HOW DO BUILDINGS IMPACT HEALTH AND WELLNESS

SANDEEP AHUJA
WELL AP, LEED AP BD+C
ILFI Facilitator and Ambassador, USGBC Faculty
We spend 90% of our time indoors.
OUR ENVIRONMENT IS CHANGING HOW WE LIVE
WHAT MATTERS MOST?

3

30

300
90% of employees admitted that their attitude about work is adversely affected by the quality of their workplace environment.
Unlock *human potential* through your building.
What if your walls and ceiling could actually eliminate VOCs, so you breathe easier?
What if you could lose weight by changing your office furniture?
AIR
# HARVARD STUDY: CO2 AND PRODUCTIVITY

<table>
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<tr>
<th>Superior</th>
<th>600 ppm CO₂</th>
<th>1,000 ppm CO₂</th>
<th>2,500 ppm CO₂</th>
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<td>95th percentile</td>
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<th>Focused activity</th>
<th>Task orientation</th>
<th>Initiative</th>
<th>Information search</th>
<th>Information usage</th>
<th>Breadth of approach</th>
<th>Basic strategy</th>
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C02 LEVELS IN REAL TIME

Start

20 min

45 min
LIGHT
What if the right light was a better morning “pick me up” than a cup of coffee?
IMPACT ON MASSING

Daylight does not penetrate all the way

32.8 %

Base Option

Meets WELL daylighting requirement

63.7 %

sDA

Spatial Daylight Autonomy describes the percentage of floor area that receives at least 300 lux for at least 50% of the annual occupied hours. As per the WELL requirements, a 55% sDA is the minimum to achieve the optimization.
IMPACT ON FACADE DESIGN LANGUAGE
PUNCHED VS RIBBON WINDOWS

sDA

Higher sDA is better

47%

39%
IMPACT ON INTERIOR DESIGN
0% OPEN/100% CLOSED

sDA 28%
IMPACT ON INTERIOR DESIGN
50% OPEN/50% CLOSED

sDA 35%
IMPACT ON INTERIOR DESIGN
75% OPEN/25% CLOSED

sDA 39%
DAYLIGHT QUANTITY VS QUALITY

No Shades
Exterior Blinds
12" Horizontal Fin
18" Horizontal Fin
Two 18" Horizontal Fin

12" Horizontal Fin With 2' 40% Frit at Top
12" Horizontal Fin With 2' 40% Frit at Top and Bottom
12" Horizontal Fin With 2' 40% Frit at Bottom
18" Vertical Fin
18" Vertical Fin With 2' 40% Frit at Bottom
FINDING THE OPTIMAL FAÇADE STRATEGY

- No Shades
- Interior Blinds
- 12" Horizontal Fin
- 18" Horizontal Fin
- Two 18" Horizontal Fin
- 12" Horizontal Fin With 2' 40% Frit at Top
- 12" Horizontal Fin With 2' 40% Frit at Top and Bottom
- 12" Horizontal Fin With 2' 40% Frit at Bottom
- 18" Vertical Fin
- 18" Vertical Fin With 2' 40% Frit at Bottom

Daylight

<table>
<thead>
<tr>
<th>Shade Type</th>
<th>SDA [%]</th>
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<tbody>
<tr>
<td>No Shades</td>
<td>60</td>
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<tr>
<td>Roller Shades</td>
<td>30</td>
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<tr>
<td>12&quot; Horizontal Fin</td>
<td>40</td>
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<tr>
<td>18&quot; Horizontal Fin</td>
<td>50</td>
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<tr>
<td>Two 18&quot; Horizontal Fin</td>
<td>20</td>
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<tr>
<td>12&quot; Horizontal Fin With 2' 40% Frit at Top</td>
<td>40</td>
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<tr>
<td>12&quot; Horizontal Fin With 2' 40% Frit at Top and Bottom</td>
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</tr>
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<td>12&quot; Horizontal Fin With 2' 40% Frit at Bottom</td>
<td>40</td>
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<tr>
<td>18&quot; Vertical Fin</td>
<td>40</td>
</tr>
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<td>40</td>
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- Interior Blinds
- 12" Horizontal Fin
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- 12" Horizontal Fin With 2' 40% Frit at Top and Bottom
- 12" Horizontal Fin With 2' 40% Frit at Bottom
- 18" Vertical Fin
- 18" Vertical Fin With 2' 40% Frit at Bottom

Daylight:
- No Shades: 60
- Roller Shades: 30
- 12" Horizontal Fin: 40
- 18" Horizontal Fin: 37
- 2 18" Horizontal Fins: 32
- 12" HF and 2' frit Top: 33
- 12" HF and 2' frit top and bottom: 39
- 12" HF and 2' frit bottom: 41
- 18" Vertical fins: 33
- 18" VF and 2' frit bottom: 33

GLARE:
- No Shades: 41
- Roller Shades: 0
- 12" Horizontal Fin: 35
- 18" Horizontal Fin: 35
- 2 18" Horizontal Fins: 37
- 12" HF and 2' frit Top: 32
- 12" HF and 2' frit top and bottom: 33
- 12" HF and 2' frit bottom: 39
- 18" Vertical fins: 33
- 18" VF and 2' frit bottom: 33

www.paternarch.com
FINDING THE OPTIMAL FAÇADE STRATEGY

- No Shades
- Interior Blinds
- 12" Horizontal Fin
- 18" Horizontal Fin
- Two 18" Horizontal Fin
- 12" Horizontal Fin With 2' 40% Frit at Top
- 12" Horizontal Fin With 2' 40% Frit at Top and Bottom
- 12" Horizontal Fin With 2' 40% Frit at Bottom
- 18" Vertical Fin
- 18" Vertical Fin With 2' 40% Frit at Bottom

Daylight

- No Shades
- Roller Shades
- 12" Horizontal Fin
- 18" Horizontal Fin
- 2 18" Horizontal Fins
- 12" HF and Top
- 12" HF and 2' frit top and bottom
- 12" HF and 2' frit bottom
- 18" Vertical Fins
- 18" VF and 2' frit bottom

GLAR
- 41
- 0
- 38
- 35
- 35
- 37
- 32
- 33
- 39
- 33

Kbtu/s/yr
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- 19
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- 26

www.patternarch.com
THE FAÇADE DESIGN
FAÇADE GLARE STUDY
HOW MANY FINS DO WE NEED?

Total Uncomfortable Hours between 8am-6pm

Current Fins  265
Half of Current Fins  345
No Fins  702

# of Hours/Year
Circadian Lighting Emulates the Natural Environment

The eyes detect light and send this information to the brain, triggering the calibration of our 24-hour cycle. Light has impacts on human health and well-being outside of image formation and color perception – including:

- calibration of the body’s biological clock and circadian rhythms
- direct effects on alertness, mood and cognition

morning afternoon evening
CIRCADIAN LIGHTING DESIGN

Perspective View Looking at Workstations Overlayed with Lux Values

Measures optimal light levels for non-image-forming photoreceptors in the human eye (pRGCs)
GETTING ENOUGH LIGHT ON WORK STATIONS

11th Floor – Area 3
FITNESS
Sitting is the New Smoking

Sitting is the Smoking
Calorie burning drops to <1 per minute

Multiple systems are negatively affected.

Disturbs mood, energy levels, and productivity

Sitting is the New Smoking
Calorie burning drops to <1 per minute

Multiple systems are negatively affected.

Disturbs mood, energy levels, and productivity
IRRESISTIBLE STAIR
HOW EFFECTIVE ARE SIT STAND DESKS IN CLASSROOMS?
COMFORT
Thermal Considerations

4% reduction in performance at warmer temperatures.¹

6% reduction in performance at cooler temperatures.¹

Acoustic Considerations

66% drop in performance when exposed to distracting noise.²

Biophilia

After 40-second microbreak, subjects who see green roofs, instead of concrete roofs, demonstrate higher concentration levels.

6% increase in concentration levels for those who saw the green roof.

8% drop in concentration levels for those who saw the concrete roof.

INCORPORATING BIOPHILIA IN DESIGN