UL Solutions

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CASE STUDY

UL Solutions Circadian Field Measurement Program Validates Kolar's Design Ambition

UL Solutions helped Kolar deliver lighting solutions to its client, Johnson Investment Counsel.

kolar

leverage insights + build brands + enhance human experience + optimize investment

LET'S GO

Introduction

Kolar is an award-winning strategic design firm that specializes in research, insights and design. With over three decades of experience, the woman-owned enterprise is passionate about finding new and innovative ways to connect people, places and brands to create best-in-class environments.

"The office of the future can become an organization's hub, an inspiring place where people want to go to socialize, learn, innovate and celebrate together," said Kelly Kolar, president and founder. "Creating employee-centered workspaces and focusing on employee experience to drive engagement and productivity is key to an organization's success."

For Johnson Investment Counsel's new Ohio office, the company wanted to create a space that inspired people and delivered state-of-the-art well-being to all those working in it. UL Solutions was brought in to capture data in this new space and help read the circadian results.

"As an employee-owned company, we want our space to reflect not only our expertise as wealth managers but also how we are focused squarely on the future for clients and employees alike, said Scott J. Bischoff, Principal of Johnson Investment Counsel.

"Our employees stay with Johnson for decades and often their entire careers, building trust and lasting partnerships with our clients. Adding healthy lighting was just one way we could continue to demonstrate our commitment."

The Goal

Kolar's multidisciplinary team uses a data-driven approach to improve the return on investment of their client's space. The team integrates employee engagement and change management inside the planning and design process to create an enhanced human experience in the physical environment while optimizing real estate investments.

Serge Bruylants, Director Workplace & Interiors at Kolar, led the team that envisioned the space. The new office had to be representative of the Johnson Investment Counsel's brand and provide a welcoming experience for their clients and visitors. At the same time, the team focused on creating a space that is both functional and promotes well-being, which required a thoughtful balance of design, ergonomics, and atmosphere.

> With UL Solution's Circadian Field Measurement Study, we were able to verify our assumptions and design. We explored the complex dynamics of workspace lighting, aiming to strike the delicate balance between fostering a vibrant work environment and mitigating issues such as glare. We were focused on spaces with limited access to daylight, a concern highlighted in the employee feedback from our engagement at the start of the project.

Serge Bruylants

The Challenge

Decades of research on circadian rhythm conducted in laboratories and in the field show that day and night light signals are required to provide better health. Committees have worked on the science of lighting and its relationship to human circadian physiology. Three groups published methods outlining the circadian science and lighting recommendations, including:

- WELL Building Standard V2: Based on Equivalent Melanopic Lux (EML)
- UL Design Guideline 24480: Based on Circadian Stimulus (CS)
- DIN/Tech Specification 67600: Based on Melanopic Equivalent Daylight Illuminance (M-EDI)

Adam Lilien, global business development manager at UL Solutions, noted that “While one can find differences of opinion about calculation methods, all three of the published models agree that in order to promote a good night’s sleep, one should be exposed to bright days and dim nights in a consistent and timely manner. This, in turn, enables better sleep and the immune system to reset, and we are better able to fend off illnesses more effectively.”

The Design

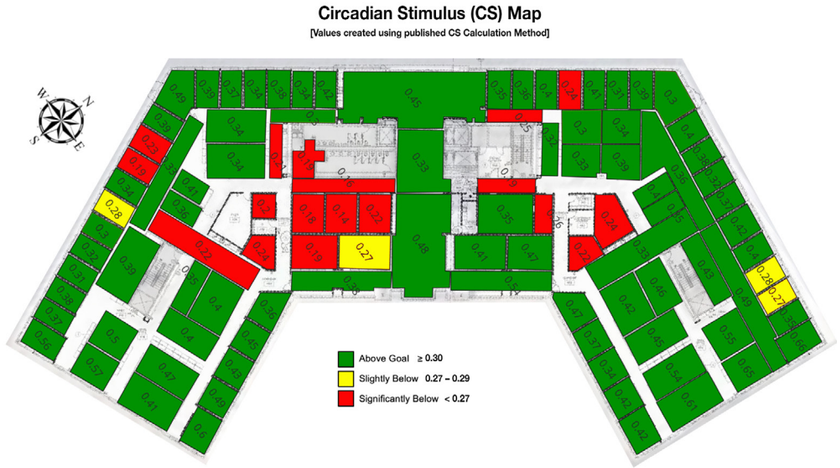
The space that Johnson Investment Counsel envisioned featured floor-to-ceiling windows and minimal interruption from structural elements, so the amount of daylight entering the office was optimal. With offices lining the windows, Kolar designed glass walls facing the internal open office areas so that the people working there could benefit from access to optimal daylight and views of the external environment. The solid walls in between the enclosed offices provide a level of privacy.

Opening up the ceiling space and painting the mechanic and structural elements white and employing pendant lighting with indirect and direct lighting was key to the design. In open areas, using workstation partitions, partially glazed to allow the lighting to carry into the center of the building. Light color cubicles and flooring were additional design decisions that led to a brighter space.

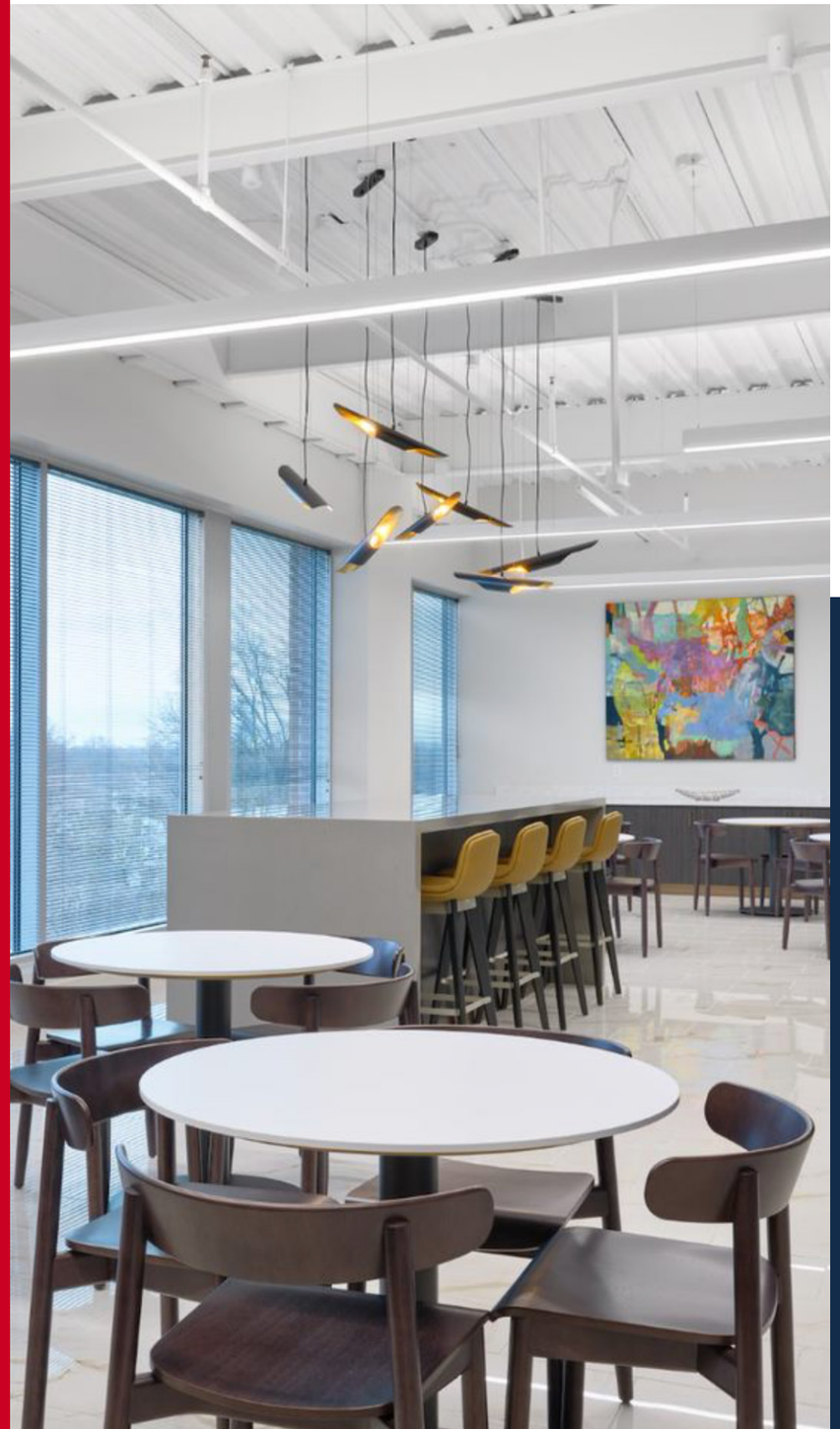
Just how effective was the lighting design in terms of delivering the needed signals?

Creating a circadian-effective lighting report of a large space manually can be very time-consuming. Kolar turned to UL Solutions to measure the result. UL Solutions created an efficient way to collect and analyze the data. With the new Circadian Field Measurement service, it's now possible to create a 2D map indicating the space's circadian score. What used to take months can now be completed in about a week.

Shown below is the office space that Johnson Investment Counsel occupies, with the Circadian Stimulus (CS) score indicated in color:



The areas that are green indicate where circadian lighting design goals were achieved. The areas in yellow were slightly below the goal. Areas is red were significantly below goal. While areas identified as below goal can be examined for lighting improvements, it is also noted that such areas may not be spaces where people work, for example, storage areas. The circadian map allows the building owner to assess their individual space.



According to Serge Bruylants, “From the insights we gained, we’re now equipped to make informed decisions regarding the selection of desk lamps, especially in areas where natural daylight is scarce, ensuring optimal illumination for tasks without compromising on glare reduction. Moreover, collaborating closely with lighting controls system providers, we’re better prepared to offer tailored advice to clients, guiding them in configuring lighting ‘scenes’ that align with circadian rhythms, such as boosting brightness levels during crucial morning hours from 9 to 11 am, thereby enhancing overall employee well-being and performance.”

> “Circadian lighting is as important as ergonomic seating. Organizations will now have another tool to help provide a healthier environment for their employees, and also help educate their people about the choices they can make to take advantage of getting the right amount of circadian light to improve their health and well-being.
>
> **Serge Bruylants**

The Testing Method

Measuring a space for its circadian effectiveness involves collecting data on the light entering the eye on the vertical plane and using the calculations outlined by one of the three published methods.

Data collection to capture the daylight coming through both the windows and the artificial lighting from the luminaires was scheduled to coincide with the 9-11 a.m. delivery of a bright daylight signal recommended by the document UL DG 24480. The Circadian Stimulus goal was CS = 0.3.

This method of collecting data in the actual environment allows for certain benefits that would be almost impossible in computer aided design (CAD) programs. While programs such as Agi32, RELUX and DiaLUX can predict the outcomes, taking measurements in the actual space takes into account the building materials used. When daylight or artificial lighting bounces off of a painted wall, a ceiling tile, a rug or furniture, the colors of the light are altered. This data collection method accounts for the actual light in the space.

Utilizing the rig designed by UL Solutions (Patent Applied), data was collected at the Johnson Investment Counsel facility. While LiDAR (light detection and ranging) identifies the position and direction of the data captured, a spectroradiometer captures the photons entering the eyes of the building occupant. A 360-degree camera was also used, which was helpful when the design team asked questions about certain results that were unexpected.

The Results

The results were post-processed using computer models to calculate the CS for each space.

- While UL DG 24480 states: “10 readings per room are required,” the readings collected for this space were over 6,000 —, well above what was required.
- The calculations delivered a CS reading at each specific spot using LiDAR.
- The calculations were averaged to determine the CS of that space.

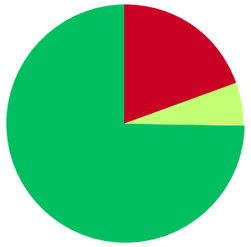
Each calculation delivered a color in that space based on a set of rules determined by the lighting designer:

CS ≥ 0.3 = GREEN

CS of 0.271 – 0.299 = YELLOW

CS ≤ 0.270 = RED

For those areas that are green, the lighting design goal is met, meaning that people working in these areas are receiving the circadian entrainment signals needed for better sleep quality. For those areas that scored yellow or red, the circadian score is below the levels needed for better sleep quality, though this may be irrelevant if the yellow or red areas are not spaces where occupants regularly work. This method allows for different design goals for each space and also enables the design goals to change over time.



The results by comparing the number of spaces with each score:

- **Above goal =** 74.5%
- **Slightly below goal =** 5.9%
- **Significantly below goal =** 19.6%

Different questions can be asked for the areas below goal:

- Are all the lights functioning as designed? For example, are any of the lights dimmed?
- Are the controls' occupancy sensitivity set appropriately? For example, do the lights come on when entering the space, or does it take a few seconds?
- Are the window blinds fully or partially closed?
- Would a change to the reflectivity of the ceiling/walls/floor or the furniture improve the score?
- Would the addition of a luminaire, such as a wall wash or desk lamp, add to the score?

Each of the three published methods of calculating the circadian effectiveness of the space can be used to generate the colors, whether the space was designed to WELL Building Standard V2, UL DG 24480 or DIN/TS 67600. Once the data is collected, any of the three methods can be calculated.

The needs of an architect or lighting designer working toward any of the three goals can be met, providing new information that is valuable no matter where the project is located.

“Through this investigation, we learned invaluable insights into refining our consultation approach for clients, especially concerning human-centered lighting, an increasingly pivotal aspect of modern workspace design. As light emerges as a key environmental factor in workspace engagement, the study also showed us how seemingly unrelated interventions, such as applying privacy film to glazed office fronts, can have a detrimental effect on optimizing both functionality and comfort within the workspace ecosystem.”

Serge Bruylants

Project Location:	Johnson Investment Counsel Office
Project area:	34,000 square feet
Project scope:	UL Solutions Circadian Field Measurement/UL DG 24480 (CS)
Project outcome:	CS score of 0.3 or higher in spaces where people work
Engagement:	March 2023 to October 2023

Conclusion

Although the Kolar team had initially not designed the space to specifically meet or exceed circadian design goals, the results are clear: they delivered a space that exceeded the high expectations of their client.

“The findings from the UL Solutions Circadian Field Measurement study shed light on how users can actively shape the influence of circadian light within their surroundings, offering valuable insights for enhancing both productivity and well-being. Furthermore, we sought validation regarding the efficacy of diffuse uplight in our open office zones, recognizing its potential to positively impact employee comfort and performance,” stated Bruylants.

For more information, visit
UL.com/services/human-centric-lighting

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