Welcome to today’s presentation:

*Workplace Design - Lighting and Acoustics*

*December 9, 2021*

The presentation will start at 2 pm Eastern

*Note:* Phones are automatically muted during the presentation. A formal Q&A document, session slide deck, and a recording of this class will be made available on [www.gsa.gov/ces](http://www.gsa.gov/ces)
Workplace Design - Lighting and Acoustics
The Low Hanging Fruit of Successful Post-COVID Workplaces
December 9, 2021

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GSA-PBS Office of Design and Construction (CO)

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“Light is my almighty physician”

— Thomas Jefferson
Schedule Adequate Time for Pre-Design and Design

Lighting and Acoustic issues are typically nearly impossible to fix after build out.

Understanding workplace drivers early in the process allows you to create a future workplace that truly supports how people work.

As time passes, change becomes more difficult and more expensive.

Credit: Construction Industry Institute
CWS Tools to Address Workplace Dissatisfaction

“Sound Matters” publication

Total Workplace Score Card
Very Helpful CWS Tools to Direct Design

Total Workplace Score Card

TEN STEPS TO ACQUIRING ACOUSTIC COMFORT IN THE CONTEMPORARY OFFICE

BEHAVIOR
1. Walk-Walkthrough – Identify the balance of concentration and interaction among the workers in the office to help create zones. Reference Research (RISQ), which has a survey to determine this.
2. Speech Privacy – Identify the need for privacy in the work tasks and the work patterns in the WPS.
4. Behavioral protocols – Develop protocols with the participation of the various work teams to reduce distractions and appropriate use of online tools.

DESIGN
5. Zoning – Achieve the well-defined zones of activity, such as “huddle,” “discussion,” “collaboration,” “co-working,” etc. The design should be flexible and adaptable to accommodate different functions and work patterns. The design should be flexible to accommodate different functions and work patterns.
6. Sound Masking Systems – Specify sound masking systems in open plan office areas. See page 47 for information regarding sound masking systems.
7. Walls – Specify Sound Rating Construction Products as outlined in this guide.

LIGHT MATTERS
How to achieve a cost efficient, effective lighting experience in the contemporary workplace

Produced by GSA Public Buildings Service

October 2020

LESS IS MORE

Total Workplace Score Card

ADDITIONAL RESOURCES
Download Example Score Card
GSA Center for Workplace Strategy
Choosing Health-Enhancing Strategies
### Highlights From “Light Matters”

Let’s explore Glare mitigation

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<td>☑ Minimize Glare</td>
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Tips to Minimize Glare

Avoid highly reflective materials and surfaces

Avoid fixtures with bare or exposed bulbs

Use Indirect Lighting
- Indirect pendants
- Cove lighting
- Wall washers
- Floor Lamps

Use layers of light vertically and horizontally
- Ambient Lighting
- Accent Lighting
- Task Lighting

Optimal computer use
- Minimize direct light on screens
- Uniform vertical illumination to minimize contrast

Utilize daylight
6 Reasons Why Light Matters Now…and in the Future

- **Recent LED technology** has GREATLY improved the quality of the lighting, its cost and sustainability
- We have not dealt with quality lighting in office space and it is essential to **raise the governments experience Index** which is the lowest of all sectors
- Competition from the **home office** experience where experience of light and view may be much better

Credit: Gensler Workplace Research
6 Reasons Why Light Matters Now…and in the Future, con’t

- **Health and Wellness** will be a priority post-COVID-19

- We know lighting matters to mental and physical health and performance

- **Workers more effective** with better lighting (more alert- better rested – better mood) when lighting is synced to the appropriate color light at the time of day.

Per Center for the Built Environment, UC Berkeley, the top 3 office complaints
Returning to the Office: Moving From the Light?

The home office often has access to light and view …but not for everyone

many have interruptions, dependent care and bandwidth problems - with far fewer spatial alternatives…
Returning to The Office: Moving Into the Dark?

The contrast may prove to be a morale shock. Equity issues are apparent.
What’s Wrong With This Picture?

- **VIEW FROM SEATED POSITION** renders terrible glare when looking at standing individual.
- **TOTAL LACK OF CIRCADIAN STIMULATION**
- **MISALIGNMENT OF LIGHTING ABOVE WITH WORKSURFACE BELOW** causes dim worksurface.
- **LACK OF COLOR** (which human beings crave) and poor CRI.
- **POOR NOISE REDUCTION COEFFICIENT** causes sound to migrate.
- **LACK OF VISIBILITY** increases acoustic problems and kills collaboration.

Credit: Gensler Workplace Research
Change Lighting Strategies: Ceiling Plans Matter
Break Rooms – Should Not Break the Spirit!

Really???

Strive for the vibe you hope to achieve

Credit: Gensler Workplace Research
The History of Lighting – At a Glance

Throughout human evolution – A dependence on sunlight and fire

Long, Long Ago...

Incandescent bulbs start to be used

1879

Fluorescent tubes start to be used almost universally

1927

Fluorescent tubes come on the scene

1970

LED fixture efficacy improvements allow energy efficient AND high quality lighting systems

2015

“Now, it’s always noon indoors” - James Hillman
Sustainable and Human-Centric Architecture

Back to the Future??

Government Office Building, Washington, DC, 1970

Government Offices (Uffizi) Florence, 1560

More than 30% of electric power in office buildings typically goes to lighting. Most of it is wasted due to poor design or outdated equipment. Due to the use of fluorescents, light levels are 300-400 times greater today than 100 years ago.
It’s All in Your Head!

How a utilitarian understanding of vision began

1722: Antony van Leeuwenhoek discovered “rods and cones”
2002 David Berson et al discovered a novel receptor that sends impulses to a completely different area of the brain and to glands that are essential to regulating the “body clock” that we term Circadian rhythms, from the Latin, roughly translated as throughout or “around the day.”
Introduce Circadian Lighting Strategies and Equipment

To Improve Alertness, Performance and Morale!

Credit: Arup San Francisco Office
Zone Work Activities With Reference to Solar Orientation

North is best for enclosed offices because light does not project

Opening office with light shelves to project light and reduce glare

West harsh light needs heavy duty window treatment in late afternoon

Enclosed office block light

rank and file in the dark
Sunlight Sells Itself – Humanistic Orientation

46 mins
Office workers with windows had more sleep per night than those who didn’t.

40%
Workplaces with good daylight had a 3% - 40% gain in productivity and sales.

No. 1
Daylight is the number one wanted natural element in workplace design.

16%
Well-designed classrooms with natural light explained a 16% variation in learning.

15%
Workers in offices with natural elements, such as greenery and sunlight were found to be 15% more creative.

6.5%
View quality and daylight explained a 6.5% variation in sick leave in a workplace study.

Vit. D
Daylight supports the regulation of Vitamin D, serotonin, melatonin and promotes healthy eye development.

Rewilding Design | Benefits of Natural Light
Zone Electric Lighting to Support Variation in Work Tasks

Casual Gathering/Work does not need significantly high levels. If used for Lounging only, lights might even be off.

Open Office Lighting Needs Higher Light Levels at Task Plane for Written Work

Legend:
- Ø or ☑️ Recessed Fixture (Shape & size reflect actual fixture)
- △ or 四 Surface Mount (Shape & size reflect actual fixture)
- ● or ⬂ Suspended Fixture or Pendant (Shape/size reflect actual fixture)
Insist on Lighting Vertical Surfaces
The Low Cost of Fluorescent Lighting…

…Fundamentally Changed the Dependence Between Inside and Outside

- HUGE FLOOR PLATES
- NO INTEREST IN BUILDING ORIENTATION
How Can We Respond Quickly and Inexpensively?

“Circadian Shower” Examples

Create clearings in the “forest” of workstations

Credit: Ken Wilson

Credit: RTKL, DC
Case Study: “Abandon Hope, All Ye Who Enter Here”

Dante Alighieri – The Inferno
In the future workplace - to keep the organizational culture from dissipating, we may need to “hack” our buildings - to make them livable, attractive and able to compete with the home office.
Lighting Design and Acoustic Mitigation Can Overlap
Acoustic Mitigation Becomes Part of the Workplace Toolkit
Why Acoustics Matter to Work

The Mental & Behavioral Effects of Noise

- Increased aggressiveness
- Impatience and nervousness
- Decreased helping behaviors
- Lowered attention span
- Decreased problem solving
- Memorization problems
- Comprehension problems
- Neurotransmitter deficiencies
- Interpersonal problems
- Social behavior problems

Credit: Dr. Gary Madaras Rockfon Corp.
**Why Acoustics Matter to Health**

Clinical Manifestations of Stress Occurring with Noise

- Increased heart rate
- Elevated blood pressure
- Dilation of pupils
- Increased respiration rate
- Increased muscle tension
- Fatigue and nausea
- **Heart attacks**
- Increased ulcer formation
- Intestinal motility changes
- Increases in adrenaline
TEN STEPS TO ACHIEVING ACOUSTIC COMFORT IN THE CONTEMPORARY OFFICE

BEHAVIOR
1. Work patterns - Identify the balance of concentration and interaction among the workers in the office to help create zones. Reference PBS’s WSG, which has a survey to determine this.
2. Speech Privacy – Identify the level of privacy required for the work based on the work patterns in the WSG.
4. Behavioral protocols – develop protocols with the participation of the subject work group, aimed at reducing distractions and appropriate use of space use.

DESIGN
5. Zoning – After determining the work patterns, (see #1 above, under “Behavior”), develop a layout strategy which will locate incompatible functions apart from each other. Locate conference and focus rooms convenient for interactive workers to “duck into” and to act as barriers between various work patterns. Consider elements such as file banks to further separate incompatible functions.
6. Planning – Carefully consider the effect on neighboring workstations when locating supporting activities such as copier rooms, coffee bars and entries to conference rooms when a queue could be anticipated – adjacent to large conference rooms, for instance.
7. Furniture – Select furniture which complies with LEED NC credits EQ 8.1 and IT 2 to obtain 1 or 2 LEED credits. The low partitions required will achieve the desired access to natural light and view while allowing occupants to be aware of other nearby workers. Where a work station partition is in front of the worker when seated at the desk, the noise reduction coefficient (NRC) of the partition should be 47 so that speech is not reflected backward when the worker seated at his or her desk speaks. Where possible, the layout should locate the desks so that workers will not be speaking directly “at” each other.

ACOUSTIC TREATMENT
8. Sound Absorbing Ceilings and Walls - Specify ceilings having a minimum NRC of 0.9 in open plan office areas and NRC 0.8 in meeting rooms and training facilities. In conference, meeting and training facilities, provide absorptive panels on 30% of walls with a minimum NRC of 0.8.
9. Sound Masking Systems - Specify sound masking systems, particularly in open plan office areas. See page 42 for information regarding sound masking systems.
10. Walls - Specify Sound Rated Wall Constructions as follows:
   - STC 55 minimum to isolate video conference and training rooms.
   - STC 45 minimum to separate conference rooms and executive office areas requiring confidential speech privacy.
   - STC 40 minimum to separate private offices required in normal speech privacy.
The Acoustic Case Against High Partitions

If I can’t see you, I’m not disturbing you...

Workspace

Hotel Corridor
Work Patterns and Acoustic Expectations

The modern office is a combination of “The Library and the Bazaar”
GSA’s Workplace 2030 Program will expand these categories to reflect hybrid work
Follow “Sound Matters” Guidance – Achieve Acoustic Comfort
Why Acoustics Matter to Cost

Sources

Graphic Credit: Dr. Gary Madaras, Rockfon Corp.
The ABC’s of Acoustics

A

Sound **ABSORPTION** via various materials, particularly at the ceiling (but also at walls and carpeting), absorbs sound and keeps it from reflecting deeper into the space. (Absorption is measured in **Noise Reduction Coefficient - NRC**)

B

Solid barriers are used in **BLOCKING** sound transmission from one space to another. (Blocking ratings are expressed as the **Sound Transmission Coefficient - STC**)

C

Sound masking **COVERS** conversations, helping to reduce its intelligibility and thus, it’s ability to distract. (Cover ratings are expressed in the **Noise Coefficient – NC**)

39
Absorption
Noise Reduction Coefficient (NRC)

A “Good” NRC of .70 is typical in private offices
The ABC’s of Acoustics – B is for Blocking

Blocking
Sound Transmission Coefficient (STC)
The ABC’s of Acoustics – C is for Cover

Cover
Noise Coefficient (NC)

STC + NC = Speech Privacy Potential (SPP)
**Cover Sound – Degrees of Speech Privacy**

### Degrees of Speech Privacy

<table>
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<tr>
<th>PRIVACY RATING</th>
<th>SPEECH PRIVACY POTENTIAL (SPP)</th>
<th>DESCRIPTION OF PRIVACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total privacy</td>
<td>90</td>
<td>Shouting is only barely audible.</td>
</tr>
<tr>
<td>Highly confidential</td>
<td>85</td>
<td>Normal levels are not audible. Raised voices are barely audible but not intelligible.</td>
</tr>
<tr>
<td>Excellent</td>
<td>80</td>
<td>Normal voice levels are barely audible. Raised voices are audible, but most unintelligible.</td>
</tr>
<tr>
<td>Good</td>
<td>75</td>
<td>Normal voices are audible but unintelligible most of the time. Raised voices are partially intelligible.</td>
</tr>
<tr>
<td>Fair</td>
<td>70</td>
<td>Normal voices are audible and intelligible some of the time.</td>
</tr>
<tr>
<td>Poor</td>
<td>65</td>
<td>Normal voices are audible and intelligible most of the time.</td>
</tr>
<tr>
<td>None</td>
<td>Less than 60</td>
<td>No speech privacy.</td>
</tr>
</tbody>
</table>

**STC + NC = Speech Privacy Potential (SPP)**

55 + X = 80 (SPP)
Good Sound Masking Makes Good Neighbors

Credit: Cambridge Acoustics
Example:

For 1,000 Employees/ $50,000 Average Salary / $1.50. square foot investment + overhead multiplier =

@3% productivity enhancement = 0.12 Year ROI!

$ 225,000 first cost /1,000 workers = $19,000,000 savings after 10 years
Ceilings should be NRC .90

20% of the walls should be NRC .80

Panels should be NRC .65 to prevent noise ricochet
Panel Height Matters

You want to partitions to be high enough that from a seated position, you can't see over them.

If you can only understand 20% of someone’s conversation when you are not looking at them, the ability to see their lips moving increases the amount to nearly 55%.

If you start at 50%, it increases to almost 90%.
Thank You For Attending!

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Q&A

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Center for Workplace Strategy
National and Regional POCs
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*eRETA Digest*

*February 8th, 2022  1:00pm-2:30pm*

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