SAINT-GOBAIN

OCCUPANT COMFORT STUDY
REVISITED 2022

MOVING FORWARD: OCCUPANT EXPERIENCE, HEALTH, AND WELL-BEING

In 2018, three years after opening a new, state-of-the-art North American corporate headquarters in Malvern, Pennsylvania, Saint-Gobain published a landmark Occupant Comfort Study. Created in partnership with the University of Oregon's High Performance Environments Lab (HiPE), the longitudinal analysis—the first of its kind based on size and scale—revealed that a **systems-based design approach utilizing multiple solutions and strategies** can have a stronger collective impact on a building's ability to optimize the occupant experience.

The findings also indicated the need to move away from a traditional prescriptive design model that relies on one building solution to achieve occupant comfort and satisfaction.

Now, more than three years later, we revisit the findings to see what was learned, what has evolved, and what—in a post-pandemic world—will change.

"When we did the building," says Saint-Gobain's Lucas Hamilton, Manager, Applied Building Sciences, "the stretch programs for high-performance buildings were things like LEED, which is very much about the environment, or EnergyStar, which is very much about energy, and neither were very much about people."

People are the very core of every factor considered to impact, improve, and enhance comfort and productivity in the current—and future—spaces of commercial real estate.

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CREATING A LIVING LABORATORY

Conducted in four phases over 36 months, the study considered occupant satisfaction, productivity, and health by evaluating Indoor Environmental Quality (IEQ) parameters, including indoor air quality (IAQ), thermal, visual, acoustical, and spatial comfort, as well as occupant experience pre-, mid-, and post-renovation move.

The 277,000-square foot Saint-Gobain Malvern headquarters is LEED® (Leadership in Energy and Environmental Design) Platinum certified for both commercial interior and core and shell. It was created through adaptive reuse of a dormant office building, with 15% of the project classified as new construction and 85% as renovation.

Designed to serve as a living laboratory, the Malvern facility integrates and evaluates more than 60 of the most innovative technologies from our family of brands; in this way we continue to look forward even as we honor 14 generations of Saint-Gobain employees dedicated to improving the built environment.

MALVERN NEXT-GEN HQ IQ

- 65-acre campus
- up to 800 employees
- 116 collaborative spaces
- fitness center
- pond
- reclaimed water fountain installation
- 1.3 miles of publicly accessible walking trails

SEE + HEAR + FEEL + BREATHE = INDOOR ENVIRONMENTAL QUALITY (IEQ)

An exceptional example of Saint-Gobain's design discipline, the building embodies a leading-edge approach to architecture and interior design, combining elements of sustainability, beauty, and comfort to improve occupant well-being with the lowest environmental impact.

Making buildings adaptable to their inhabitants shifts the comfort paradigm. Traditionally, design elements that improve the employee experience have been viewed as non-essential benefits. These are commonly cut to reduce construction costs, but this short-term approach often leads to long-term compromises in workplace productivity, operational costs, and environmental impacts.

Leading employers, owners, and developers are now changing the way they connect and assign value to aspects affecting employee well-being.

SEE

HEAR

FEEL

BREATHE

BRINGING THE OUTDOORS INDOORS

Biophilic design connects people with nature by introducing natural elements to indoor design, for a healthier and more productive work environment. This is a departure from the evolution of the built environment, which has traditionally separated people from nature owing to an unduly narrow emphasis on improving efficiency. An ironic, unintended consequence of this paradigm, which resulted in increasingly artificial and static indoor environments, was a decline in human health and happiness.

Measurable benefits of biophilic design elements in Malvern range from the doubling of sales leads generated per incoming call to a 50 percent increase in the number of qualified applicants per job opening. Employees' survey responses show that their perceptions of productivity and happiness at work have dramatically improved. These are tangible results that go straight to a company's bottom line. A healthier, happier workforce leads to a more profitable company.

Whether via windows to actual nature or interiors that echo natural tones, introducing natural elements into the places people live, work, learn, play, and heal encourages us all to consider buildings from a life cycle perspective rather than just a construction cost viewpoint. This sustainability focus is a key part of Saint-Gobain's ambition to deliver well-being to daily lives, and a prime motivator behind the living laboratory concept.

FIRST-HAND FACTS

As a company founded to make building materials that transmit and reflect sunlight, Saint-Gobain found biophilic design to be a compelling framework for demonstrating a commitment to innovation and leadership in sustainability. The new Saint-Gobain Malvern headquarters realizes these intentions with visual experiences of nature, variable airflow and thermal conditions, acoustic absorption and diffusion, daylighting, and fresh air ventilation.

Combining this holistic approach with best-in-class products and building technologies creates spaces that leave occupants feeling physically better and mentally more productive. By experiencing the impact of their products firsthand, Saint-Gobain employees are able to benefit from, evaluate, and share in the performance experience of the company's building solutions.

Above: Using exterior building sensors and a proprietary control system, **SageGlass**® literally follows the sun: it automatically tints on a gradient to reduce glare, but still offer access to daylight and natural views. Advanced tools manage daylighting, energy use, and color rendering.

DEFINING INDOOR ENVIRONMENTAL QUALITY

Saint-Gobain's design approach combines key aspects of indoor comfort with high-performance criteria to create sustainable buildings that meet occupants' needs while promoting health and well-being. Indoor Environmental Quality (IEQ) is determined by myriad components, but primarily through these four: Acoustical Comfort, Thermal Comfort, Visual Comfort, and Indoor Air Quality. For commercial real estate investors, understanding these factors will help maximize project results.

ACOUSTICAL COMFORT

One goal for the Malvern headquarters was to create open, collaborative spaces where people from different businesses and functions could work together to drive creativity and innovation. While open-concept workspaces provide many benefits, they can pose challenges for workers in need of peace, quiet, and privacy. In any workplace, acoustical comfort is affected by sound generated by coworkers, building systems, and outdoor sources. These distractions can make it harder for employees to concentrate and complete tasks.

THERMAL COMFORT

Thermal comfort is a dynamic quality of the built environment comprising variables such as airflow velocity, air and radiant temperatures, relative humidity, and the occupants' capacity to make adjustments to their surrounding climate. This last aspect is especially significant given the most common complaints related to thermal comfort are that areas are too hot or too cold. But thermal comfort is more complex than just temperature, and requires a balance of its variables.

VISUAL COMFORT

At its essence, visual comfort begins with the availability and dissemination of natural light, as well as the attenuation of solar heat. Since daylight changes constantly, visual comfort also factors in elements that can augment and, if necessary, replace natural light. Visual comfort can also be enhanced by the presence of windows that offer access to natural views, as promoted by biophilic designs.

INDOOR AIR QUALITY

Occupants always breathe easier knowing that, well, they're breathing easier. Advancing air quality requires the consideration of many factors ranging from outdoor air quality to interior finishes and furnishings, mechanical system performance, the control of odors, and the absence of internal pollutants.

MEASURING INDOOR ENVIRONMENTAL QUALITY

Saint-Gobain partnered with subject matter experts led by Dr. Ihab Elzeyadi, Director of the University of Oregon's High Performance Environments (HiPE) Lab, to conduct an extensive four-phase comparative analysis of Indoor Environmental Quality.

Phase One: A research team inspected the existing unoccupied Malvern facility prior to its adaptive renovation and reuse

Phase Two: The team examined the former Saint-Gobain headquarters in Valley Forge, Pennsylvania, to establish a benchmark for the performance of the new headquarters

Phase Three: The team analyzed the new headquarters following envelope upgrades and interior design retrofits, but prior to occupancy

Phase Four: The study assessed the newly completed Malvern headquarters post-occupancy

Dr. Elzeyadi and Saint-Gobain staff employed two tools developed by the HiPE Lab to assess IEQ across different seasons and retrofit stages of the new headquarters. The first was the IEQ Toolbox™, a unique protocol formulated to create data visualizations and measurements of air quality, daylight distribution, and occupants' visual, thermal, and acoustical experience throughout various areas of a building using long-term longitudinal data measurements, seasonal measurements, and point-in-time measurements.

The second tool was the Space Performance Evaluation Questionnaire (SPEQ™), which was administered in October 2015 when employees still worked at the Valley Forge facility, as well as one-year and two-years post-occupancy. The survey gleaned additional insights and anecdotes regarding occupants' experiences and impressions of the new headquarters. The questionnaire was designed to evaluate 30 issues through 76 questions pertaining to:

- Workspace characteristics (location, views, duration of use, type, and comparison to previous workspace)
- IEQ satisfaction
- Comfort of ambient environment (visual, thermal, acoustical, spatial, ergonomic and air quality)
- Health and well-being
- Productivity

Employees also had the opportunity to share additional information through open-ended questions, as well as in focus groups representing different job levels and workstation locations. The response rate for the SPEQ survey was consistently high in each of the three years it was conducted, with nearly 40 percent of Saint-Gobain employees voluntarily participating each year, demonstrating high engagement and commitment from our employees to evaluate and improve products and technologies in our new headquarters.

Overall, results of the study showed that the technologies implemented at the new Saint-Gobain headquarters resulted in substantial advancements in visual, thermal, and acoustical comfort, as well as air quality.

> "I feel healthier, more productive, and happier in this office. A work environment is critical to job performance and satisfaction, in my experience."
>
> Amiel Gross, Litigation Counsel

ATTAINING INDOOR ENVIRONMENTAL QUALITY

We introduced several elements to ensure our environments were collaborative and productive for all.

ACOUSTICAL COMFORT

- Surfaces such as perforated wall and ceiling panels were introduced to help absorb sound
- Environments were modified to reduce reverberant echo noises
- High-performance interior and exterior façades were installed
- Vibrating, noise-generating components of HVAC systems were isolated
- Speech intelligibility between workstations was managed with noise-reducing wallboard, workstation partitions, and laminated glass fine-tuned with a white noise masking system

We mapped sound absorption, sound levels, and workstation distraction distances to evaluate the effectiveness of our acoustical comfort tactics. According to employee responses, average acoustical comfort improved by 42.2 percent.

THERMAL COMFORT

- The building envelope's insulation levels and air tightness were increased to exceed the existing building energy code by 30 percent
- A high thermal performance glass façade was installed on north and east facing orientations to create interior surfaces with comfortable temperatures
- An electrochromic glass façade was installed on south and west facing orientations to decrease the impact of solar heat gain
- All outdoor air supplied to the building was pre-conditioned to remove excess humidity

Thermal comfort was improved throughout the building through a post-move commissioning procedure. The high performance system was assessed for thermal comfort using visualization techniques to identify and adjust individual units to satisfy localized air temperature, radiant temperature, and air velocity preferences. The building's original outdoor air ventilation units were replaced due to consecutive system failures.

The building automation system and individual thermostats were optimized with software, instrumentation, and sensor upgrades to improve system response and control. Thermostats were optimized to allow temperature adjustment in collaborative spaces to meet occupant comfort needs on demand.

VISUAL COMFORT

- Furniture layout and the provision of flexible working spaces around the perimeter, combined with the placement of opaque and transparent partitions, create sweeping views of nature that provide an abundance of natural light with views possible from 92 percent of the interior space
- Dynamic electrochromic (south and west) and high performance (north and east) glazing systems were installed on the building façade to maximize daylight distribution
- Daylight glare is dynamically controlled with the electrochromic glazing system
- Majority of horizontal and vertical surfaces have high light reflectance values of 70% or greater
- Additional space lighting was created using a slim profile LED luminaire with a sharp cut-off angle integrated into the suspended acoustical ceiling

The majority of spaces receive useable daylight during the day within a range useful to the occupant. Glare sources and brightness levels are within desired ranges throughout the majority of the building to limit occupant visual discomfort. Measurements and space performance visualization techniques coincided with the occupant experience survey results.

INDOOR AIR QUALITY

- Two wallcovering innovations were implemented: one with the ability to trap and neutralize 70 percent of harmful aldehydes and thus sanitize the air, and another designed with an anti-microbial coating that actively repels and kills fungus and black mold
- Drywall tapes used in wall-finishing featured mold- and mildew-resistant properties
- Wallboard and ceilings absorb formaldehyde, a Volatile Organic Compound (VOC), from the air and convert it to a safe, inert compound
- Tile backing board featuring superior moisture and mold resistance were used in relevant spaces throughout the building

Air quality was impacted by seven discrete facets: outdoor air ventilation, particulate filtration, dehumidification, moisture flow management, air leakage control, VOC control, and contaminant capture.

> “The acoustics allow you to feel like you can talk at a normal volume without disturbing the others around you when in your cube. The breakout rooms are fantastic for doing business when critical items are being discussed. Overall, this is one of the best environments I have worked in.”
>
> Michael Negri, COE CapEx Sr. Buyer

By selecting sustainable building materials and installing building systems to supply continuous fresh air ventilation, we were able to deliver significant advancements in indoor air quality at the new headquarters, providing a safer and healthier environment for our employees.

> “I have not sneezed one time since moving into the new building. Its open floors are great; the air is fresh and clean.”
>
> Joe Loughran, Loyalty Programs Specialist

Ultimately, strategies implemented at our new headquarters delivered significant enhancements in indoor air quality, with employees rating this as the most improved element of the new headquarters on the SPEQ. Results revealed that employees experienced a 91.6% improvement in collective indoor air comfort in the new headquarters.

Additionally, occupants’ satisfaction with indoor environmental quality (a measurement composed of employees’ ratings of temperature, lighting quality, acoustics, air quality, smell, ergonomics, and space function) improved by 47.9 % in the new space.

Above: The square patterns in **Gyptone® BIG™** gypsum board absorb sound waves, which travel through the holes into the insulation-lined plenum. This unique performer also reflects sound in large areas where we want speech to carry, but without echo for enhanced intelligibility.

DATA ANALYSIS RESULTS

An advanced statistical analysis by the University of Oregon confirmed previous findings related to the eco-system impacts of building materials and strategies. **The collective influence of the environment created by the multiple high performance solutions integrated into the headquarters have significant positive impacts on the occupants' comfort, satisfaction, productivity, and health.**

The additional statistical analysis conducted confirms that this pioneering longitudinal study provides compelling evidence to the impact of an eco-system of green building systems and materials on employees' improved perception of performance, multi-comfort, satisfaction, and health.

This exemplary study is one of the largest studies to date that employed longitudinal IEQ analysis and measurements for both quantitative and qualitative experience combining building physical performance as well as occupant's subjective experiences.

Positive and statistically significant change existed for all outcomes creating sizeable improvements to overall building performance and the occupant's holistic experience. **The findings provide significant evidence to the value of green and sustainable building strategies and materials on the triple bottom-line of people, profit, and planet.**

> "The Saint-Gobain HQ is an inspirational environment to work in, and every day I am proud to work in a building that utilizes all of the innovative products we make as a total system for optimal performance. From the superior acoustics to the open and collaborative working environment with my coworkers to the wellness services the company provides, I know my health and well-being are better off by working for such a forward-thinking, state-of-the-art organization."
>
> Francesca Vaughn, Segment Marketing Manager

MALVERN NEXT-GEN HQ IQ

Employees report:

- 42.2% improvement in **Acoustical Comfort**
- 4.8% enhancement of **Thermal Comfort**
- 56.4% boost in **Visual Comfort**
- 91.6% increase in **Indoor Air Quality**

EMPLOYEE IMPACT ON BUILDING PERFORMANCE

Saint-Gobain employees have directly impacted the performance of our new headquarters in intentional ways, often through the CrowdComfort mobile app, but also in some unintentional ways via workspace personalization, lifestyle choices, and product use.

For example, when comparing visual comfort measurements in the building pre- and post-occupancy, we found a 15 percent decrease in the collection and dispersion of daylight due to window shades and decorations. While individuals close to the building's glass façade may still have abundant day-light, these losses have the greatest impact on colleagues working closest to the building's center.

Our Indoor Air Quality sampling indicated that employees with pets at home were bringing tiny mementos of their furry friends to work via clothing and other belongings, resulting in the presence of low-risk but detectable levels of cat and dog allergens in all employee areas.

Additionally, while monitoring VOC levels, we observed daily increases as the building becomes occupied: perfumes, hair products, artificial sweeteners, citrus or fermented foods, and dry-cleaned clothing cause a chemical reaction in which the human body produces formaldehyde.

In order to optimize performance in our new headquarters, we encourage employees to:

- Allow at least 25 percent daylight in a space to ensure eye comfort and productivity
- Keep a tidy workstation to expose lightly colored work surfaces that balance light
- Refrain from displaying flyers, banners, and displays in front of windows, which reduces other employees' outdoor views of nature and daylighting
- Properly sort single-stream recyclables and dispose of food waste in pantries to keep workspaces clean
- Move during the day for improved energy levels, ergonomics, and productivity

POST-PANDEMIC, PRE-FUTURE

A global health event in early 2020 quite literally sent entire workforces home. Those businesses that could pivot to accommodate remote employees did so, and working remotely has caused many employers to review the physical properties of their workplaces. Today, we cautiously begin to consider not just how to get workers back into the buildings, but also what those offices, classrooms, retail spaces, and healthcare facilities must do to protect their people and earn them back.

All the factors so carefully attenuated and measured in the transition from Valley Forge to Malvern are what we today find as the most crucial in ensuring the physical and mental well-being of people at work. To achieve a high level of Indoor Environmental Quality, it's key to have acoustical, thermal, visual, and air quality factors working in concert.

So now, what changes? In Malvern, keeping employees safe and productive when they return in force will involve reorganizing to create more **space and collaboration zones through flexibility and maximizing the utilization of each square foot of the floor plan.**

"This reaction to the pandemic, regarding how interiors are used, is going to be universal," states Hamilton. "And some might do it sooner than others, but everyone's going to have to do it."

OCCUPANT EXPERIENCE IS THE DIFFERENTIATOR

"As we attempt to come back," notes Stan Gatland, Saint-Gobain's Manager, Building Science and Comfort, "we're refocusing the idea that offices aren't cubicles and closed-door conference rooms. They're really human collaboration places."

It's a subtle distinction, but it is a mindset shift for people to know why—and how—they'll one day get together again. "Because people can work from home—they'll change jobs and companies to get what they want—but at the end of the day, when they do come together, the purpose of the office in the future is going to be human collaboration," says Gatland.

"There's a huge element of confidence in spaces that needs to be restored," adds Hamilton, "Because people think about that more than they used to, prior to the pandemic. And so, if you talk about confidence in spaces you're mostly today talking about having the proper, highest amounts of fresh air you can provide."

IN CONTINUATION

Our living laboratory continues. New data collection will be used to assess and improve building performance and the experience of the people working in the space. It's an ongoing journey, one we are committed to and one that we know will evolve with the needs of our employees.

Perhaps one of the most important things we have learned is this: as a dynamic building adapts to occupants' needs, those needs themselves change. Improvement, then, means being committed to that process of changing and adapting as people learn how to take better advantage of their environment.

It's an iterative process well-suited to the concept of a living laboratory: human interaction drives product and system improvement because each raises the other's game. It's what we hoped for several years ago when we designed the building and it's what we believe in today. In this way, the Indoor Environmental Comfort design strategy has created a unique dialogue among our employees, outside researchers, building management, and our research teams, all focused on improving the quality of human experience at this increasingly dynamic headquarters.

Today, as the world re-emerges from the confines of a pandemic, new thought must inform the creation of commercial spaces. Building these requires more than mere materials; it demands an understanding of how humans best engage with their environment, and how that environment can best empower people to deliver their best.

With the experience and scientific knowledge of our team of experts—and the ongoing learnings gleaned from our living laboratory—we can help lead you toward that ideal space. Achieving a new level of Indoor Environmental Quality is essential to reassuring and retaining occupants, and it is also eminently attainable. Allow us to show you how.

Visit **sgcommercialsolutions.com** or contact us at **commercial.solutions@saint-gobain.com** to get started.

SAINT-GOBAIN

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