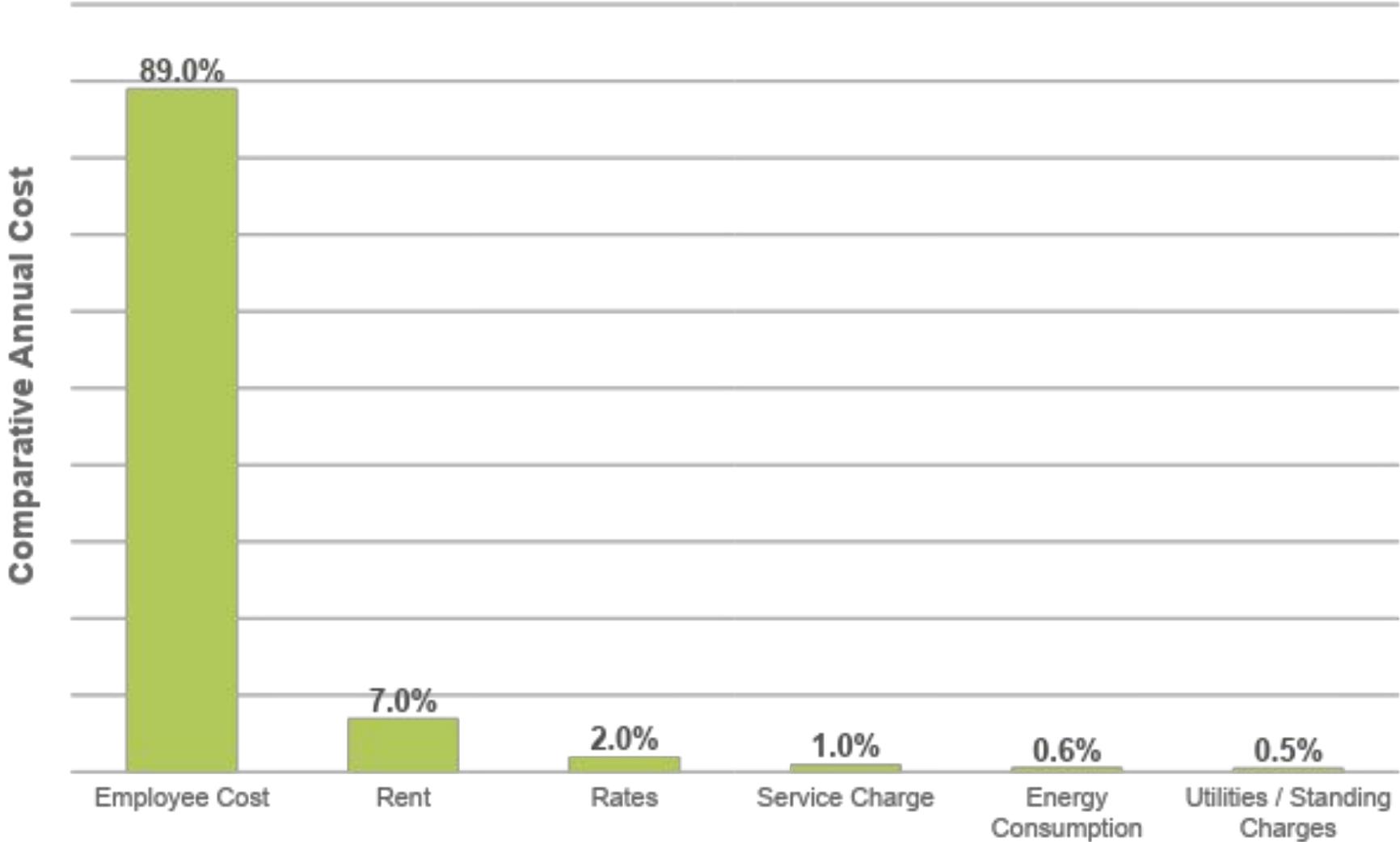


**Health & Wellbeing Consulting**

# Why design for Health & Wellbeing?

---

# Why focus on health & wellbeing?



Source: *What Colour Is Your Building*, David Clark, RIBA Publishing 2013

# Why focus on health & wellbeing?

---



**\$33 BILLION**

Total loss in payroll costs and lost productivity annually to the Australian economy



**92 MILLION**

Working days lost in Australia per annum



**8%**

The percentage of payroll that this loss accounts for in total



**\$3,230**

The average amount (per employee) that a business loses to employee absenteeism annually



**\$340**

The average cost of absenteeism per day, having risen from \$308 in 2013

# Why focus on health & wellbeing?

---

**Seven in 10** Australian men are overweight or obese



**One in two**

Women are overweight or obese



**One in four**

Children are overweight or obese



# Why focus on health & wellbeing?

**One in 20**

Australians eats  
enough fruit  
or vegetables



**One in five**

Australians  
suffers from  
hay fever



**One in three**

Australians  
gets enough  
exercise



**One in 20**

Australians  
has diabetes



# Why focus on health & wellbeing?

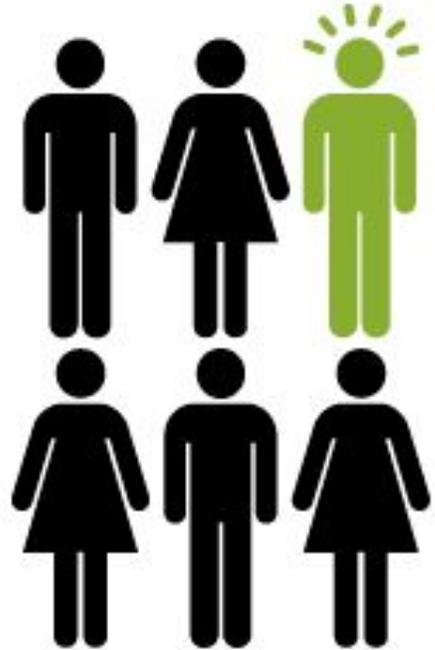
**Three out of 20** Australian adults are daily smokers



**One in six** Australian adults is at risk of long-term harm from alcohol



**One in six** Australian adults suffers from a mental health or behavioural problem



# Research in a healthcare environment

---

# The Research

---

- Access to Daylight
- Views Out
- Cleanliness
- Acoustic Environment

**‘Patients who were in sunny rooms had a reduced length of stay (3.3 days in dull rooms, 2.3 days in sunny rooms)’**

Ulrich & quan 2004 (patients with myocardial infarction)

**‘When nurses where exposed to daylight for at least three hours each day, they experienced less stress and were more satisfied at work’**

Joseph 2006

**‘Patients who had views of trees from their windows experienced shorter hospital stays, had less need for pain reducing medications’**

Ulrich 1984

# The Research

---

- Access to Daylight
- Views Out
- Cleanliness
- Acoustic Environment
- Ergonomic (Comfortable)
- Practical – layout and storage
- Flexible
- Personal Space / Privacy / Security

**‘Storage is seen to have a particular impact on the ability of nurses to be able to work efficiently’**

CABE/PWC Study 2004

**‘Estimates of time nurses spend in transit vary from 8% to 29% (Ampt Westerbrook et al 2007)’**

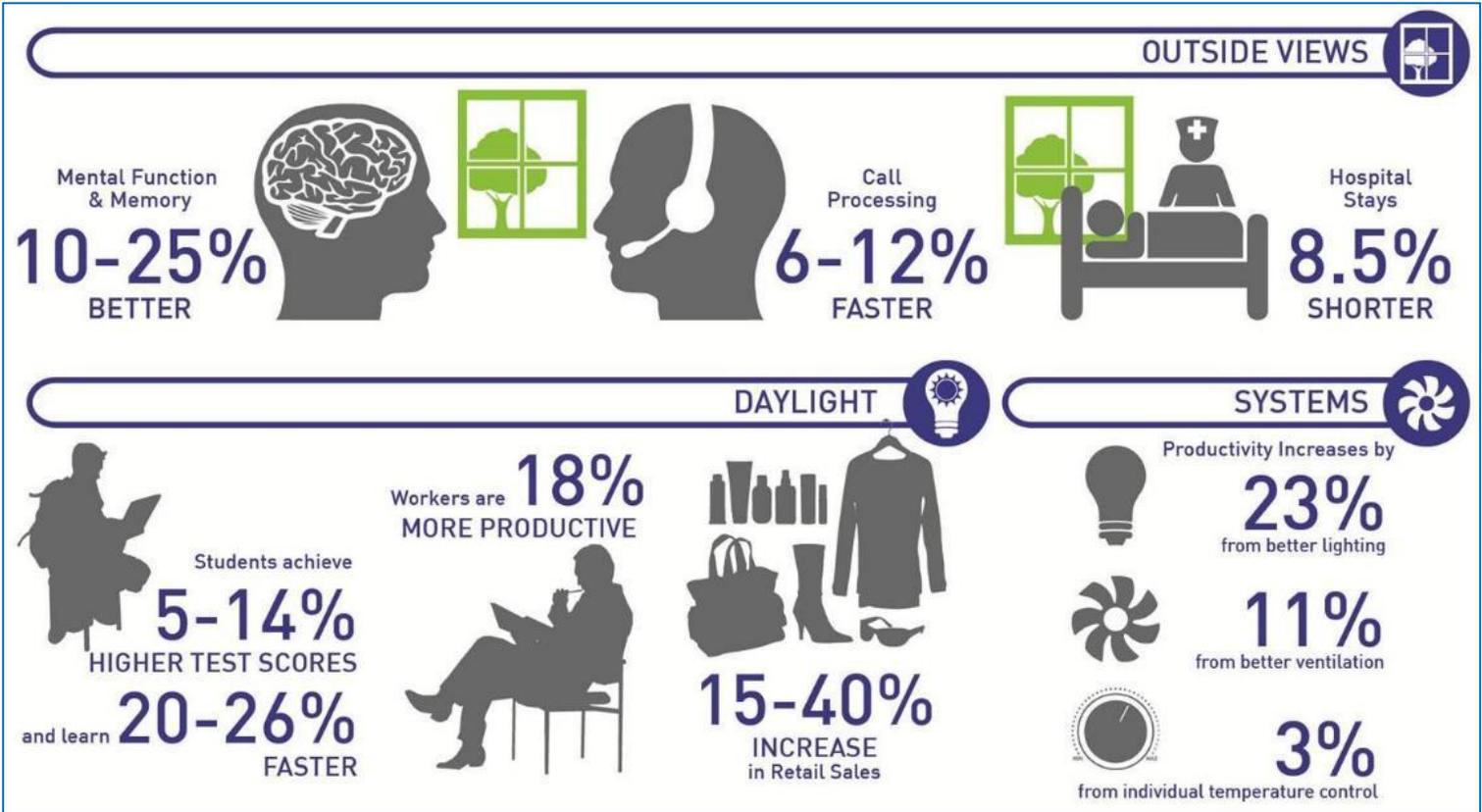
Joseph 2006

# Benefits of a healthy building

---

# Benefits of Healthy Buildings

- Physical, mental and social health
- Reduced absenteeism
- Reduced presenteeism
- Concentration and learning
- Happiness and morale
- Staff retention
- Productivity



Source: World Green Building Council

# Benefits to Healthcare Buildings

- **Benefits**

- Calmness and wellbeing
- Infection control
- Staff feel more respected and valued
- Staff seen as individuals
- Better treatment, better experience
- Less stress
- Climate risk management

- **Outcomes**

- Improved recovery and increased patient throughput
- Reduced staff sickness
- Better staff retention
- Improved performance
- Reduced analgesic medication



Source: Practice Greenhealth

# Industry benchmarking tools for **healthy** buildings

---

# Green Star – Indoor Environmental Quality (IEQ)

- **Indoor Air Quality**
  - *Ventilation System Attributes; Provision of Outdoor Air; and Exhaust or Elimination of Pollutants*
- **Acoustic Comfort**
  - *Internal Noise Levels; Reverberation; and Acoustic Separation*
- **Lighting Comfort**
  - *Glare Reduction; Daylight; and Views*
- **Indoor Pollutants**
  - *Paints, Adhesives, Sealants and Carpets; and Engineered Wood Products*
- **Thermal Comfort**
  - *Thermal Comfort; and Advanced Thermal Comfort*



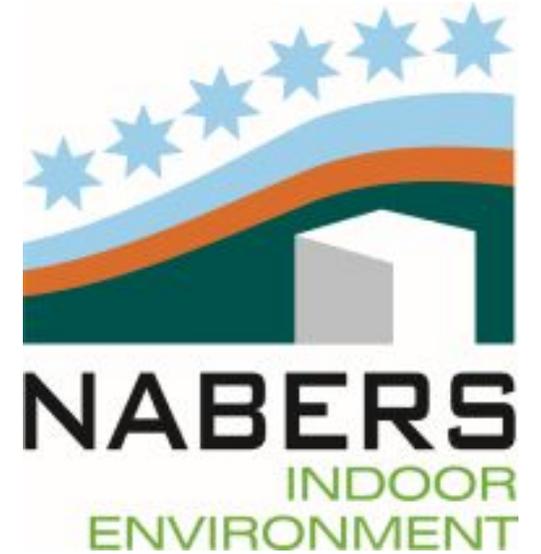
## Indoor environment quality (IEQ)

Aims to encourage and reward initiatives that enhance the comfort and well-being of occupants. The credits within this category address issues such as air quality, thermal comfort and acoustic comfort.

# NABERS Internal Environment (IE)

---

- **NABERS Indoor Environment rating measures:**
  - *Indoor Air Quality; Lighting Quality; Temperature & Thermal Comfort; and Acoustic Quality.*
- **Indoor Environment Ratings**
  - ***Base building** designed for building owners and managers, who generally control and maintain the thermal services, air systems and building cleaning services.*
  - ***Tenancy** for building occupants who control and manage the design and materials used in their office fit-out, lighting and their internal noise levels, as well as indoor air quality if they have control over this.*
  - ***Whole building** for organisations that both manage and occupy their office space, or in some cases where a single tenant occupies the entirety of a building.*
- **Basis of Ratings**
  - *Occupant Satisfaction Survey;*
  - *Site visit and spot measurements; and*
  - *Annual Monitoring (optional)*



# WELL Building Standard



- Physical, mental and social health
- 100% focused on occupant health and wellbeing
- Based on research and the science of human health and body systems
- Assessment
  - *Design*
  - *Construction*
  - *Performance Verification*
- Performance Verification
  - *Biggest differentiator from other ratings*
  - *Independent assessor will visit the project:*
    - *Visual inspections*
    - *Performance tests*
- Assessment includes operational policies, not just design and construction!



Well Building Standard (v1)



Well Building Standard (v2)



<p></p> <p><b>Fitwel 1-Star Rating</b></p> <p>Building has achieved a basic level of health promotion by incorporating evidence-based design and policy strategies that support the physical, mental, and social health of its occupants.</p>	<p></p> <p><b>Fitwel 2-Star Rating</b></p> <p>Building has achieved an intermediate level of health promotion by incorporating evidence-based design and policy strategies that support the physical, mental, and social health of its occupants.</p>	<p></p> <p><b>Fitwel 3-Star Rating</b></p> <p>The highest level achievable. Building incorporates an exemplary number of evidence-based design and policy strategies that support the physical, mental, and social health of its occupants.</p>
---	--	---

		IMPACTS COMMUNITY
		REDUCES MORBIDITY + ABSENTEEISM
		INSTILLS FEELINGS OF WELL-BEING
		SUPPORTS SOCIAL EQUALITY FOR VULNERABLE POPULATIONS
PROVIDES HEALTHY FOOD OPTIONS		
		PROMOTES OCCUPANT SAFETY
		INCREASES PHYSICAL ACTIVITY

# Designing healthy buildings

---

# WELL Concept #1 – Air

- Access to fresh air (Mechanical, Natural, mixed-mode)
- Ventilation effectiveness (Good air distribution)
- Air filtration
- Healthy building entrances – revolving doors or air locks
- Air quality monitoring
- Cleanable surfaces

## ***Health impact***

*Improving air quality globally and decreased air pollution could reduce the burden of respiratory and cardiovascular diseases, health-care costs, workforce productivity loss due to illness and increase life expectancy for local populations.*



Cundall Hong Kong office, fresh air



Cundall Hong Kong Office, Air Quality Monitoring & dashboard



1 Blich- Revolving doors



IEQ testing and monitoring

# WELL Concept #2 – Water

- Water quality testing and treatment
- Drinking water availability and promotion

## Case Study:

- Pipework in London is very old and contaminates water (Lead pipes)
- Filtration unit needed, however caused further problems

### ***Health impact***

*Research indicates that thirsty individuals who drink water prior to performing a mental task have faster reaction times than those who do not drink water.*



Cundall London – activated carbon water filter



# WELL Concept #3 – Nourishment

- Healthy food options
- Tap and basin design for effective hand washing
- Food storage and preparation
- Nutritional messaging
- Mindful eating – high quality eating spaces
- On-site food production

## ***Health impact***

*Increased nutritional knowledge has been shown to promote healthy eating and especially fruit and vegetable intake. Fruit and vegetable intake is associated with increased productivity and job performance.*



Cundall Sydney



Cundall London



Cundall London



Cundall Birmingham

# WELL Concept #4 – Light

- Glare control – windows and workstations
- Daylight, and access to windows & views
- Surface design and internal finishes
- Lighting design – Illumination, glare, colour rendering
- Circadian lighting design

## ***Health impact***

*Studies have found a relationship between proximity to windows and productivity, especially when windows offer an opportunity to connect with the outdoors.*



Daylight Optimised Blinds



Circadian Lighting

# WELL Concept #4 – Circadian Lighting

- Two considerations for design:
  1. *Stimulate alertness during the day*
  2. *Mimic natural circadian rhythms*
- Daytime alertness stimulated by bright white light reaching receptors in the eye.
- Good daylight within a building achieves this, or artificial lighting can replicate daylight if designed correctly.
- Top-down lighting only is not effective.
- Colour temperature adjustable now lighting available.



Daylight Colour Temperatures



Lighting Colours

# WELL Concept #4 – Workplace Lighting

- Suspended lighting above workstations for task & desk lighting
- Up-lighting and wall-washes for background lighting



Cundall Birmingham

- Energy efficiency – only light what you need to and work with the natural daylight.
- Provide visual interest



Cundall Manchester

## WELL Concept #4 – Ward Lighting



**Future Ward - Integrated Medical Interiors**

**CUNDALL**

## WELL Concept #4 – Ward Lighting

---



**Future Ward - Lighting Scene (Morning)**

## WELL Concept #4 – Ward Lighting



Future Ward - Lighting Scene (Midday)

## WELL Concept #4 – Ward Lighting



Future Ward - Lighting Scene (Medical)

## WELL Concept #4 – Ward Lighting

---



**Future Ward - Lighting Scene (Evening)**

## WELL Concept #4 – Ward Lighting

---



**Future Ward - Lighting Scene (Night)**

# WELL Concept #5 – Fitness

- Interior fitness circulation (staircase design & promotion)
- Physical activity spaces, facilities and equipment (internal & external)
- Active transportation support (End of trip facilities, repair stations, etc.)
- Active furnishings (sit / stand desks, treadmill desks, etc.)

## ***Health impact***

*Worldwide, if physical inactivity was reduced by 10% or 25%, over 533,000 and 1.3 million deaths, respectively, could be avoided every year.*



Insurance Australia Group (IAG), Paramatta



Cundall Sydney Standing Desks



End of Trip (EoT) Facilities



Bank of Melbourne Fitout

# WELL Concept #6 – Comfort

- Ergonomics
- Thermal Comfort - Mechanical (heating & air-conditioning)
- Thermal Comfort – Architectural (orientation, window shading & insulation)
- Acoustics – external noise, building noise, reverberation, privacy
- Sound masking

## ***Health impact***

*Designing for ergonomic safety can help prevent the physical stress of work-related musculoskeletal disorders. Maintaining optimal thermal comfort can maximize productivity and decrease errors.*



JLL Melbourne



Sound Masking

# WELL Concept #7 – Mind

- Beauty and design
- Adaptable spaces (designated collaboration and quiet zones, and private and quiet spaces)
- Biophilia (connection to nature)
- Audio soundscaping



Breakout , Contemplation & Quiet Zones



Soundscaping

## ***Health impact***

*Individuals who feel a great sense of psychological support from their organization have greater attachment to the organisation.*



Bendigo Bank, Adelaide



Cundall, Birmingham

# WELL Concept #7 – Biophilia



Plants- UK Green Building Council



Shapes- Cundall Manchester



Natural Materials- Cundall Birmingham



Connection to outside- NSW Parliament House Project - Education Centre

# Innovation

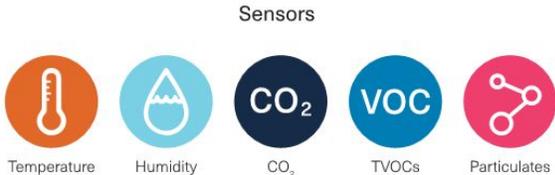


Cundall developed its own IEQ sensor which it has linked up with Awair to commercialise allowing it to create a new IEQ problem-solving service

## Designing for Health & Wellbeing

### Indoor Environmental Quality (IEQ):

- Temperature, Humidity, Carbon Dioxide, Total Volatile Organic Compounds (TVOC) and Particulates



Cundall VAR is a unique tool that offers a combination of audio-prediction modelling and gaming-quality graphics to inform design decision making

## Virtual Acoustic Reality (VAR)

- Virtual reality to give a new vision to acoustic design
- Portable
- Dynamic and immersive
- 360 degree vision and altering the 3D view displayed to match the user's orientation



Cundall has undertaken R&D on impact of plants on IEQ to experiment on different plant varieties, air movement & lighting

## Active Living Wall

### Impact of different plants on IEQ

- IAQ impact
- Impact of lighting levels
- Is there a plant tipping point
- Impact of fan-forced air passing over plant foliage and through the growing medium to filter the air

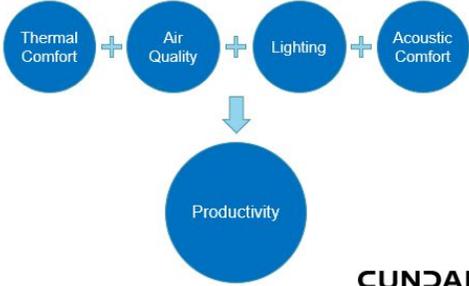


Following extensive review of academic research Cundall has developed a model to quickly predict loss of productivity at a workstation over a floorplate

## Productivity Mapping

### Environmental Parameters:

- Temperature, Carbon Dioxide, Daylighting and Views, Acoustics



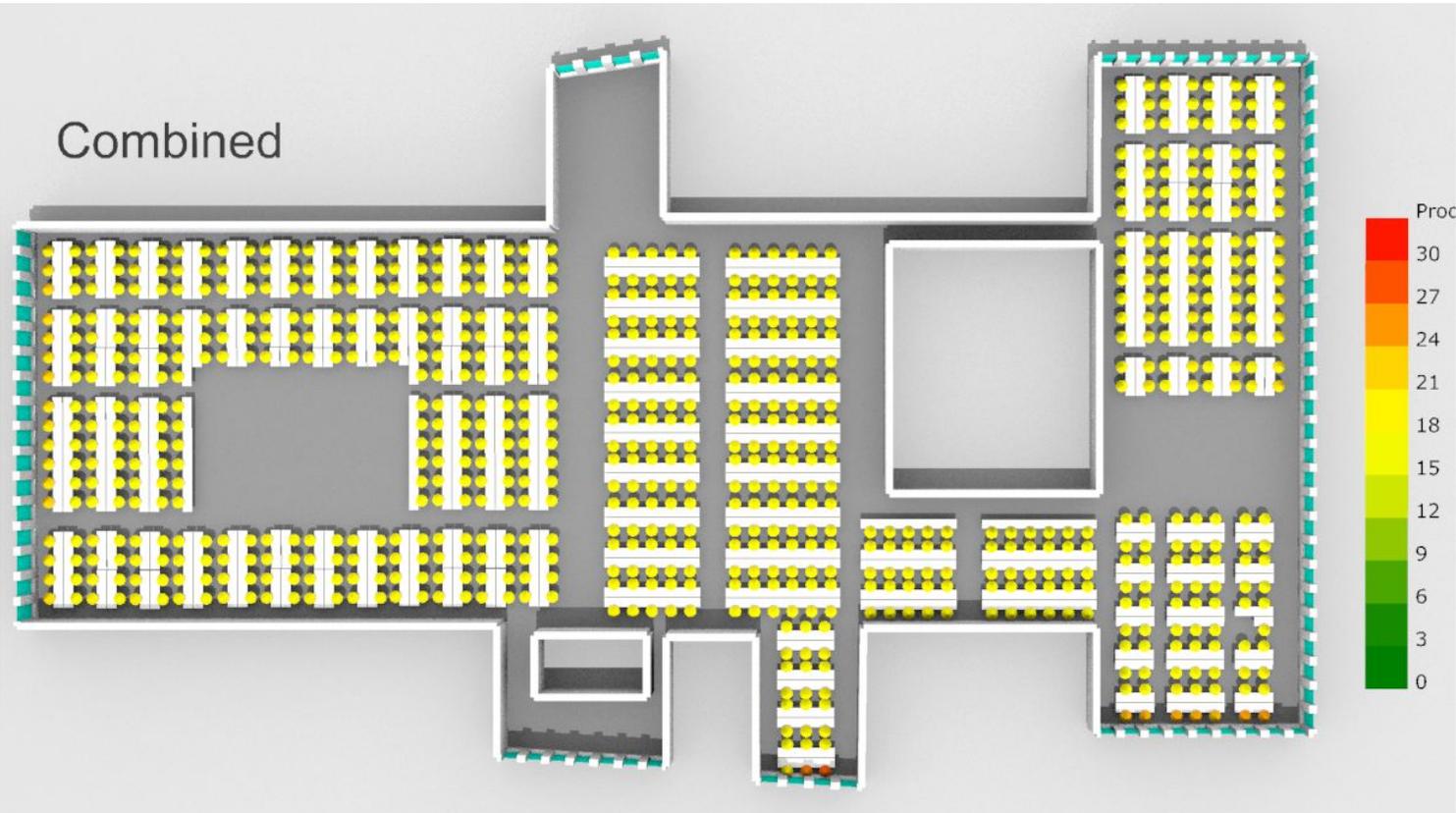
CUNDALL

CUNDALL

# Evaluation & Testing

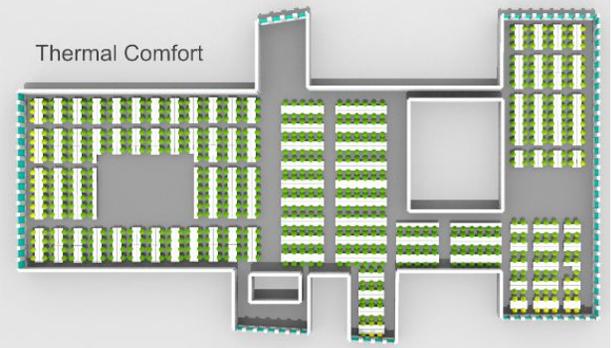
---

# Test-Fit – Architectural Optimisation

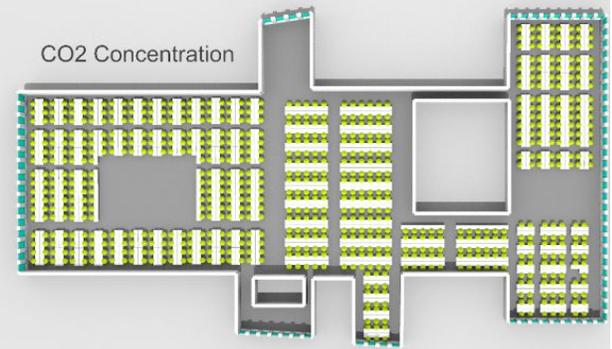


Aggregated Annual Performance

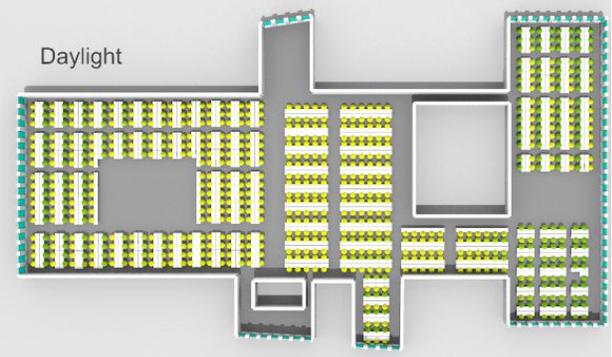
Thermal Comfort



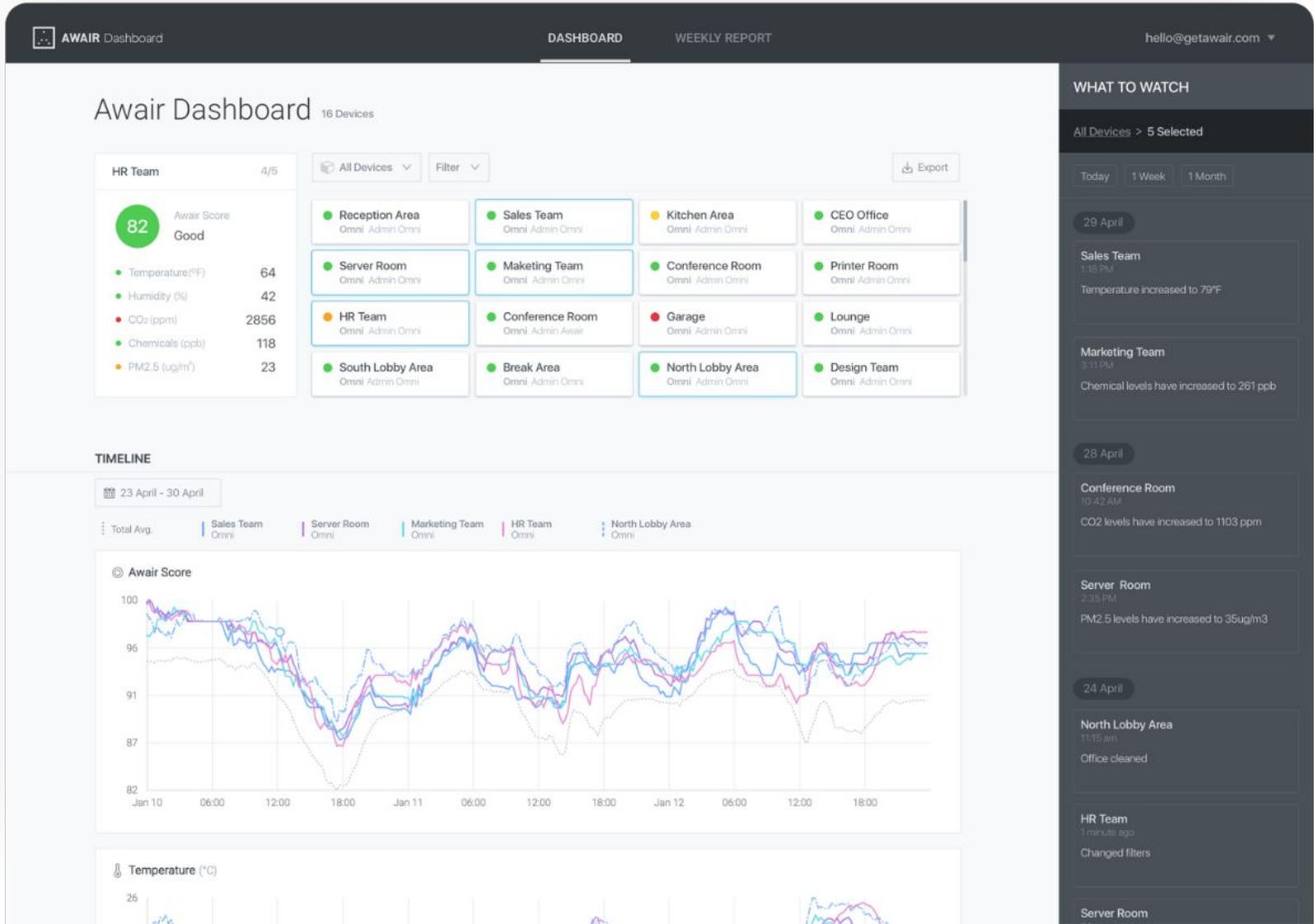
CO<sub>2</sub>



Daylight



# Monitoring – Indoor Air Quality (IAQ)



Sensors



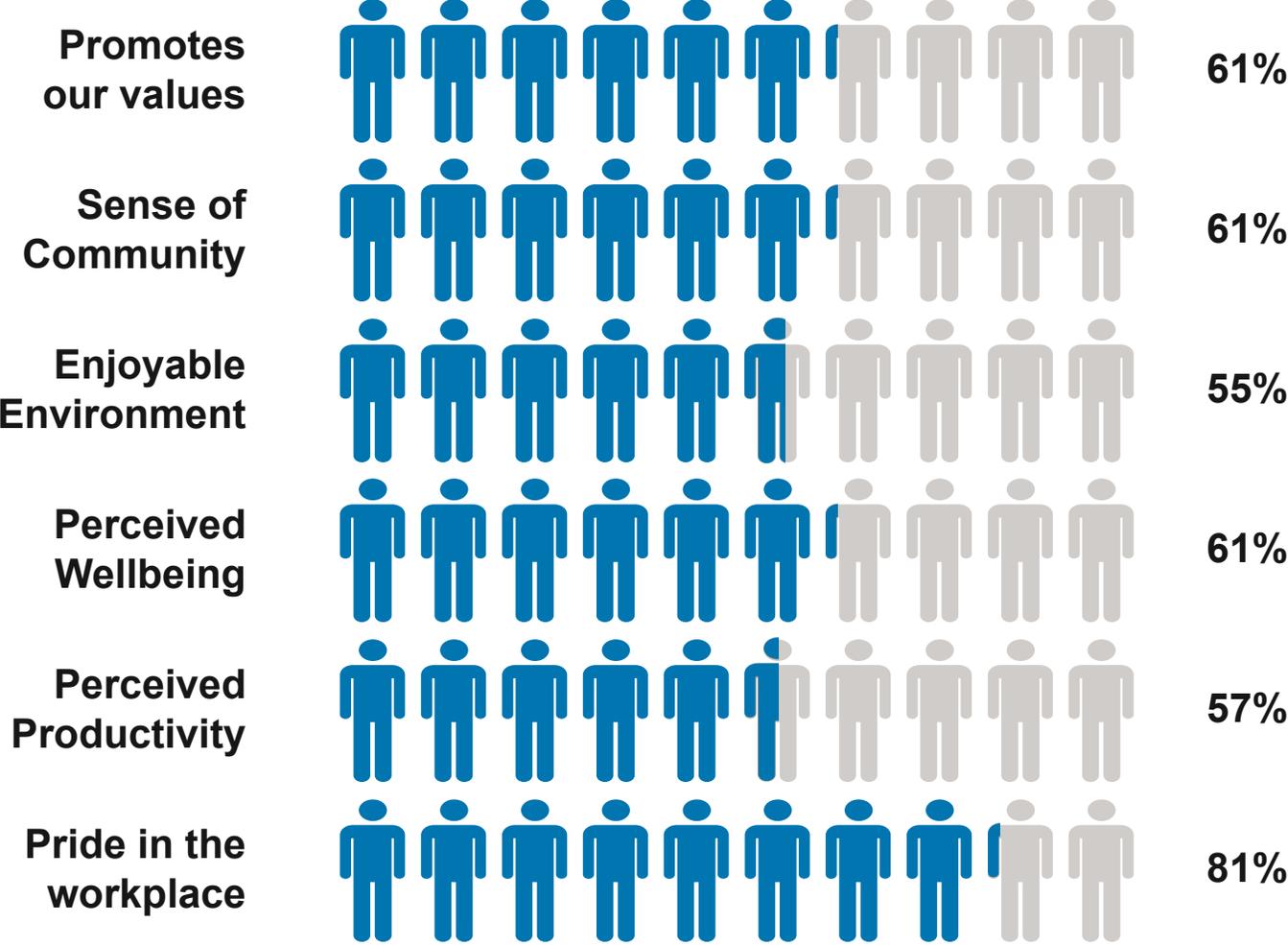
# The results of designing for **healthy** indoor environment

---

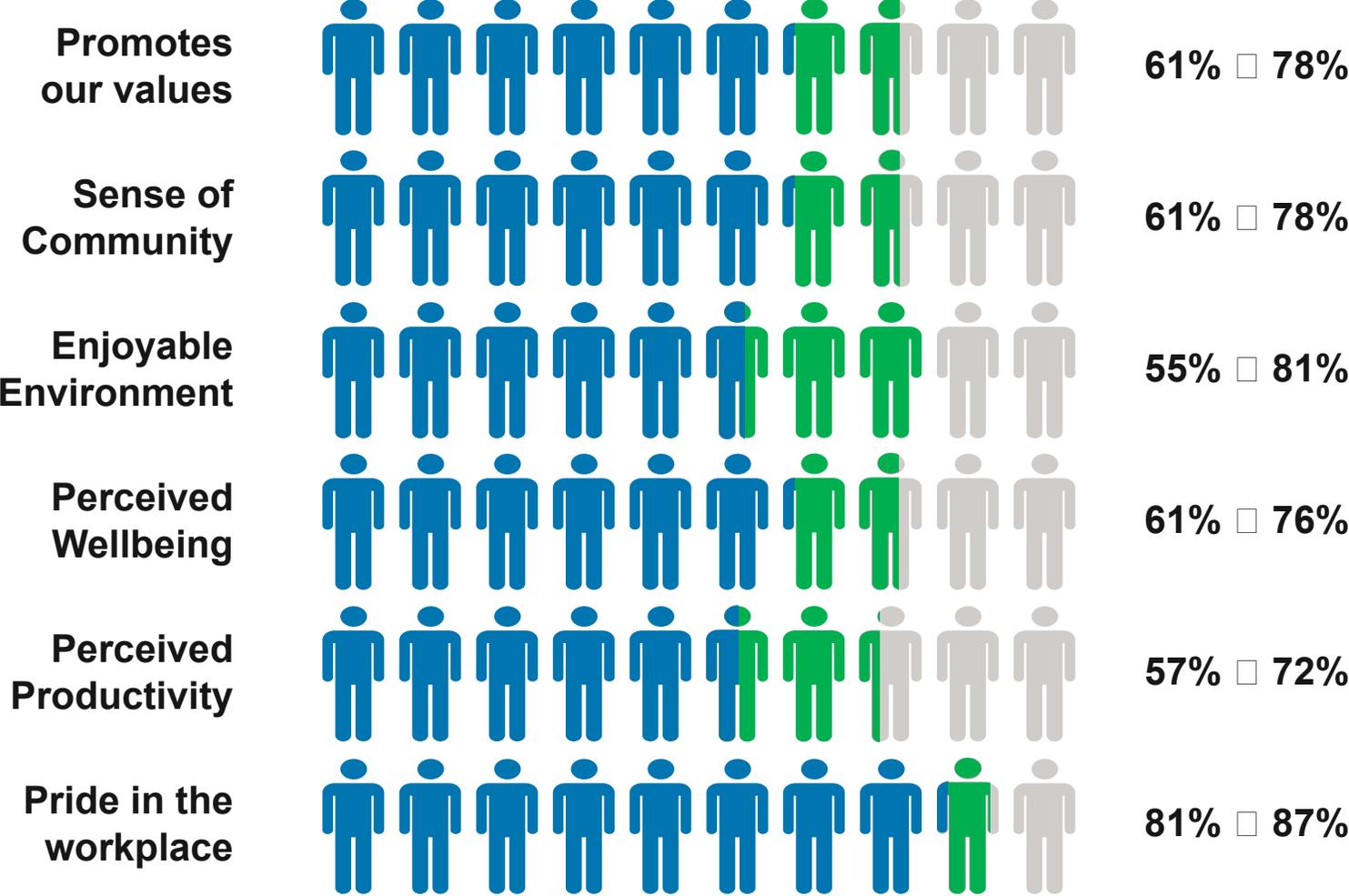
# One Carter Lane – WELL Certified (2016)



# Cundall London – Post Occupancy Survey

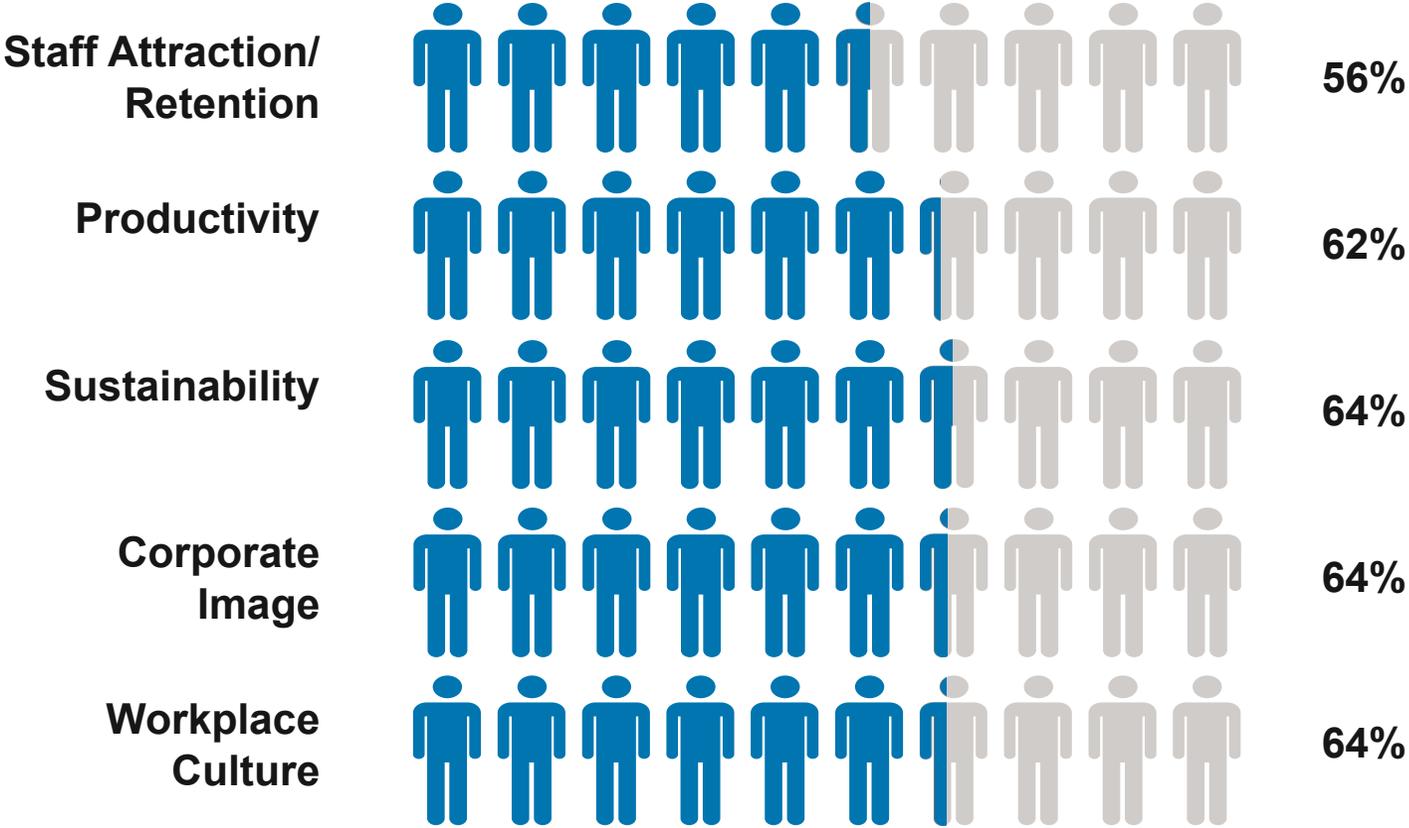


# Cundall London – Post Occupancy Survey

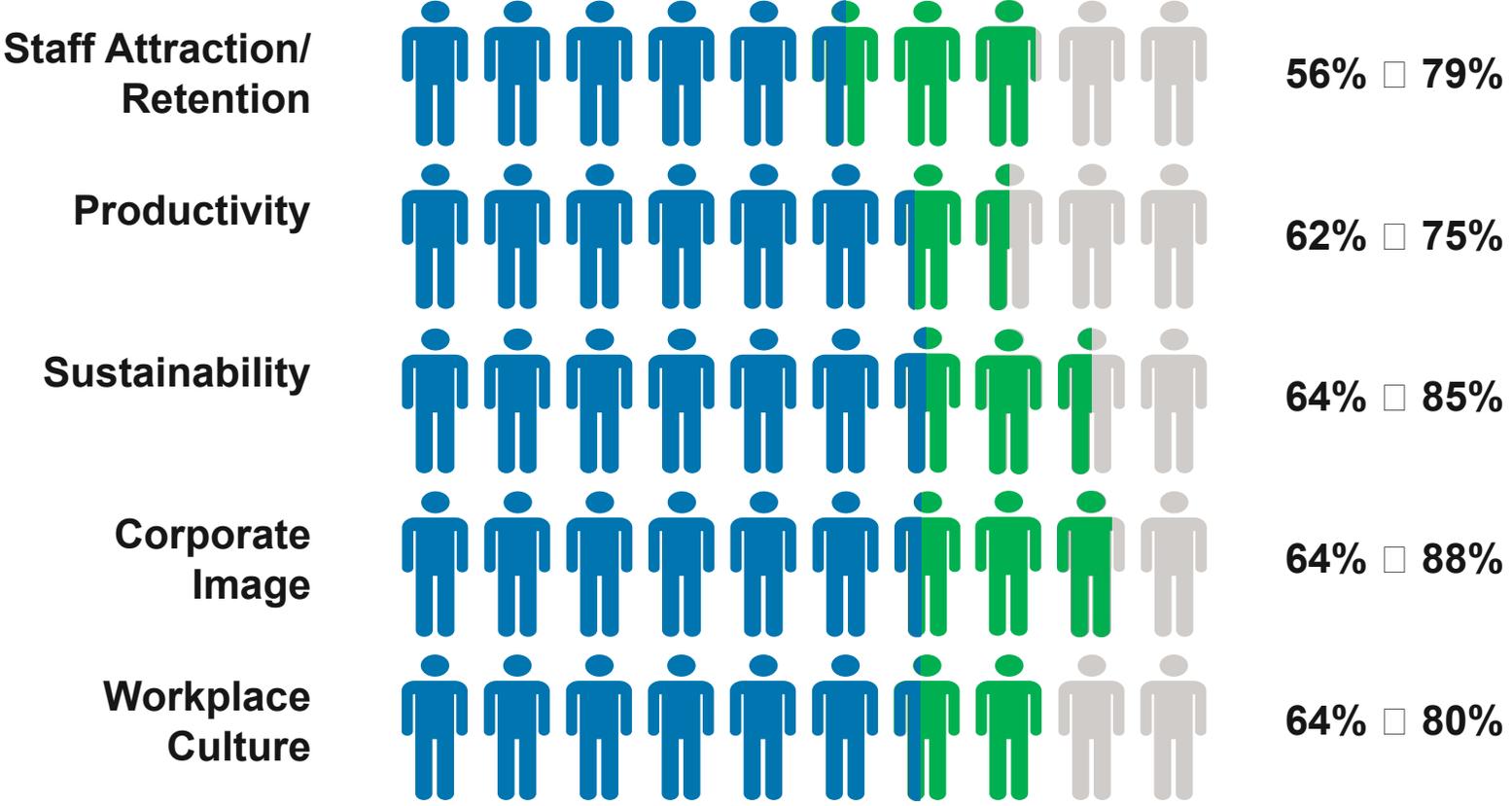


● Saffron House    ● One Carter Lane

# Cundall London – Post Occupancy Survey



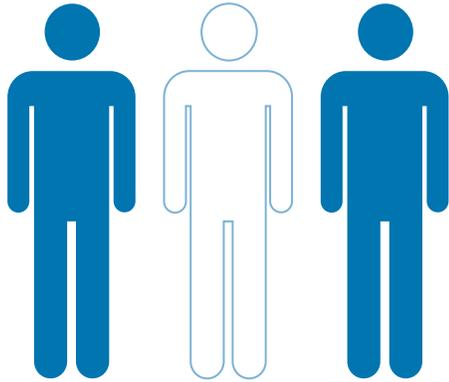
# Cundall London – Post Occupancy Survey



● Saffron House    ● One Carter Lane

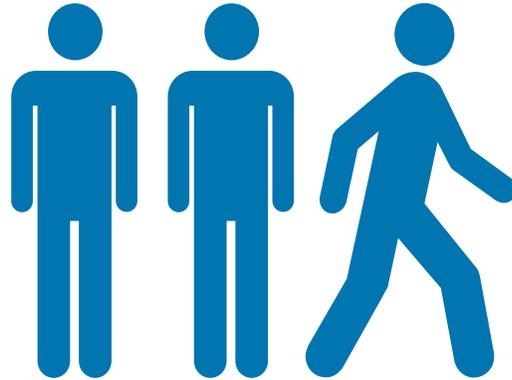
# Cundall London – The Results

---



**50%**

REDUCTION IN  
ABSENTEEISM



**27%**

REDUCTION IN STAFF  
TURNOVER



**\$385k**

SAVING PER  
ANNUM

# Summary

---

# Summary

- Designing for health and wellbeing is good design
- Designing to code or standards does not ensure a healthy indoor environment
- A coordinated design approach is needed – architect, building services, acoustics & ESD
- Industry tools such as WELL and fitwel are available for inspiration, benchmarking, or for full certification
- NABERS Indoor Environment (IE) and IEQ sensors offer guidance and methodology to test and evaluate



*Royal Children's Hospital*

# Questions?

**Contact: Caimin McCabe**  
[c.mccabe@cundall.com](mailto:c.mccabe@cundall.com)

