About Cundall

21 OFFICES GLOBALLY

ESTABLISHED IN 1976

950+ PEOPLE WORLDWIDE

500+ AWARDS WON

PROJECTS DELIVERED IN 50+ COUNTRIES

35+ LANGUAGES

1st ONE PLANET COMPANY

2020 ZERO CARBON BY
Cundall services

Building services engineering
Civil engineering
Structural engineering
Sustainable design

Acoustic engineering
Building Information Modelling (BIM)
Building automation
CDM consultancy
Planning

Fire engineering
Geotechnical
Health and wellbeing
IT and audio visual
Lighting design

Planning
Survey solutions
Transportation
Vertical transportation

To find out more about our services visit:
www.cundall.com
One Planet Company

We practise what we preach

- World’s first consultancy to be formally endorsed as a One Planet Company by sustainability charity BioRegional
- Applied the 10 One Planet Principles to guide our commitment, actions and services
- Cundall Sustainability Roadmap available on www.cundall.com

<table>
<thead>
<tr>
<th>Health and happiness</th>
<th>Encouraging active, sociable, meaningful lives to promote good health and well being</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity and local economy</td>
<td>Creating bioregional economies that support equity and diverse local employment and international fair trade</td>
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<tr>
<td>Culture and community</td>
<td>Respecting and reviving local identity, wisdom and culture; encouraging the involvement of people in shaping their community and creating a new culture of sustainability</td>
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<tr>
<td>Land use and wildlife</td>
<td>Protecting and restoring biodiversity and creating new natural habitats through good land use and integration into the built environment</td>
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<tr>
<td>Sustainable water</td>
<td>Using water efficiently in buildings, farming and manufacturing. Designing to avoid local issues such as flooding, drought and water course pollution</td>
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<tr>
<td>Local and sustainable food</td>
<td>Supporting sustainable and humane farming, promoting access to healthy, low impact, local, seasonal and organic diets and reducing food waste</td>
</tr>
<tr>
<td>Sustainable materials</td>
<td>Using sustainable and healthy products, such as those with low embodied energy, sourced locally, made from renewable or waste resources</td>
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<tr>
<td>Sustainable transport</td>
<td>Reducing the need to travel, and encouraging low and zero carbon modes of transport to reduce emissions</td>
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<tr>
<td>Zero waste</td>
<td>Reducing waste, reusing where possible, and ultimately sending zero waste to landfill</td>
</tr>
<tr>
<td>Zero carbon</td>
<td>Making buildings energy efficient and delivering all energy with renewable technologies</td>
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</table>
Health & Wellbeing
2\textsuperscript{nd} Wave of Sustainability
Healthy Buildings

Healthy Planet
90% of our lives are spent indoors and it has a lasting impact on our health..
Biggest cost is people

INVEST IN PEOPLE FOR RETURN ON INVESTMENT

Source: Knoll Workplace Research “What’s Good for People, Moving from Wellness to Well Being”, Kate Lister 2004 Studies include those conducted by organizations including Harvard Business Review and World Economic Forum and the American Journal of Health Promotion Image courtesy of World Green Building Counsel Report “Health, Wellbeing & Productivity in Offices”
Trends towards healthy buildings...
Impact on productivity

8% Improvement in performance.

35% Reduction in absenteeism.

4% Reduction in performance at cooler temperatures.

6% Reduction in performance at warmer temperatures.

46min More sleep per night on average for office workers with windows.
Impact on sustainability

12 l/s/person to 25 l/s
8% improvement for everyone?

800% more fan energy or more plant space
More cooling & heating
The WELL Building Standard V1

AIR  WATER  NOURISHMENT  LIGHT  FITNESS  COMFORT  MIND
The WELL Building Standard V2

- **AIR**: 14 features, 4 preconditions, 10 optimizations
- **WATER**: 8 features, 3 preconditions, 5 optimizations
- **NOURISHMENT**: 13 features, 2 preconditions, 11 optimizations
- **LIGHT**: 8 features, 2 preconditions, 6 optimizations
- **MOBILITY**: 12 features, 2 preconditions, 10 optimizations
- **THERMAL COMFORT**: 7 features, 1 precondition, 6 optimizations
- **SOUND**: 5 features, 1 precondition, 4 optimizations
- **MATERIALS**: 14 features, 3 preconditions, 11 optimizations
- **MIND**: 15 features, 2 preconditions, 13 optimizations
- **COMMUNITY**: 16 features, 3 preconditions, 13 optimizations

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Air - Demand driven control

CO₂ Sensors

ASHRAE
Air - Health Materials
Air - VOCs

“...I understand it now, if I can eat it, I can install it...”
### Air - VOCs

“…it doesn’t have that new car smell…”

<table>
<thead>
<tr>
<th>Element</th>
<th>WELL Standard</th>
<th>Cundall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>&lt;9ppm</td>
<td>0.8ppm</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>&lt;27ppb</td>
<td>1.28 ppb</td>
</tr>
<tr>
<td>Ozone</td>
<td>&lt;51ppb</td>
<td>5.5 ppb</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>&lt;53ppb</td>
<td>21ppb</td>
</tr>
<tr>
<td>PM2.5</td>
<td>&lt;15µg/m³</td>
<td>8µg/m³</td>
</tr>
<tr>
<td>PM10</td>
<td>&lt;50µg/m³</td>
<td>0µg/m³</td>
</tr>
<tr>
<td>Total VOCs</td>
<td>&lt;500µg/m³</td>
<td>1323.2µg/m³</td>
</tr>
</tbody>
</table>

“…I can smell the difference…”
Air Quality In Use

Continuous Monitoring
Water - Testing
Astronomical Time Clock – Circadian Lighting
Light
• More reflective floor
• 20-30% more daylight
Seating for 30% of staff
Nourishment
Nourishment
Nourishment
Nourishment
Cycle to Work

Health & Wellbeing

Welcome to Shape Your Rewards
Our Flexible Benefits Scheme
Mind: Beauty + Design
Mind: Beauty in the eye of the beholder
A better environment to work in?

- **Reduce stress** - more calming and nicer place to be
- **Productivity** - increase between 10%-15%.
- **Staff Cost** - reduce absenteeism by up to 50%, minor illness by 30%.
- **Noise** - by up to 5 decibels
- **Creativity** - Increased creativity by 15%.
- **Healthier looking** - reduce dry skin by 20%.
- **Spend More** - retail areas with trees
Feel Good Factor

What is the impact on productivity?
Night Time Oxygen
Toxin Removal
Day Time Oxygen
Mind: Biophilia
Mind - Biophilic Design
Mind - Biophilic Design
Mind: Biophilia – Connection with nature
Mind: Biophilia – Refuge
Designing to code or standards does not ensure a healthy indoor environment
Comfort - Temperature

CUNDALL LONDON

LOCAL WEATHER

Air Temperature
21 °C

Relative Humidity
64 %

OUTDOOR AQI

London
PM2.5
86 AQI

PM10
35 AQI

NO2
45.3 AQI

As of
2017-10-16 14:00:00

INDOOR AIR QUALITY

PM2.5
1.0 μg/m³

PM10
1.0 μg/m³

TVOCS
8.11 μg/m³

IN TEMPERATURE

A1
25.4 °C

A2
26.3 °C

A3
27.4 °C

A4
23.4 °C

A5
26.3 °C
# WELL – Cost

**Total Cost £850,000**

**1,500m² fit-out**

- Joinery materials £3,000
- Egger board to joinery units £1,500
- Compliant ply to vinyl floor £60
- Bolon floor in lieu of carpet £5,200
- Compliant paint coats £7,000
- Variable air volume to meeting rooms £5,000
- Air Water / Testing £2,000
- Water Filter £7,000

**Total £30,760**

3.6% uplift or £200 per head
Cundall London – Post Occupancy Survey

- Promotes our values: 61%
- Sense of Community: 61%
- Enjoyable Environment: 55%
- Perceived Wellbeing: 61%
- Perceived Productivity: 57%
- Pride in the workplace: 81%

Saffron House
Cundall London – Post Occupancy Survey

Promotes our values

Sense of Community

Enjoyable Environment

Perceived Wellbeing

Perceived Productivity

Pride in the workplace

61% → 78%

61% → 78%

55% → 81%

61% → 76%

57% → 72%

81% → 87%

Saffron House

One Carter Lane
Cundall London – Post Occupancy Survey

- Staff Attraction/Retention: 56%
- Productivity: 62%
- Sustainability: 64%
- Corporate Image: 64%
- Workplace Culture: 64%

Saffron House
Cundall London – Post Occupancy Survey

- Staff Attraction/Retention: 56% → 79%
- Productivity: 62% → 75%
- Sustainability: 64% → 85%
- Corporate Image: 64% → 88%
- Workplace Culture: 64% → 80%

Saffron House
One Carter Lane
HR Metrics - Absence Rate

50% REDUCTION IN ABSENTEEISM COMPARED WITH 27%

27% REDUCTION IN STAFF TURNOVER

£212k SAVING PER ANNUM
What’s next?
Environmental factors affecting productivity

- Other Factors affecting productivity
- Thermal quality
  - Air temperature
  - Radiant temperature
  - Air velocity
  - CO₂ concentration
  - Perceived air quality
  - VOCs concentration
- Acoustic quality
  - Background noise
  - Distraction noise
- Visual quality
  - Daylighting
- Perceived productivity
  - Outside views
- Biophilia
Cognitive Testing

Linking Productivity & Environment
Choose the figure that completes the series.

a  b  c  d  e
Measuring Productivity

Effects of CO₂ concentrations on cognitive performance

Linking Productivity & Environment
Measuring Productivity

Predicted views and daylighting productivity loss
Measuring Productivity

Thermal Comfort

Daylight

CO₂

Differential

2.6%

£520,000

Saffron House

One Carter Lane
Architectural Test-Fit Optimisation

Combined

Aggregated Annual Performance

Thermal Comfort

CO₂

Daylight
Architectural Test-Fit Optimisation

Aggregated Annual Performance

Differential = 0.3%
£1,100,000 per floor
Thank you for listening