

Architect & Design Sustainable Design Leaders
Post Occupancy Evaluation Survey Report

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ABSTRACT

Interest in Post Occupancy Evaluation (POE) is growing. Due to the various definitions of this scope of work, and the tools and knowledge required to provide these services, many are not sure where to find more information, how to evaluate if this service should be provided in their own practice, and how to get started.

This report synthesizes survey responses from 29 sustainable design leaders across the U.S. and Canada in order to document the current status of POE in the architecture profession. Over half of these firms (40 employees and larger) are currently conducting POEs and almost all would like to conduct POEs on a majority of their projects in the near future. Tools and resources to assist in the development and implementation of POEs are also included.

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1.0 INTRODUCTION

1.1 Survey Methodology

In order to assess the current status of Post Occupancy Evaluation (POE) among architectural professionals, a survey was conducted among firms included in the Architecture and Design Sustainable Design Leader (SDL) network. The SDL is an informal network of sustainability directors at mid-sized and large architecture firms, which meets annually for a two-day Summit, and serves as a forum for new ideas and support group for shared challenges. The network is convened and supported by BuildingGreen, Inc.

In July 2014, twenty-nine of the sixty SDL firms surveyed responded. All of the responses, save one, were intended to represent the entire firm and not individual or regional offices within the same company.

Questions included in the survey aimed to summarize the current state of affairs, as well as understand each firm's goals and process. Because of the Sustainable Design Leaders' role leading sustainable and green building initiatives in their respective firms, these people are involved in discussions related to Post Occupancy Evaluation in their own offices and are more inclined to be knowledgeable and have experience with this topic.

The survey results are aggregated and reported anonymously in this report, of which an initial draft was presented to the group surveyed on July 24, 2014 at the annual summit held on Bainbridge Island, WA.

2.0 POST OCCUPANCY EVALUATION OVERVIEW

Although valued by the design community, Post Occupancy Evaluation is currently rare. It also takes a variety of forms. The same term is often used to describe a wide range of services. The purpose of this report is to describe the variety of POEs currently conducted and how they could be improved.

Of the responses received, a majority of these architects currently conduct POEs. Eight firms (27%) noted that they did not currently perform Post Occupancy Evaluation. All offices noted that they would like to conduct more POEs than they currently provide. The majority reported that they would like to conduct POEs on 75% or more of their projects (Figure 1).

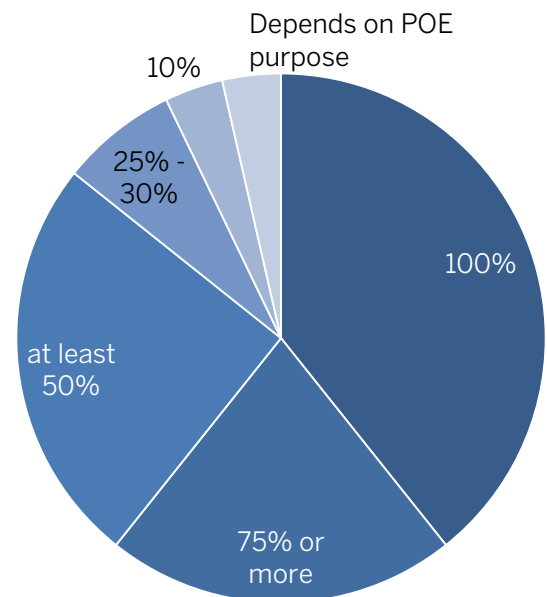


Figure 1: IDEAL PERCENTAGE OF PROJECTS. 28 responses

2.1 Challenges

Several challenges were noted as to why these architects did not conduct POEs more frequently. The most frequent reason given was the design team time and cost required to produce meaningful results.

Additional concerns include:

- designer and client liability concerns
- client privacy concerns (including disclosing energy performance data)
- lack of client demand or interest and challenges communicating value to the client
- lack of timely responses from the client/user
- client desire to control or limit employee feedback
- limited site access
- unsuitability for certain program types (such as retail)
- timing of the POE, since this typically occurs after project closeout
- lower priority of non-billable or research tasks
- defining scope and aligning expectations of what will be evaluated
- design team awareness and/or experience

2.2 Understanding Value

Education (most notably Higher Education) clients demonstrated the most interest in the POE process (Figure 2). Although it can be argued that healthcare and lab spaces could benefit most from comfort and performance validation, access to these turned-over and occupied spaces is understandably the most difficult. Value in the commercial office sector seems to gravitate towards owner-occupied facilities, non-profits, and companies focused on recruitment and retention.

Although most of the firms surveyed work internationally, none responded that clients seem most receptive to POEs in Europe. This is surprising since according to the Building Research Establishment (BRE) website, "it is becoming mandatory on many public projects."¹ BRE publishes the BREEAM standard, popular in the United Kingdom and several other European countries, which includes a mandatory assessment after construction is complete. Respondents did note that domestically, clients on the West Coast, in the Northwest and Northeastern regions, and Hawaii have shown a greater interest than other parts of the U.S.

Most of those surveyed were unsure if clients even value this service (Figure 3). Some responses indicated that clients appreciate the value of POEs, but not to the extent of paying extra for them yet. If provided, the reports are well regarded and appreciated, only if the conclusions are actionable.

Other firms noted that since the purpose of the POE is to enhance the quality of future work, the design team should place greater value on the opportunity to assess completed projects,

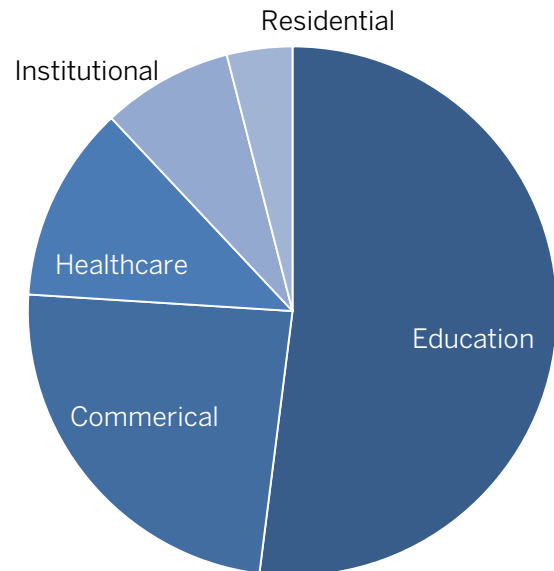


Figure 2: FUNCTIONAL MARKETS WITH MOST RESPONSIVE CLIENTS. 25 responses

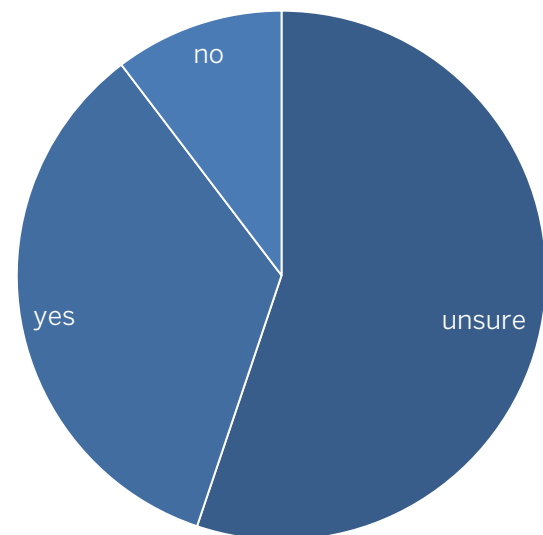


Figure 3: DO CLIENTS VALUE POES? 29 responses

¹ "BRE Group: Post-Occupancy Evaluation (POE)." *BRE Group: Post-Occupancy Evaluation (POE)*. Building Research Establishment, n.d. Web. Apr. 2015.

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to enhance performance on future projects. Learning from these previous experiences can impact future design, coordination and detailing on the next project. It was also noted that POEs can be effective tools to better define project goals in future work.

The value of POEs can also be quantified by the experience of this group, which showed a range in the number of completed POEs (Figure 4). However, please note that responses to this question may vary based on the definition of the POE scope, which can differ dramatically, as addressed in the Scope section of this report.

Of the eighteen firms that have completed POEs, the ability to provide this service across an entire portfolio varies. The majority were successful in implementing POEs on less than 5% of projects completed in the last year (Figure 5). This is interesting in light of the group's strong interest in POEs and the overwhelming desire to conduct POEs on at least half of their built work. All stated that they would like to provide more POEs.

2.3 Post Occupancy Evaluation Goals

Survey respondents were asked to rank eight goals and priorities related to Post Occupancy Evaluation (Figure 6). Obtaining real feedback on design and performance, learning from previous experiences, and extending the client relationship and exposure were dominant first priorities (Figure 7). Almost all who did not select the most popular first priority "soliciting feedback on design and performance aspects of projects" selected this as their second priority.

The approach a firm will take to POE will vary depending on the goals. Most often the term POE is an abbreviation for Post Occupancy Evaluation. However, there are some who would prefer to replace "Evaluation" with "Engagement." Definitely, Post Occupancy Evaluation provides

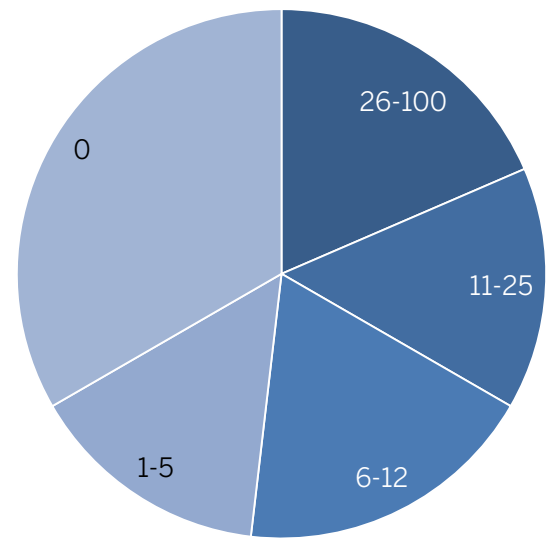


Figure 4: NUMBER OF POES COMPLETED. 27 responses

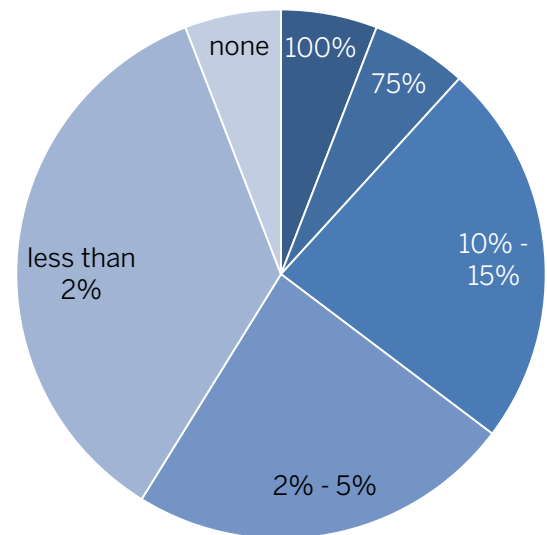


Figure 5: PERCENTAGE OF PROJECTS IN THE LAST YEAR. 17 responses

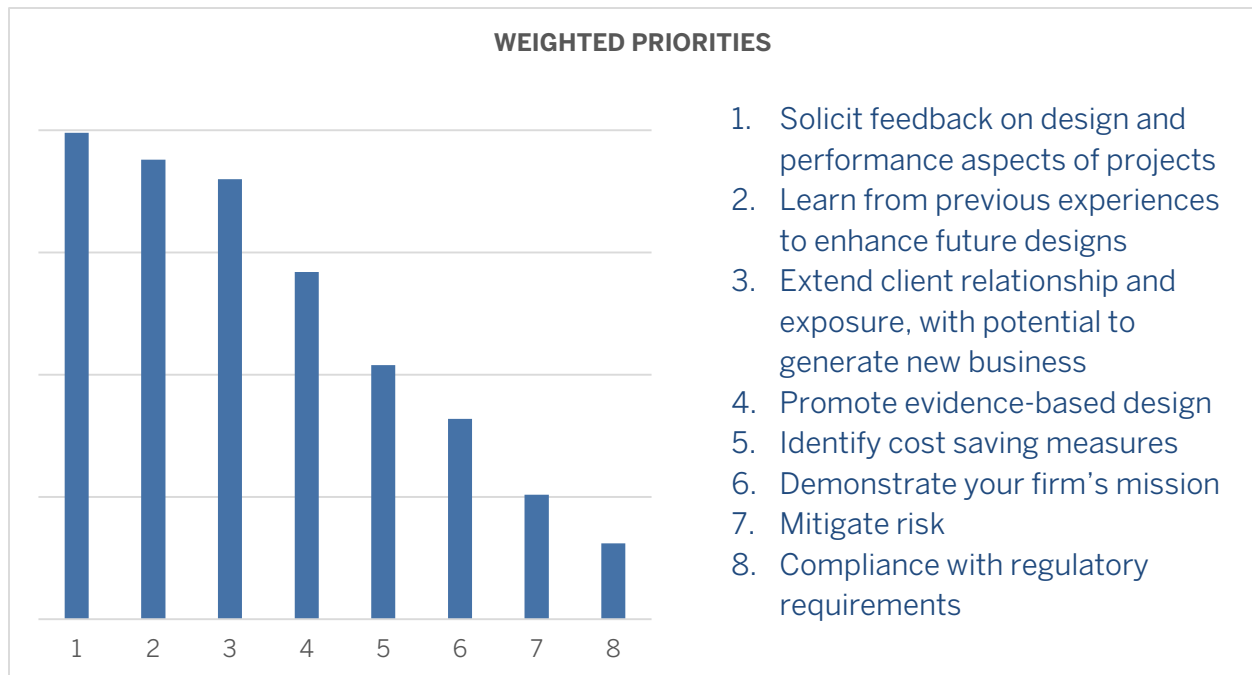


Figure 6: WHAT DO YOU HOPE TO ACHIEVE WITH POE?

the design, client and construction team an opportunity to evaluate the project, comparing the end result with initial Owner Project Requirements (OPR) or other stated design and performance goals. It is also a chance to verify the effectiveness of certain design strategies that may be replicated on future projects. One firm goes even further to conduct exit surveys with the design team and builder, to evaluate the design process itself, as well as the goal setting process.

The POE process offers a unique opportunity to engage the users of our completed projects, whether through interviews, surveys, observations, or happenstance conversations while taking measurements. Delivering a report with actionable items to enhance the effectiveness and performance of the project provides opportunities for the design team to give feedback and add value for our clients, building owners, and tenants.

Taking this thought logic to the next step, the E in POE could also be an abbreviation for “Excitement.” As we observe and learn how

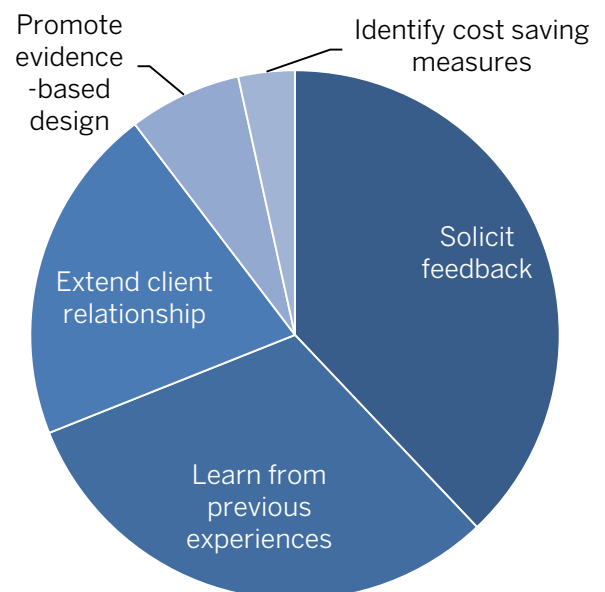


Figure 7: FIRST PRIORITY. 29 responses

people live, work and play in these environments, it is important to be reminded that although buildings provide shelter and functional requirements to support our contemporary lifestyles, the power of retaining an architect as part of the project team is as much art as science. We are the curators of beauty, inspiration, and planning for the future.

3.0 DEFINING THE SCOPE OF WORK

Post Occupancy Evaluation is a broad catch-all designation, and the scope of work can vary dramatically from project to project (by client interest and engagement, building typology, city or region). The potential scope to be considered can be categorized into quantitative and qualitative data. The following sections outline various methodologies that have been used to aggregate this information

3.1 Quantitative Metrics

Given the right equipment and access to the project site, measuring quantitative performance data is fairly simple and not that time consuming. The graph below (Figure 8) illustrates measurements currently taken by survey respondents in blue and metrics they would like to measure in the future in red.

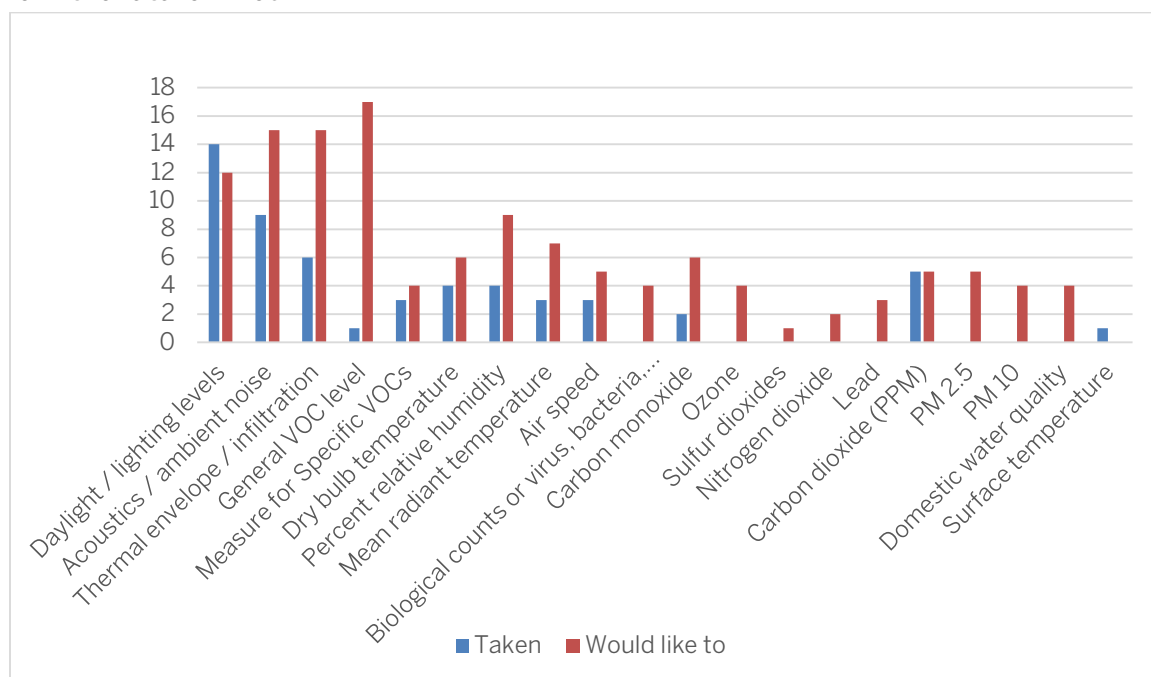


Figure 8: QUANTITATIVE MEASUREMENTS TAKEN AND DESIRED.

The top three metrics can be assessed with light meters, professional decibel meters (or a free application on your mobile device), and a thermal imaging camera. A basic light meter can be purchased for around \$100 - \$250, based on data logging and storage capacity. Thermal imaging cameras are more expensive and can be purchased from around \$4500 - \$6500 or rented.

Additionally, over half of the respondents noted that they would like to measure general volatile organic compound (VOC) levels, but this is easier said than done. ASHRAE 62.1 does not recommend target TVOC (total VOC) levels because there is no single method to measure all

VOCs that may be of concern. Instead, specific air quality measurements should be targeted and measured only if there is a known or suspected presence.² The following is a list of common chemicals of concern in nonindustrial environments:

- Carbon monoxide
- Formaldehyde
- Lead
- Nitrogen dioxide
- Odors
- Ozone
- Particulates
- Sulfur dioxide
- Radon
- VOCs
- TVOCs

Air quality monitors are expensive and results are often difficult to interpret. Portable sensors range dramatically in cost from \$3500 - \$30,000 each, depending on the substance to be measured. Bio-aerosol samples must be sent to a lab for testing, which requires additional cost. Fixed sensors can be used for ongoing monitoring with an approximate cost of \$1000 each, with a recommendation to provide 1 sensor for every 5,000 sf. To monitor a 100,000 sf building, an approximate cost of \$25,000 includes the sensor interface with a Building Automation System (BAS) or IP-based system.

In addition to taking physical measurements, additional quantitative data should be requested or observed as part of the POE analysis. 17 of the 20 respondents conducting POEs request operational hours as part of their POE process.

Almost all firms also include space usage observations (Figure 9) as part of their analysis.

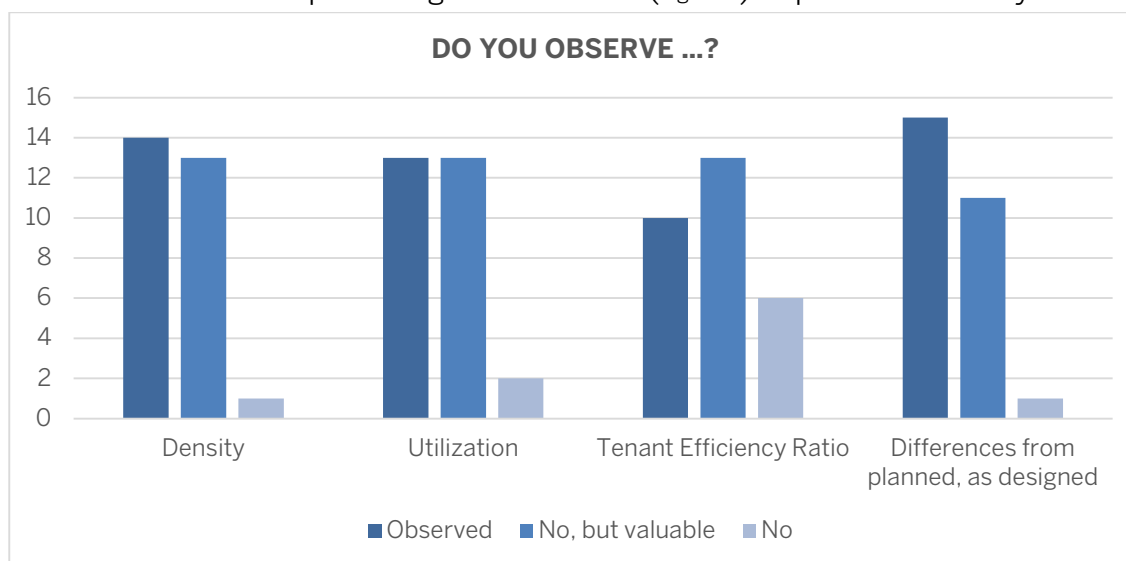


Figure 9: SPACE USAGE OBSERVATIONS

² "Chapter 7- IEQ Indoor Air Quality." *Performance Measurement Protocols for Commercial Buildings*. Atlanta: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 2010. 135-44. Print.

Additionally, most firms collect data from Facility Managers and Owners (Figure 10). The most accessible information is utility bill data if the tenant or building owner are willing to share this information. A review of control functionality can also be provided by the Facility Managers.

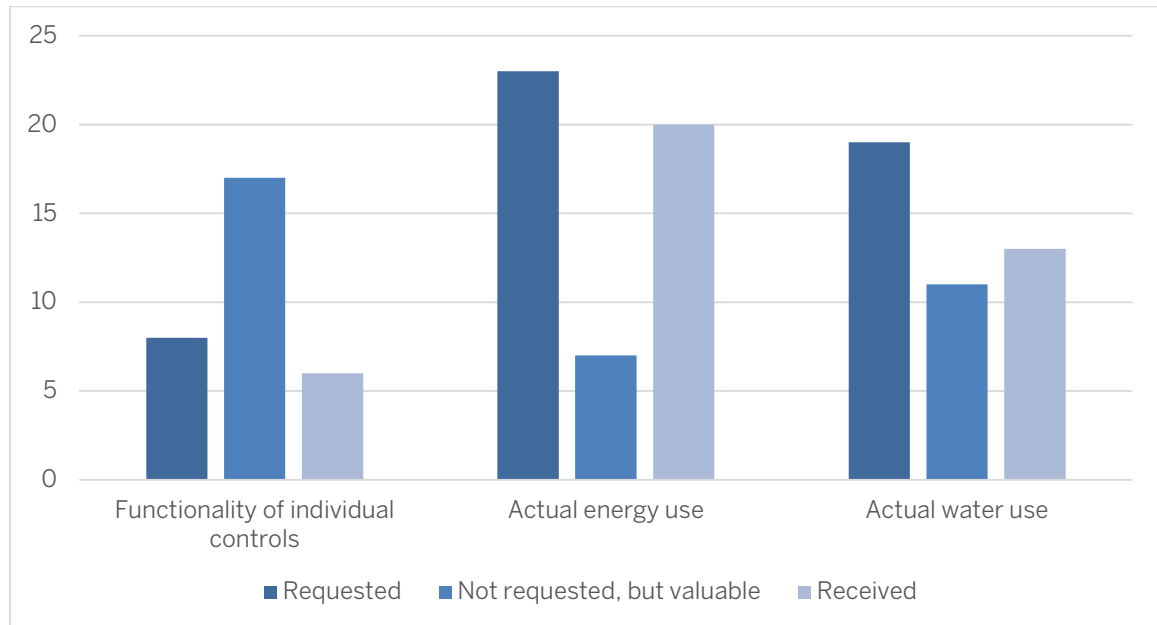


Figure 10: FACILITY MANAGEMENT METRICS REQUESTED, DESIRED AND RECEIVED

Baseline information (Figure 11) including clothing values and activity level can be used to calibrate qualitative responses in user surveys.

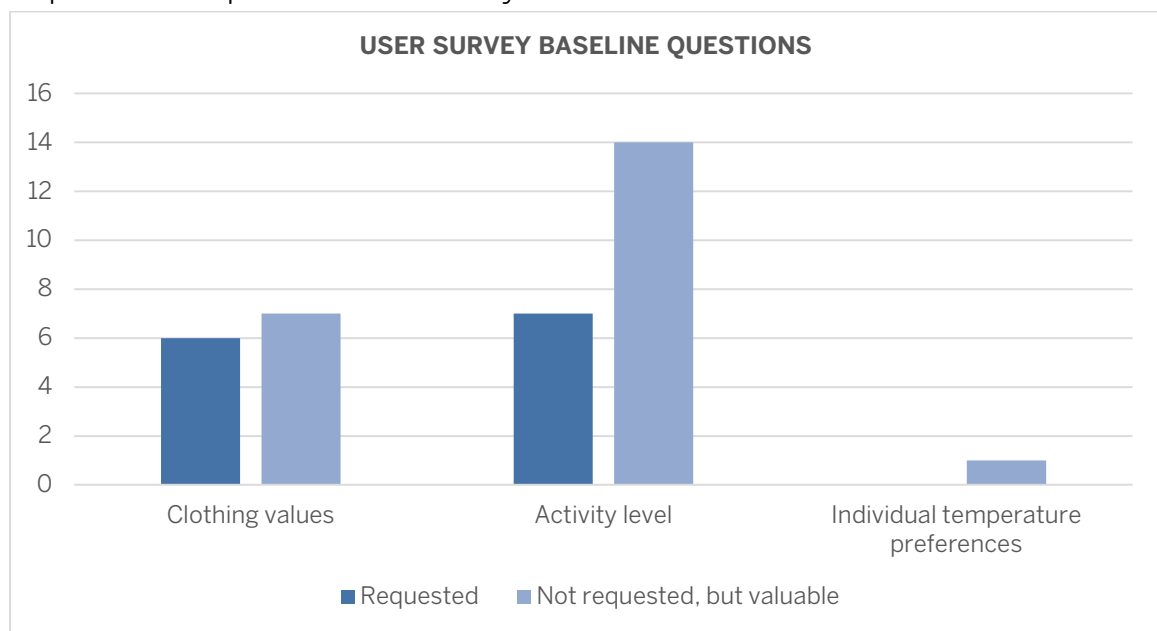


Figure 11: USER SURVEY QUESTIONS TO ESTABLISH BASELINE

Performance data from Human Resource departments can also be collected (Figure 12). This is not currently a common practice among the practitioners surveyed, but will add value to the data collected, especially if pre- and post- occupancy metrics can be compared.

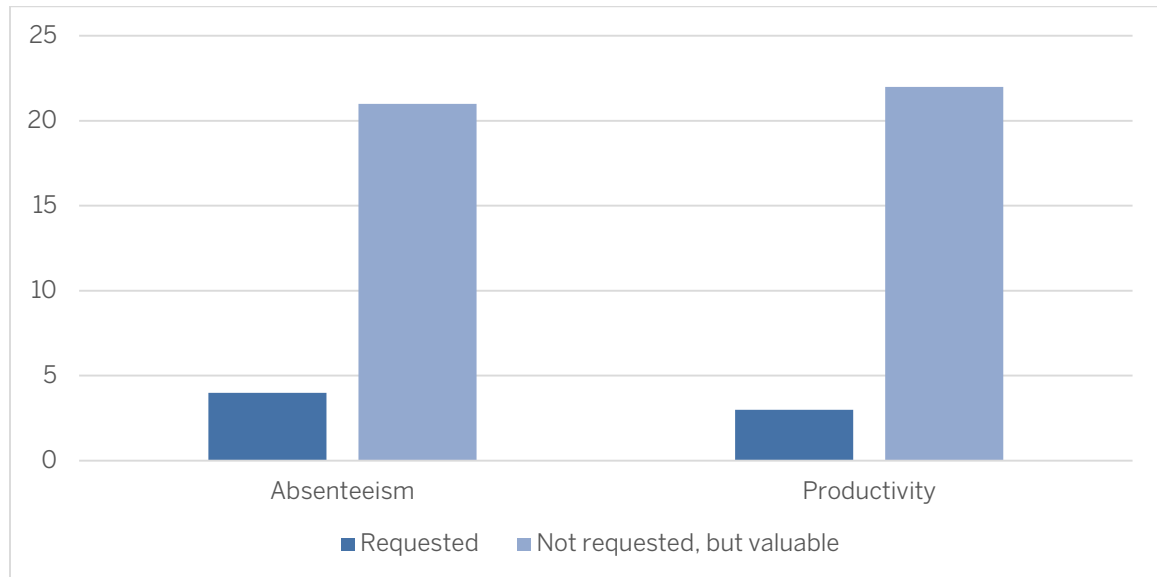


Figure 12: HUMAN RESOURCE METRICS

3.2 Qualitative Surveys and Observations

A series of qualitative metrics are also evaluated by this group through the use of surveys (Figure 13). Most see value in expanding the review to include additional data points. Again, blue represents current data collection.

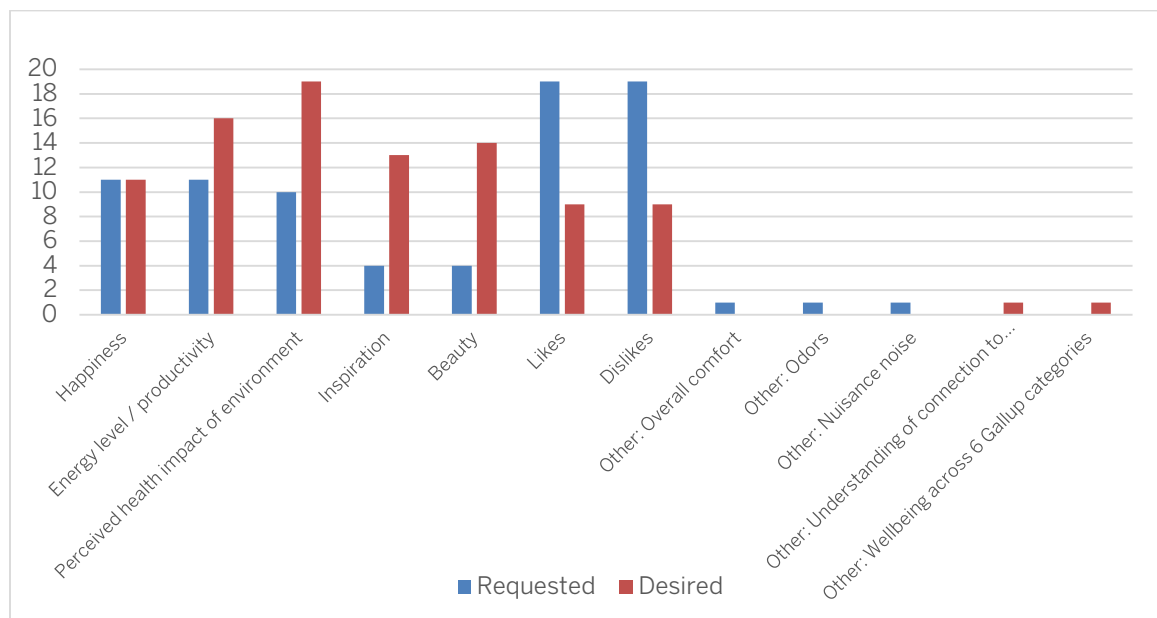


Figure 13: QUALITATIVE METRICS REQUESTED AND DESIRED

A significant challenge with evaluating user feedback is understanding the cause **or** correlation to building design, construction, and operations. Occupants' relationship with supervisors and other employees, as well as job satisfaction and overall stress levels could impact survey or interview responses. Someone may just be having a bad (or good) day. Great care should be taken when formulating survey questions. There are professionals, such as ethnographers or strategy consultants, specifically trained to interview and develop neutral and effective survey questions.

It is most helpful to look for patterns in the responses. A large enough sample set, across multiple office divisions or workgroups will help normalize the results, and identify trends, as well as outliers. One should expect to receive a large proportion of negative feedback, since most people typically make more of an effort to complain than to provide compliments. Interviews allow an opportunity to dig deeper, by asking follow up questions to better contextualize the responses given. The most effective strategy noted by several respondents is to tie the question to specific building attributes, such as daylight, sound, thermal comfort, or connection to their employer's specific needs or mission statement.

How questions are positioned can make a difference as well. As an example, if occupants are asked an open ended question such as how does the space positively or negatively affect your performance, respondents will be less likely to admit to a negative impact on their job performance, even if they are very dissatisfied with the space.

The architects surveyed use a variety of strategies to develop POE surveys. Most firms create their own custom questionnaires (Figure 14). Some of these custom forms are supplements to the Center for the Built Environment (CBE) and General Services Administration (GSA) POE survey questions. Some clients have developed their own POE forms that their design teams uses to administer POEs.

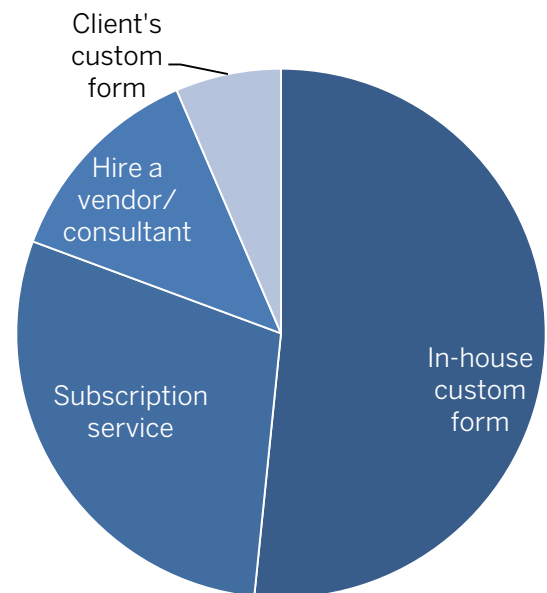


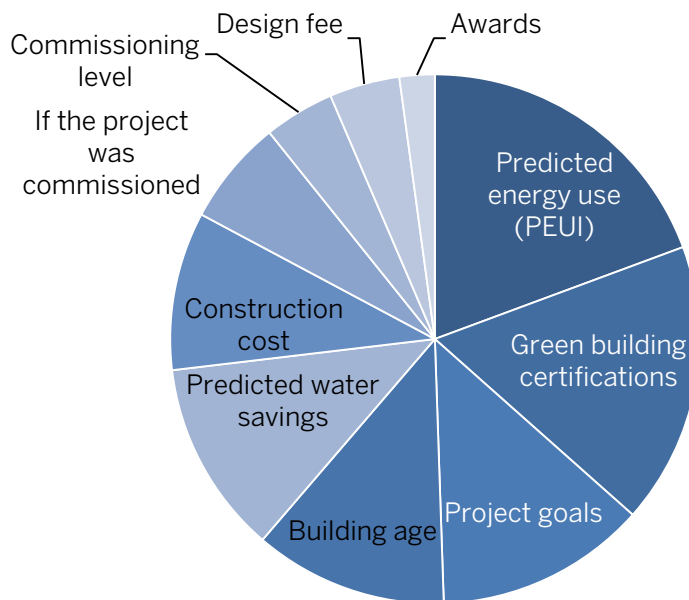
Figure 14: QUESTIONNAIRE DEVELOPMENT

Because most architects are not specialized in interpreting this type of data, it may be helpful to use an outside resource to prepare survey questions and interpret the results. A small percentage of this group subcontracts this service out to a vendor or sub-consultant. An array

of Strategy Consultants can be retained to lead these efforts, or to provide the full service as a package. The middle road is to subscribe to a subscription-based service, which provides the survey and analyzes the results and provides conclusions. CBE is a popular choice and offers several free studies with membership. One firm responded to the survey noting that they have collaborated with their client's Human Resources department to filter qualitative feedback.

3.3 Comparing POE results with Project-specific data

To better understand the quantitative metrics and qualitative data generated, it is important to also document other project criteria (such as those shown in Figure 15), whether they are external to the design, or part of the initial project goals. Having this information included in a POE analysis will enhance the value of the information collected.



Several of the respondents measure success against specific Owner Project Requirements (OPR) or the project's Basis of Design (BOD). Benchmarking against client objectives is one clear way of demonstrating a project's successes. Through the development of a POE process, most firms recognized a need to formalize project goals in a standardized document. POEs have also helped encourage teams to set higher goals. Setting aspirational goals likely leads to achieving them, or getting somewhere close to these goals. When modest goals are set, you rarely go further.

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Those that assess commissioning levels as part of their POE process usually align this with LEED requirements, although often clients have additional items they add to the scope of work.

3.4 Engagement

The Post Occupancy platform is also an effective means of re-engaging with clients and user groups. Since POEs should not be conducted immediately after project turnover, but rather after about a year (see section 3.5), this is an ideal opportunity to reconnect with a client or tenant group to collaboratively evaluate a project, understand if their priorities or design goals for future projects have changed, and evaluate new opportunities to collaborate. Based on the priorities noted in section 1.4 above, Evaluation could easily be replaced with a more active Engagement in the POE acronym.

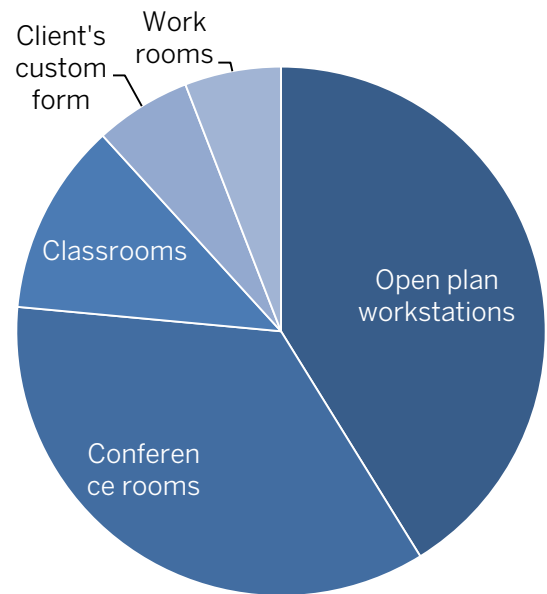


Figure 16: QUESTIONS ADDRESSING SPECIFIC AREAS OF INTEREST

POEs are an opportunity for designers and owners to solicit direct feedback from the users and operators on the functionality and success of various project components. The architects who participated in this study include survey or interview questions specifically about open plan workstations, conference rooms, and classrooms, where applicable (Figure 16).

Feedback during the POE process is often solicited from a variety of project stakeholders (Figure 17), extending beyond the building occupants. Only six of the respondents did not have a desire to increase the variety of stakeholder feedback to include in the POE process.

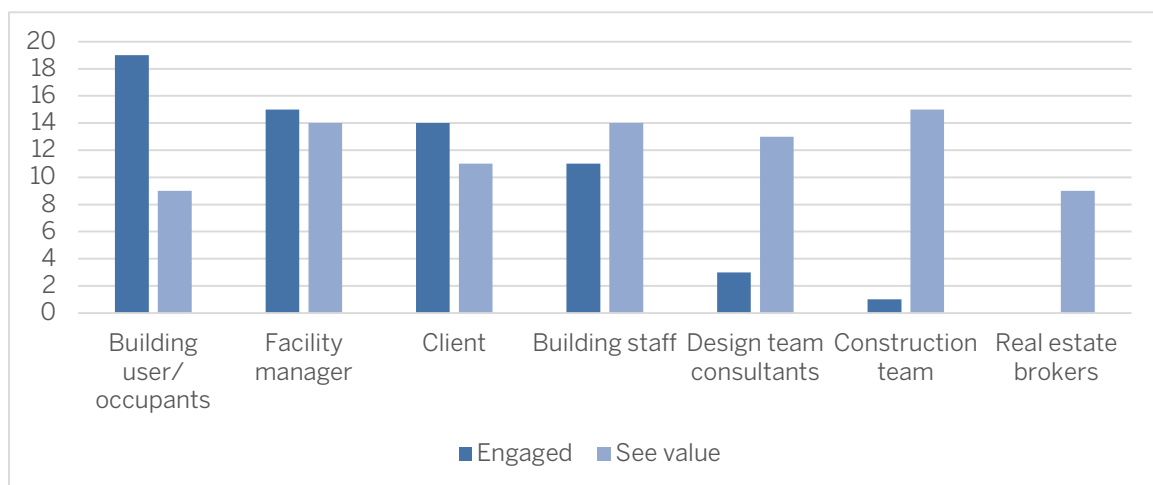


Figure 17: STAKEHOLDER ENGAGEMENT REQUESTED AND DESIRED

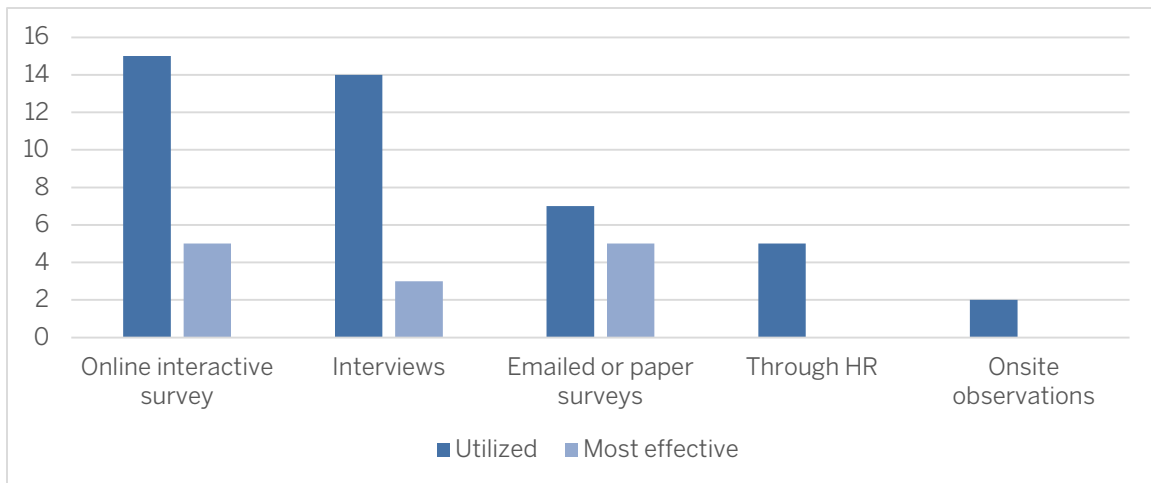


Figure 18: METHOD OF ENGAGING STAKEHOLDERS

Several methodologies are used to collect qualitative user feedback, including in-person and telephone interviews, emailed or distributed paper surveys, online interactive surveys, utilizing an organization's Human Resources department, site visits, or through onsite observations (Figure 18). Of these various means of data collection, there is not one clear, most effective strategy reported by survey respondents. It is often believed that in-person interviews are the most effective in learning about project performance and user impacts, however anonymity also encourages a greater response. Respondents concluded that anonymity increased participation and also more candid feedback. Some thought distributed surveys were excellent, others had low participation rates and got much better results with interviews, whether in person or via telephone.

Of the 20 responses to our inquiry on survey question types, most utilized a combination of question styles (Figure 19). There was no clear, most effective way to solicit responses. Several noted that open ended responses were the most effective in really understanding what is going on. However these types of questions require a greater commitment on the part of the user, as well as the evaluator. Free-response questions may also require more specialized expertise to evaluate the responses. Responses can be highly influenced by the order of questions, leading information in the question itself, and a variety of unrelated circumstances. The way a question is worded can also bias the response.

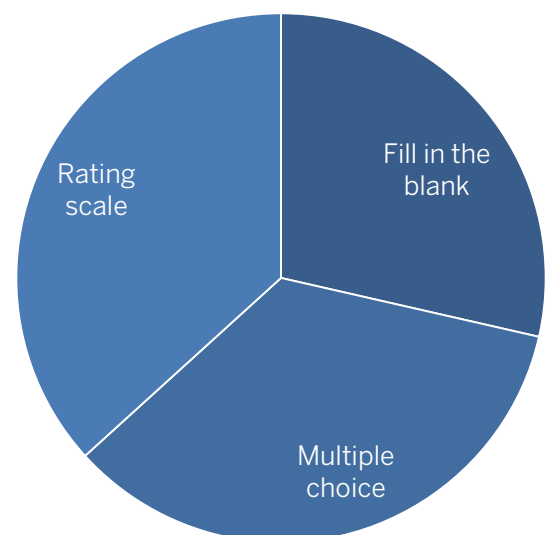


Figure 19: SURVEY QUESTION TYPES

After spending all this effort on data collection, it is very important to analyze and use it effectively. Finding the most appropriate way for your practice to communicate these results to clients, design team members, and/or user groups varies. However this very important last step is the synthesis of all this work and is thus very important.

3.5 Timing

The importance of getting pre-occupancy data has been discussed. This assessment can be provided during the Programming or early design phases (Figure 20). Although most prefer to wait until around the one year anniversary of occupancy to provide the POE service, some start as early as 6-8 months after a building is turned over for occupancy. It is beneficial to have full occupancy to really understand how the building is performing.

Some teams also provide a mini-POE immediately after construction or around the three months after occupancy, which could be tied to the Commissioning process.

A few teams found it helpful to provide POEs as late as two to three years after occupancy. In these cases, building operators and managers continue to improve upon the calibration of the building systems in an iterative manner with repetitive measurement and verification, along with recalibration of the design case energy model. Usage also changes as occupancy increases or if there are program changes and/or relocations of various user groups. These are all good opportunities to re-engage with a POE.

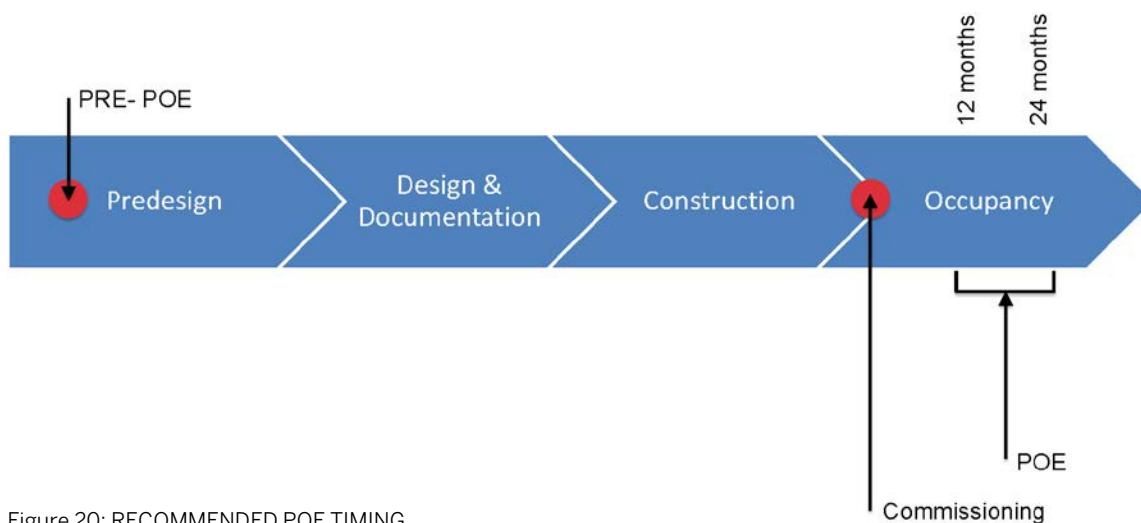


Figure 20: RECOMMENDED POE TIMING

3.6 Resources

Perhaps the most important consideration when trying to determine the extent of POE services to offer is the question of how much effort it will require. The range of person-hours required to complete a POE varies drastically from project to project and in different firms surveyed (Figure 21). The least amount of time reported was 8 hours to aggregate performance data into a report. Compare this to over 200 hours reported by another firm. A significant amount of time can also be dedicated to establishing a process that can be replicated on future projects. One firm has spent over 2400 hours in the process of completing ten POEs. However the bulk of the effort was focused on the first few projects where the team was establishing their process and a set of internal standards. As addressed in the scope section, one of the reasons for these large variances is that the scope of work can also vary greatly. A reasonably effective POE could be completed within a week, given the right tools, resources, and experience. According to several respondents, a predominantly survey-based POE can be completed in under 40 hours, including report preparation.

Overwhelmingly, architects are not charging clients for this service (Figure 22). One firm has services to provide POEs for an entire school district. Another noted that, periodically, their healthcare research and consulting team is able to consolidate POE efforts with other related services, as a package. If POE is not specifically requested by clients, there are clear challenges providing these type of services in competitive markets, especially if clients are comparing proposals from various potential architects. It is difficult to communicate the added value of this enhanced service in an RFP response. Although the cost can be broken out as a potential additional service, it is unlikely the client will elect to increase their cost without a clear demonstration of the value to them. If costs are absorbed into project or office overhead, it may become difficult to complete the studies that

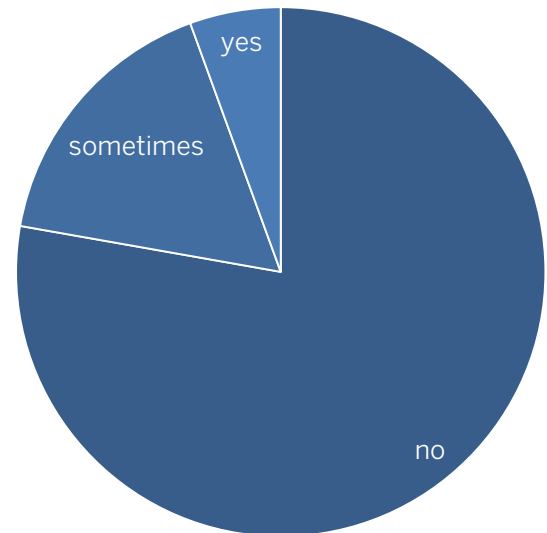


Figure 21: PERSON-HOURS TO COMPLETE ONE POE. 10 responses

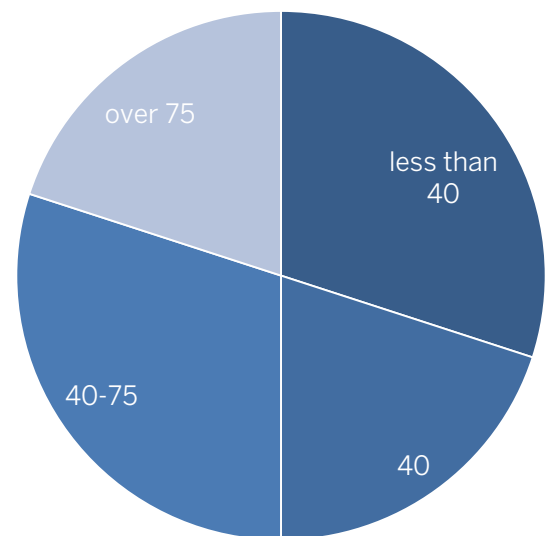


Figure 22: DO YOU BILL CLIENTS FOR THIS SERVICE? 18 responses

happen well after project completion, when project team members have moved onto other efforts, or other ongoing billable tasks take precedence at that time.

4.0 CONCLUSIONS AND DISCUSSION

If firms are serious about conducting Post Occupancy Evaluation, a real commitment must be made on behalf of the firm, which includes a financial commitment and process to track and maintain compliance. Conversations with legal advisors may be required to bring comfort to all parties involved, especially to address concerns of perceived risk and liability from the discovery and/or documentation of occupant dissatisfaction or building performance concerns. Training will be required to familiarize teams with tools and methodologies to conduct POEs, analyze the results, and provide actionable reports.

The benefits of POE to each individual firm should be considered in relationship to the needs above. Will POEs influence and improve design outcomes of future projects? Will the experience conducting POEs and the resulting knowledge give your office a competitive advantage and help distinguish your practice from that of your peers? Will the re-engagement of clients and project stakeholders contribute to the development of new business? Will the increasing interest in Post Occupancy Evaluation lead to a shift in the standard of care, influencing the standard services architects provide?

As the results of this survey of Sustainable Design Leaders across the U.S. and Canada shows, several firms have established Post Occupancy Evaluation as part of their standard practice. All of the respondents are planning to conduct more POEs in the future, almost all with the goal of providing this service on a majority of their projects.

4.1 Next Steps

The New York City Regional SDL will host a series of roundtable discussions engaging the design, building construction and real estate industries, as well as strategy consultants, marketing specialists and legal counsel. Look for a report on the conclusions from these discussions next year.

5.0 ACKNOWLEDGEMENTS

As a project manager at Skidmore, Owings & Merrill in New York, **Julie Hiromoto** manages complex projects, balancing design excellence and technical expertise. Her diverse portfolio includes supertall office buildings, tenant interiors, residential and mixed-use towers, healthcare master planning and a datacenter. She has worked extensively in New York City and on projects in Mexico City and South Korea.

As a Project Manager, Designer and Senior Technical Architect, Ms. Hiromoto has specialized in curtain walls and sustainable, energy efficient design. She pursues her passion for green building by leading SOMNY's High Performance Design initiatives and through her work launching the Center for Architecture Science and Ecology (CASE).

Julie also serves as an Adjunct Professor with New York University's Shack Institute of Real Estate. She is the Vice-Chair of the Large Firm Roundtable Sustainability Group and the New York Regional Leader of the A+D Sustainable Design Leaders Network. Ms. Hiromoto completed a BS ARCH at Georgia Tech summa cum laude and a MARCH, with highest honor, from Columbia University's Graduate School of Architecture Planning and Presentation (GSAPP).

5.1 Advisors

Thank you to the 2013 POE breakout discussion participants who laid the ground work for this report: Robert Winstead (Stantec Architects) and Mike Manzi (Boora Architects) provided comments and feedback on the initial survey questions and responses. Nadav Malin (BuildingGreen) also made recommendations on the data collection process.

5.2 Peer Reviewers

Mina Hasman, LEED AP BD+C, BREEAM AP
Skidmore, Owings & Merrill, Inc

Julie Hendricks, AIA, LEED AP
Vice President, Director of EcoServices
Kirksey Architecture

Teresa Rainey, PE, P.Eng., LEED Fellow
Director
Skidmore, Owings & Merrill LLP

5.3 Survey Participants and Contributors

The Architecture Sustainable Design Leaders Network is open to all design firms with over forty employees. Individuals with this responsibility within each organization are invited to contribute to the network via an internet hosted bulletin board. An annual summit provides an opportunity for up to two representatives from each office represented in the network to collaborate face to face, allowing opportunities for knowledge sharing, cross fertilization of ideas, peer support and relationship development. The following firms contributed responses to the survey included in this report:

- Bergmeyer Associates
- BNIM
- Boora Architects
- Cannon Design
- FXFOWLE
- Gensler
- GGLO
- HCMA
- HKS
- HOK
- Kirksey
- KlingStubbins
- Lake|Flato Architects
- Moody Nolan
- NBBJ
- Payette
- Perkins+Will
- RTKL
- SCB
- Stantec Architecture
- Skidmore, Owings & Merrill LLP
- SGJJR, Phoenix Office
- SMMA
- The Beck Group
- The Miller Hull Partnership
- Tsoi/Kobus & Associates
- WRNS Studio
- Yost Grube Hall Architecture
- ZGF

6.0 APPENDIX

6.1 Appendix A- Sustainable Design Leaders Survey

6.2 Appendix B- Sample POE Survey Questions

6.3 Appendix C- Examples and Case Studies

6.4 Appendix D- Resources

Appendix A- Sustainable Design Leaders Survey

SDL- 2014 POE survey

At last year's retreat, many were interested in better understanding our Post Occupancy Evaluation efforts. The information you provide will be kept confidential, aggregated and reported back to the SDL group at this year's annual summit at the end of July.

*** Required**

Office Name *

Name of individual completing survey *

in case clarifications to your answers are required

The responses to this survey correspond to: *

☐ my entire office (firm-wide)

☐ Other:

Do you currently conduct POEs? *

☐ Yes

☐ No

Current State of Affairs

Would you like to do more POE?

☐ Yes

☐ No

What percentage of projects is ideal?

What are the challenges to conducting POEs on every project?

Do your clients value this service?

☐ yes

☐ no

☐ not sure



Additional comments

Appendix A- Sustainable Design Leaders Survey

List any functional markets where clients seem to be more responsive to POEs?

List any geographic markets where clients seems to be more responsive to POEs?

Our office has conducted POE(s)

How many POEs has your completed?

- ☐ 1 - 5
- ☐ 6 - 10
- ☐ 11 - 25
- ☐ 26 - 100
- ☐ more than 100
- ☐ Other:

What percentage of projects completed in the last year?

Would you like to do more?

- ☐ Yes
- ☐ No

Rank your priorities in what you hope to achieve with POE.

If one of the choices below is not a goal, do not select it and leave the rest of the questions on this page unanswered.

First priority

- ☐ Solicit feedback on design and performance aspects of projects.
- ☐ Extend client relationship and exposure, with potential for generating new business.
- ☐ Learn from previous experiences to enhance future designs.
- ☐ Identify cost saving measures.
- ☐ Promote evidence-based design.
- ☐ Regulatory requirements- which specifically?
- ☐ Demonstrate your firm's mission.
- ☐ Mitigate risk.
- ☐ Other:

Appendix A- Sustainable Design Leaders Survey

Quantitative data

Check all of the physical measurements you currently take.

- ☐ Daylight / lighting levels
- ☐ Acoustics / ambient noise
- ☐ Thermal Envelope / infiltration
- ☐ General VOC level
- ☐ Measure for specific VOCs. List which specifically in the comment box below
- ☐ Dry bulb temperature
- ☐ % relative humidity
- ☐ Mean radian temperature
- ☐ Air speed
- ☐ Biological counts or virus, bacteria, etc.
- ☐ Carbon monoxide
- ☐ Ozone
- ☐ Sulfur Oxides
- ☐ Nitrogen Dioxide
- ☐ Lead
- ☐ CO2 (PPM)
- ☐ PM 2.5 ($\mu\text{g}/\text{m}^3$)
- ☐ PM 10 ($\mu\text{g}/\text{m}^3$)
- ☐ Domestic water quality
- ☐ Other:

We don't currently, but see value in taking the following physical measurements.

- ☐ Daylight / lighting levels
- ☐ Acoustics / ambient noise
- ☐ Thermal Envelope / infiltration
- ☐ General VOC level
- ☐ Measure for specific VOCs. List which specifically in the comment box below
- ☐ Dry bulb temperature
- ☐ % relative humidity
- ☐ Mean radian temperature
- ☐ Air speed
- ☐ Biological counts or virus, bacteria, etc.
- ☐ Carbon monoxide
- ☐ Ozone
- ☐ Sulfur Oxides
- ☐ Nitrogen Dioxide
- ☐ Lead
- ☐ CO2 (PPM)
- ☐ PM 2.5 ($\mu\text{g}/\text{m}^3$)
- ☐ PM 10 ($\mu\text{g}/\text{m}^3$)
- ☐ Domestic water quality
- ☐ Other:

Appendix A- Sustainable Design Leaders Survey

Do you request operational hours?

- ☐ yes
- ☐ no
- ☐ we don't, but this would be valuable

Do you observe space use: density?

- ☐ yes
- ☐ no
- ☐ we don't, but this would be valuable

Do you observe space use: utilization?

- ☐ yes
- ☐ no
- ☐ we don't, but this would be valuable

Do you observe space use: tenant efficiency ratio?

- ☐ yes
- ☐ no
- ☐ we don't, but this would be valuable

Do you observe space use: differences from what was planned / designed?

- ☐ yes
- ☐ no
- ☐ we don't, but this would be valuable

Check all the items you REQUEST from facility managers / ownership

- ☐ functionality of individual controls
- ☐ actual energy use
- ☐ actual water use
- ☐ Other:

Check all the items you RECEIVE from facility managers / ownership

- ☐ functionality of individual controls
- ☐ actual energy use
- ☐ actual water use
- ☐ Other:

We don't currently request this data, but see value doing so

- ☐ functionality of individual controls
- ☐ actual energy use
- ☐ actual water use
- ☐ Other:

Appendix A- Sustainable Design Leaders Survey

We collect the following data in user surveys

☐ Clothing values

☐ activity level

☐ Other:

We don't currently, but see value in collecting the following data in user surveys

☐ Clothing values

☐ activity level

☐ Other:

We work with Human Resource teams to collect the following metrics

☐ absenteeism

☐ productivity

☐ Other:

We don't currently, but see value in working with HR to collect metrics on:

☐ absenteeism

☐ productivity

☐ Other:

Qualitative data

Check the following qualitative metrics you currently evaluate from the user's perspective

☐ happiness

☐ perceived health impact of environment

☐ energy level / productivity

☐ inspiration

☐ beauty

☐ likes

☐ dislikes

☐ Other:

Appendix A- Sustainable Design Leaders Survey

We don't currently, but see value in evaluating the following from the user's perspective

- ☐ happiness
- ☐ health impact of environment
- ☐ energy level / productivity
- ☐ inspiration
- ☐ beauty
- ☐ likes
- ☐ dislikes
- ☐ Other:

How do you determine if the above is based on the physical environment, or someone just not liking their job (or the people they work with)?

Please elaborate on how you (would) collect qualitative feedback.

Comparing POE results with project-specific data

Check the following which you evaluate in conjunction with POE.

- ☐ building age
- ☐ construction cost
- ☐ design fee
- ☐ green building certifications
- ☐ awards
- ☐ project goals, such as individual user control, percent vision area, etc. Please elaborate in comment box below.
- ☐ if the project was commissioned
- ☐ commissioning level. describe how you define this in the comment box below.
- ☐ PEUI
- ☐ predicted water savings
- ☐ Pre-construction data (comparing before and after user feedback and/or data)

Care to elaborate on project goals?

How do you assess commissioning level?

Appendix A- Sustainable Design Leaders Survey

Your POE process

Which of the following do you use as a basis for developing POE questions? Check all that apply

- ☐ Hire a vendor / consultant who provides a complete packaged service.
- ☐ Subscribe to a membership service
- ☐ Create a custom questionnaire in house.
- ☐ Other:

Would you be willing to share your POE survey?

- ☐ yes
- ☐ no
- ☐ ask me again in a few weeks

Who provides feedback during your POE?

- ☐ building users / occupants
- ☐ client
- ☐ facility manager
- ☐ real estate broker
- ☐ building staff
- ☐ construction team
- ☐ design team consultant
- ☐ Other:

Currently, these stakeholders do not provide POE feedback, but we see value in engaging them.

- ☐ building users / occupants
- ☐ client
- ☐ facility manager
- ☐ real estate broker
- ☐ building staff
- ☐ construction team
- ☐ design team consultant
- ☐ Other:

Do you ask questions specific to certain program areas? Which ones?

- ☐ conference rooms
- ☐ private offices
- ☐ open plan workstations
- ☐ Other:

When is the best time to conduct a POE

On average, how many person-hours do you spend on a POE?

Appendix A- Sustainable Design Leaders Survey

Which delivery methods do you currently utilize?

- ☐ interviews: face-to-face or telephone
- ☐ online interactive survey
- ☐ emailed or paper survey
- ☐ work with / through employers' Human Resources teams
- ☐ Other:

Which methodology do you find most effective and why?

How do you solicit responses?

- ☐ fill in the blank
- ☐ multiple choice
- ☐ rating scale

Which is the most effective to meet your firm's POE goals? Why?

Do you typically bill clients for this service?

- ☐ yes
- ☐ no
- ☐ Other:

I'd like to share a successful POE case study. Please contact me at the email address or telephone number below.

References and Resources

Please check any of the resources below which you have consulted and found helpful.

- ☐ Center for Built Environment (CBE) IEQ survey and building benchmarking
- ☐ Performance Measurement Protocols for Commercial Buildings (ASHRAE / USGBC / CIBSE)
- ☐ GSA design standard compliance for end user satisfaction, sustainability and operational effectiveness
- ☐ British Council of Offices (BCO) POE Guide
- ☐ Construction Industry Council (CIC) Design Quality Indicator (DQI)
- ☐ HCFE / AUDE / University of Westminster POE Guide
- ☐ Other:

Appendix B- Sample POE Survey Questions

- Healthcare (for patients/family and staff)
- Office

Appendix B- Sample POE Survey Questions

[Organization Name]

Post-Occupancy Evaluation User Questions: **Patients and Family**

Your participation in this survey will help hospital administrators and the architecture/design team understand how the facility is currently performing in terms of its physical built environment. When answering questions, keep in mind your experience of the hospital's physical appearance: how it looks and feels, your impression of finding your way throughout the building, and how that may have impacted your visit. Your answers will inform future best practices for hospital design. Please anticipate 10 minutes for completion of the survey.

1. Patient Age: _____ Gender (please check one): Male Female
2. Relationship of person completing survey to patient: _____
3. Number of days in hospital: _____
4. Please circle the value on the following scale that best describes your experience at the hospital in the following space types:

	VERY DISSATISFIED			NEUTRAL			VERY SATISFIED	
	1	2		3	4		5	N/A
Car Valet Area/ Parking								
Main Information & Greeter Desk Experience	1	2		3	4		5	N/A
Family Resource Center and Childrens' Reading Room	1	2		3	4		5	N/A
Patient Room experience	1	2		3	4		5	N/A
Family Lounge	1	2		3	4		5	N/A

Please provide brief (one or two sentence) responses to the following questions.

5. Was it easy to find your way throughout the unit and the building? Why, or why not?
6. Did you feel comfortable in the patient rooms? If not, what design improvements would better support your comfort?
7. Did you feel that you were able to maintain your personal privacy throughout your visit? If not, in your opinion what design improvements would better support your privacy?
8. What do you think is the best physical feature of the hospital?
9. If you could change one thing about the appearance or design of the facility, what would it be?
10. Please add any comments that you have:

Thank you very much for your time.

Appendix B- Sample POE Survey Questions

[Organization Name]

Post-Occupancy Evaluation User Questions: **Hospital Staff**

Your participation in this survey will help hospital administrators and the architecture/design team understand how the facility is currently performing in terms of its physical built environment. When answering questions, bear in mind your experience of the hospital's physical appearance: how it looks, how spaces function and relate to each other, and how that may impact your ability to perform your role. Your answers will serve to inform future best practices for hospital design. Please anticipate 10-15 minutes for completion of this survey.

1. What is the job title for your current position?
2. How many years have you worked at or been affiliated with this institution?
3. Were you involved in the planning and design for the new facility? Yes No
4. Does the completed facility meet your expectations in terms of the physical environment? Yes No
Why or why not?

4. Please circle the value on the following scale that best describes your experience at the hospital in the following space types:

	DOES NOT FUNCTION WELL				FUNCTIONS VERY WELL	
Family Consult Room	1	2	3	4	5	N/A
Toy Closet & Playroom	1	2	3	4	5	N/A
Shared Offices/ Work Areas/Workroom	1	2	3	4	5	N/A
Staff Lounge	1	2	3	4	5	N/A
Locker Room	1	2	3	4	5	N/A
Care Team workstations	1	2	3	4	5	N/A
Conference/ Education Room	1	2	3	4	5	N/A
Patient Rooms	1	2	3	4	5	N/A
Medication Station/ Room	1	2	3	4	5	N/A
Nourishment Room	1	2	3	4	5	N/A
Soiled/Clean Supplies	1	2	3	4	5	N/A
Pneumatic Tube Delivery System	1	2	3	4	5	N/A
Central Core on Units	1	2	3	4	5	N/A

Please provide brief (one or two sentence) responses to the following questions.

6. Does your physical work environment facilitate efficient and effective patient care? Why or why not?
7. Do the designated staff work areas support the day-to-day functions that are crucial to your role? If not, where do difficulties occur and what could be done to improve your experience?
8. Can stretchers, wheelchairs, cribs, beds, equipment and other furniture be moved flexibly from room to room throughout the facility? If not, where do difficulties occur?
9. How could the hospital's physical environment have a more positive effect on patients?
10. Is there anything else you want to say about the physical performance of this facility?

Thank you for your time.

Appendix B- Sample POE Survey Questions

POST OCCUPANCY EVALUATION STUDY SURVEY - OFFICE OCCUPANTS

BACKGROUND

How many years have you worked in this building?

- ☐ Less than 1 year
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ More than 5 years

How long have you been working at your present workspace?

- ☐ Less than 3 months
- ☐ 4-6 months
- ☐ 7-12 months
- ☐ More than 1 year

In a typical week, how many hours do you spend in your workspace?

- ☐ 10 or less
- ☐ 11-30
- ☐ More than 30

What is your age?

- ☐ 30 or under
- ☐ 31-50
- ☐ Over 50

What is your gender?

- ☐ Female
- ☐ Male

COMMUTE

On average, many days per week do you travel to the office?

On average, how far is your typical daily commute to and from this building (in miles)?

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

PERSONAL WORKSPACE LOCATION

In which area of the building is your workspace located? See diagram above.
[List multiple choices that correspond with our floor plan zone diagram for each building.]

Are you near a window (within 15 ft.)?

- ☐ Yes
- ☐ No

How satisfied are you with your access to a window view?

0 0 0 0 0 0 0

Very Satisfied Undecided Very Dissatisfied

PERSONAL WORKSPACE DESCRIPTION

Which of the following best describes your personal workspace?

- ☐ Enclosed office, private
- ☐ Enclosed office, shared with other people
- ☐ Cubicles with high partitions (about five or more feet high)
- ☐ Cubicles with low partitions (lower than five feet high)
- ☐ Workspace in open office with no partitions (just desks)
- ☐ Other:

Is there carpet on most or all of the floor at your workstation?

- ☐ Yes
- ☐ No

In general, how clean is your workspace area? (For this questionnaire, your "workspace" is the immediate area surrounding your workstation.)

- ☐ Very clean
- ☐ Reasonably clean
- ☐ Somewhat dusty / dirty
- ☐ Very dusty / dirty

During the PAST THREE MONTHS, have the following changes taken place within 15 feet of your current workstation? (Check all that apply.)

- ☐ New carpeting
- ☐ Walls painted
- ☐ New furniture
- ☐ New partitions
- ☐ New wall covering
- ☐ Water damage

How often do you use the following at work? (Check the appropriate box for each item.)

Desktop or laptop computer

- ☐ Several times a day
- ☐ About once a day
- ☐ 3-4 times a week
- ☐ Less than 3 times a week
- ☐ Never

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

Photocopier

- ☐ Several times a day
- ☐ About once a day
- ☐ 3-4 times a week
- ☐ Less than 3 times a week
- ☐ Never

Laser Printer

- ☐ Several times a day
- ☐ About once a day
- ☐ 3-4 times a week
- ☐ Less than 3 times a week
- ☐ Never

Cleanser, glue, correction fluid, or other odorous chemicals

- ☐ Several times a day
- ☐ About once a day
- ☐ 3-4 times a week
- ☐ Less than 3 times a week
- ☐ Never

How satisfied are you with the amount of space available for individual work and storage?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

How satisfied are you with the level of visual privacy?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

How satisfied are you with ease of interaction with co-workers?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

Overall, does the office layout enhance or interfere with your ability to get your job done?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Enhances Undecided Interferes

How satisfied are you with your ability to adjust your furniture to meet your needs?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

How satisfied are you with the colors and textures of flooring, furniture and surface finishes?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

PRODUCTIVITY (INDIVIDUAL AND AS A GROUP)

How satisfied are you with your individual effectiveness or performance?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

How satisfied are you with your overall effectiveness or performance as a group?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

THERMAL COMFORT

Which of the following do you personally adjust or control in your workspace?
(Check all that apply.)

- ☐ Window blinds or shades
- ☐ Operable window
- ☐ Thermostat
- ☐ Portable heater
- ☐ Permanent heater
- ☐ Room air-conditioning unit
- ☐ Portable fan
- ☐ Ceiling fan
- ☐ Adjustable air vent in wall or ceiling
- ☐ Adjustable floor air vent (diffuser)
- ☐ Door to interior space
- ☐ Door to exterior space
- ☐ None of the above
- ☐ Other:

How satisfied are you with the temperature in your workspace?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Overall, does your thermal comfort in your workspace enhance or interfere with your ability to get your job done?

0 0 0 0 0 0 0
Enhances Undecided Interferes

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

AIR QUALITY

How satisfied are you with the air quality in your workspace (i.e. stuffy/stale air, cleanliness, odors)?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Overall, does the air quality in your workspace enhance or interfere with your ability to get your job done?

0 0 0 0 0 0 0
Enhances Undecided Interferes

HEALTH AND WELL-BEING

Have you ever been told by a doctor that you have or had any of the following?
(Check all that apply.)

- ☐ Migraine
- ☐ Asthma
- ☐ Eczema
- ☐ Hay fever
- ☐ Allergy to dust
- ☐ Allergy to molds

What is your tobacco smoking status?

- ☐ Never smoked
- ☐ Former smoker
- ☐ Current smoker

Have you had any of the following symptoms in the last 4 weeks? (Check all that apply.)

- ☐ Dry, itching, or irritated eyes
- ☐ Wheezing
- ☐ Headache
- ☐ Sore or dry throat
- ☐ Unusual tiredness, fatigue, or drowsiness
- ☐ Chest tightness
- ☐ Stuffy or runny nose, or sinus
- ☐ Congestion
- ☐ Cough
- ☐ Tension, irritability, or nervousness
- ☐ Sneezing
- ☐ Difficulty remembering things or concentrating
- ☐ Dizziness or lightheadedness
- ☐ Shortness of breath
- ☐ Nausea or upset stomach
- ☐ Dry or itchy skin

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

What happened to the symptoms when you were away from work?

- ☐ Got worse
- ☐ Stayed same
- ☐ Got better

LIGHTING

Which of the following controls do you have over the lighting in your workspace?
(Check all that apply.)

- ☐ Light switch
- ☐ Light dimmer
- ☐ Window blinds or shades
- ☐ Desk (task) light
- ☐ None of the above
- ☐ Other:

How satisfied are you with the amount of light in your workspace?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

How satisfied are you with the visual comfort of the lighting (e.g., glare, reflections, contrast)?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

Overall, does the lighting quality enhance or interfere with your ability to get your job done?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Enhances Undecided Interferes

ACOUSTIC QUALITY

How satisfied are you with the noise level in your workspace?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

How satisfied are you with the sound privacy in your workspace (ability to have conversations without your neighbors overhearing and vice versa)?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Very Satisfied Undecided Very Dissatisfied

Overall, does the acoustic quality in your workspace enhance or interfere with your ability to get your job done?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Enhances Undecided Interferes

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

CLEANLINESS AND MAINTENANCE

How satisfied are you with cleaning service provided for your workspace?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

BUILDING FEATURES

Considering energy use, how efficiently is this building performing in your opinion?

- ☐ Very Efficient
- ☐ Efficient
- ☐ Not at all energy efficient

For each of the building features listed below, please indicate how satisfied you are with the effectiveness of that feature:

Automatic daylight controls

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Occupancy sensors for lighting

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Window blinds

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Low Flow Fixtures (e.g., toilets, urinals, faucets)

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

How well informed do you feel about using the above mentioned features in this building?

- ☐ Very well informed
- ☐ Not well informed

Please describe any other issues related to the design and operation of the above mentioned features that are important to you.

Appendix B- Sample POE Survey Questions

POE Study Survey- Office Occupants

GENERAL COMMENTS

All things considered, how satisfied are you with your personal workspace?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Please estimate how your productivity is increased or decreased by the environmental conditions in this building (e.g. thermal, lighting, acoustics, cleanliness):

0 0 0 0 0 0 0
Much Increased Undecided Much Decreased

How satisfied are you with the building overall?

0 0 0 0 0 0 0
Very Satisfied Undecided Very Dissatisfied

Any additional comments or recommendations about your personal workspace or building overall?

Thank you for participating in the survey!

Appendix C- Examples and Case Studies

- Stantec Architecture, Confidential Elementary School CBE Occupant Survey Report, 2013
- Kirksey, Confidential Office Building Case Study, 2014
- Skidmore, Owings & Merrill LLP, Confidential Research Laboratory Case Study, 2012

Confidential Elementary School

Occupant Survey Report

Survey Dates: 3/20/2013 through 4/9/2013

Center for the Built Environment

University of California, Berkeley

Satisfaction in Core Survey Categories

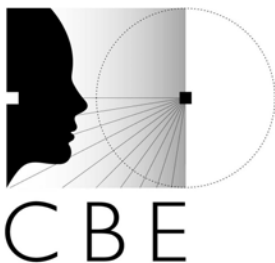
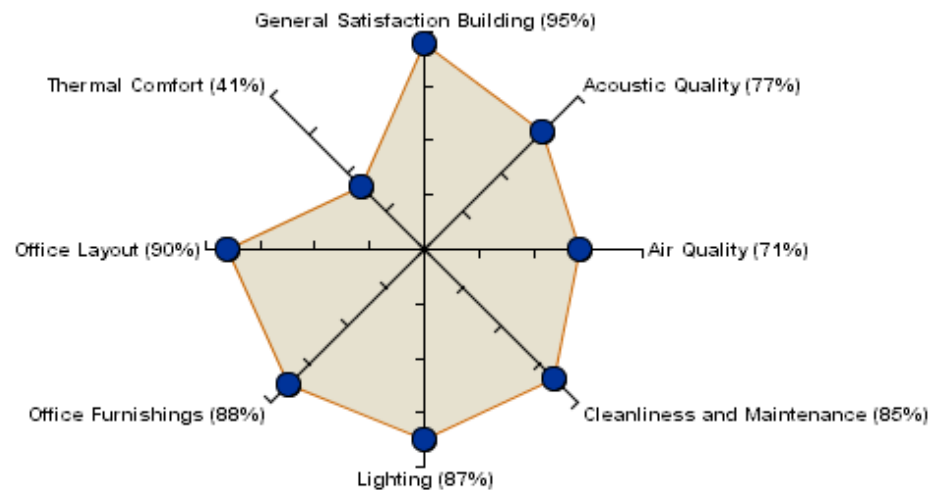


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2.9 Building Features

2.10 Ceiling Fan Control

2.11 Classroom Furnishings

2.12 Classroom Layout

2.13 Classroom Workspace

2.14 Classroom Workspace Location

2.15 Daylight

2.16 General Comments

2.17 Heating Thermostat

2.18 Operable Windows

2.19 Personal Workspace Description

2.20 Personal Workspace Location

2.21 Views

3. Appendices

(Demographics and Workspace Information)

3.1 Background

(Additional Information)

3.2 Summary of Comments by Question

3.3 Occupant Survey Methodology

3.4 How to Get the Raw Data

1.1 How to Use This Report

This report contains a lot of detail about this building. You can use this report in different ways depending on the level of detail you need. The first section, the executive summary, is a high-level overview of the building's performance. It contains basic metrics by category. Read this section if you need a general understanding of the building's performance or its relationship to other buildings. This section answers 'how.' How is the building performing from the occupants' perspective.

Section two contains information at the question level. Here you can get specific information about the drivers behind the building's score in a particular category. You can also find information about occupant responses to a particular question. This section answers 'what.' What is contributing to this level of perceived performance?

Section three contains information from and about the occupants. This is where you look for demographic information and information about how occupants use the building. You can also find comments from occupants in this section. This section answers 'who.' Who is using the building?

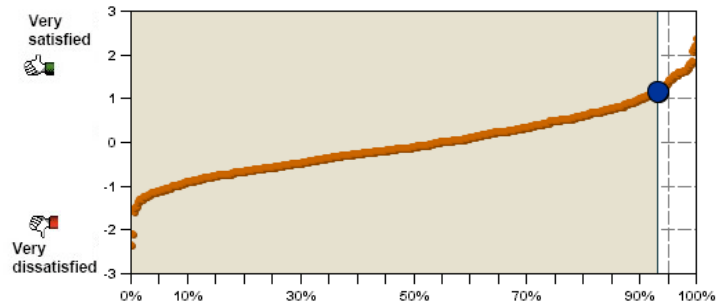
One of the most powerful uses of this report is diagnostic. The survey report gives you information about what's going right (or not so right) in your building. With this information you can make informed decisions about how to improve your buildings performance.

1.2 Building Scorecard

Performance of Confidential Elementary School in core survey categories

Acoustic Quality

93%
Percentile

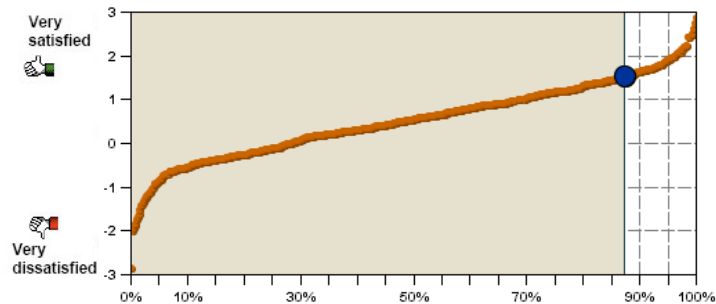


1.17
Mean Response

77%
Satisfied

Air Quality

87%
Percentile

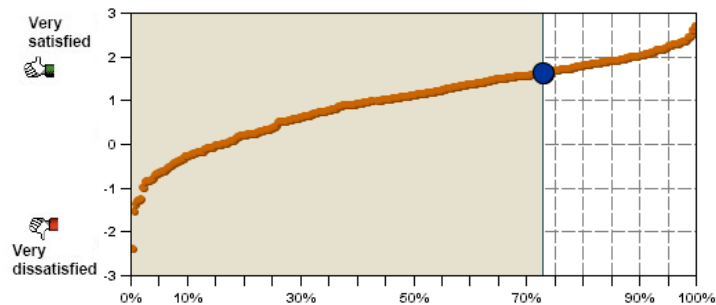


1.54
Mean Response

71%
Satisfied

Cleanliness and Maintenance

73%
Percentile

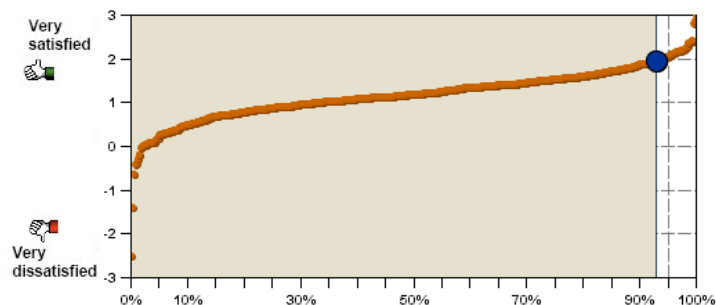


1.63
Mean Response

85%
Satisfied

Lighting

93%
Percentile



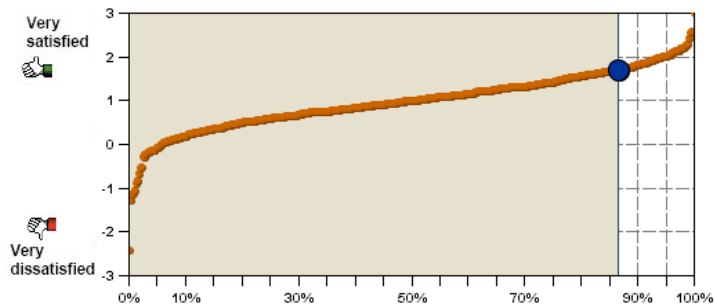
1.95
Mean Response

87%
Satisfied

Performance of Confidential Elementary School in core survey categories

Office
Furnishings

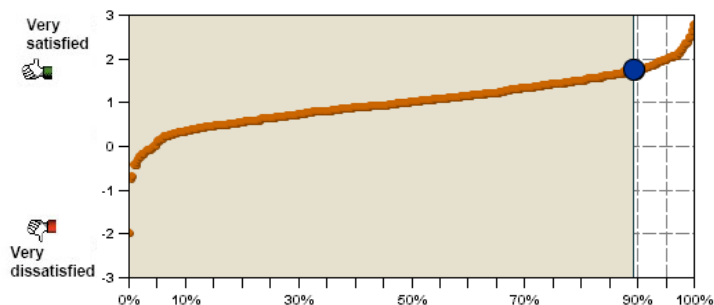
87%
Percentile



1.71
Mean Response
88%
Satisfied

Office Layout

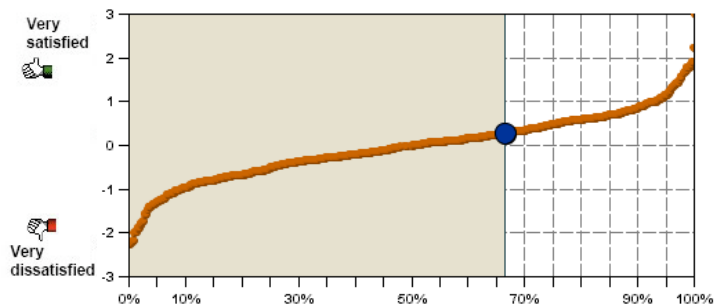
89%
Percentile



1.77
Mean Response
90%
Satisfied

Thermal
Comfort

67%
Percentile

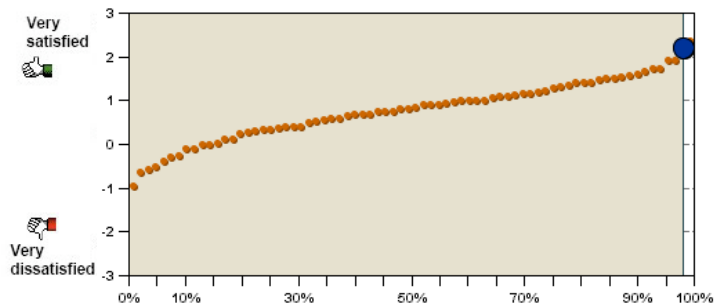


0.29
Mean Response
41%
Satisfied

Performance of Confidential Elementary School in additional survey categories

Classroom
Furnishings

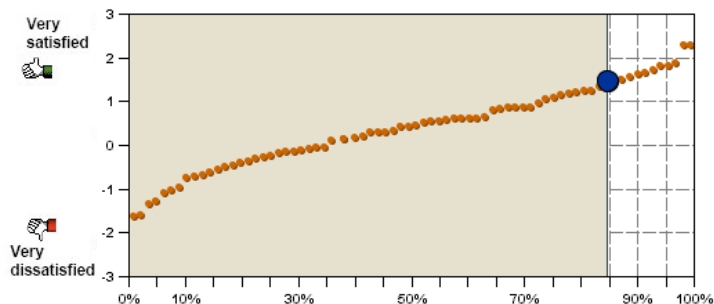
98%
Percentile



2.22
Mean Response
94%
Satisfied

Classroom
Layout

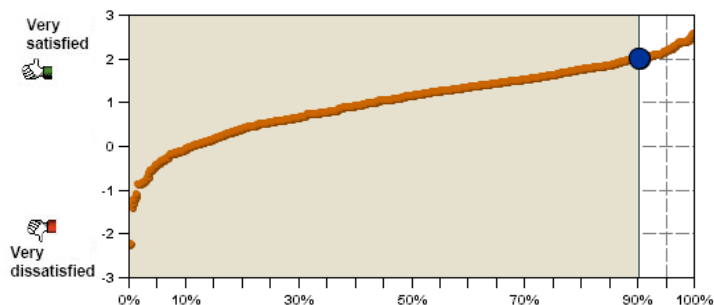
85%
Percentile



1.47
Mean Response
73%
Satisfied

General
Satisfaction-
Building

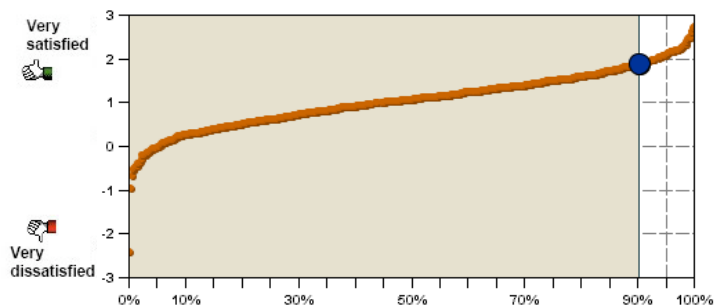
90%
Percentile



2.03
Mean Response
95%
Satisfied

General
Satisfaction-
Workspace

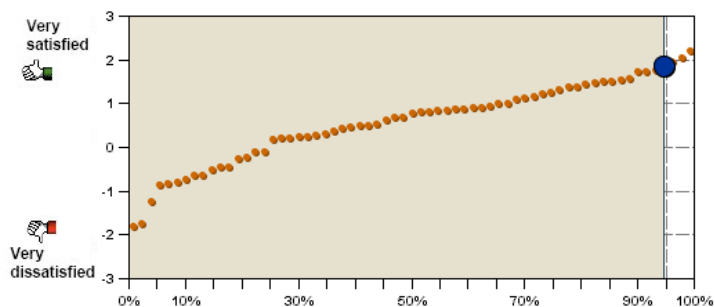
90%
Percentile



1.9
Mean Response
90%
Satisfied

Performance of Confidential Elementary School in additional survey categories

Views
95%
Percentile

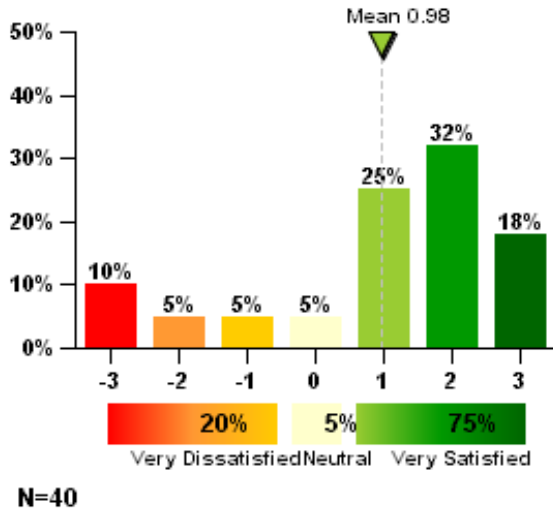


1.87
Mean Response

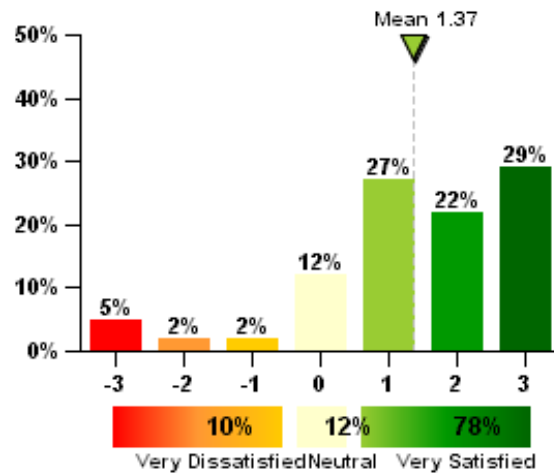
78%
Satisfied

2.1 Acoustic Quality

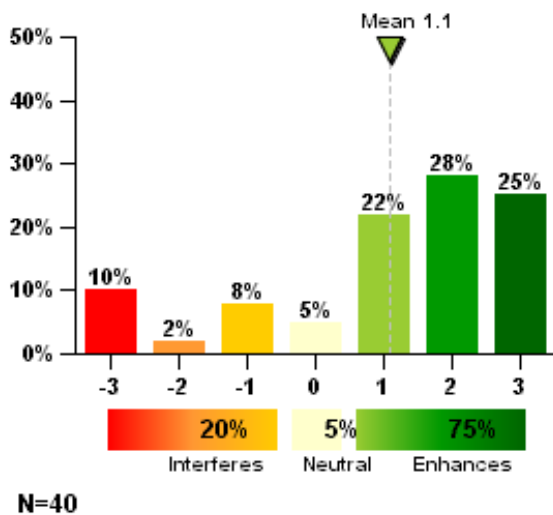
How satisfied are you with the noise level in your workspace?



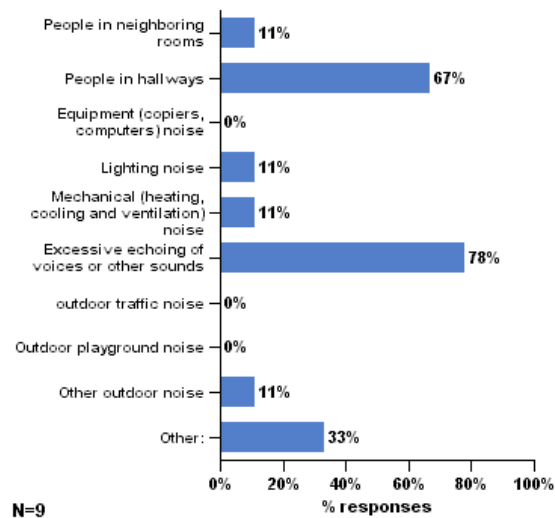
How satisfied are you with the sound privacy in your workspace (ability to have conversations without your neighbors overhearing and vice versa)?



Overall, does the acoustic quality in your workspace enhance or interfere with your ability to get your job done?

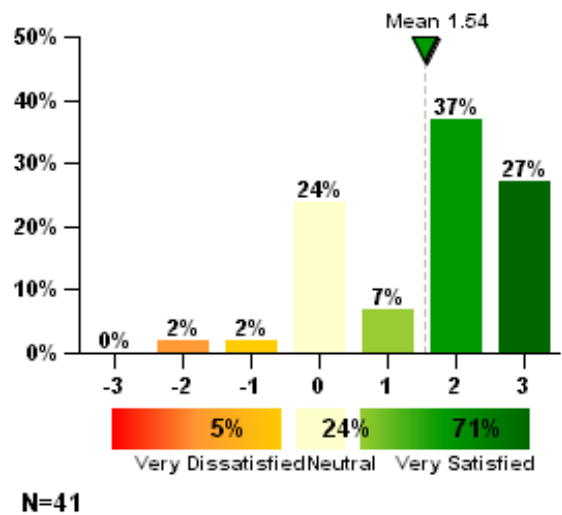


You have said you are dissatisfied with the acoustics in your workspace. Which of the following contribute to this problem? (check all that apply)



2.2 Air Quality

How satisfied are you with the air quality in your workspace (i.e. stuffy/stale air, cleanliness, odors)?



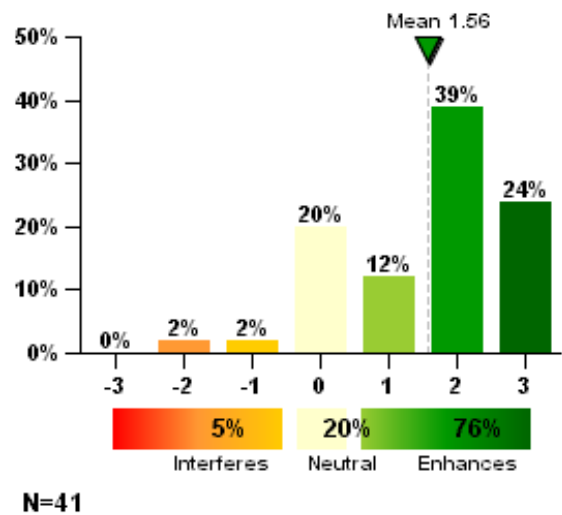
Air is stuffy/stale

Due to the limited number of responses to this question, its chart is not displayed

Air smells bad (odors)

Due to the limited number of responses to this question, its chart is not displayed

Overall, does the air quality in your workspace enhance or interfere with your ability to get your job done?



Air is not clean

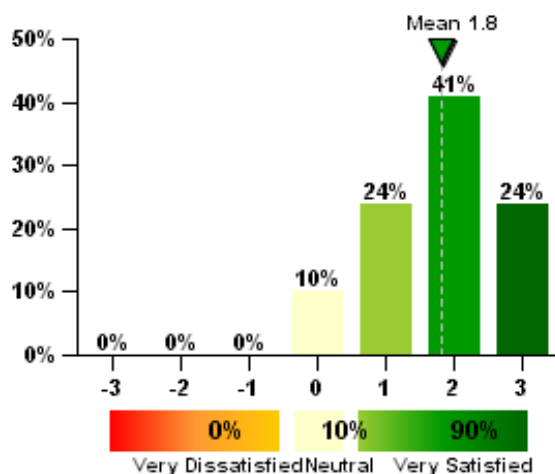
Due to the limited number of responses to this question, its chart is not displayed

If there is an odor problem, which of the following contribute to this problem? (check all that apply)

Due to the limited number of responses to this question, its chart is not displayed

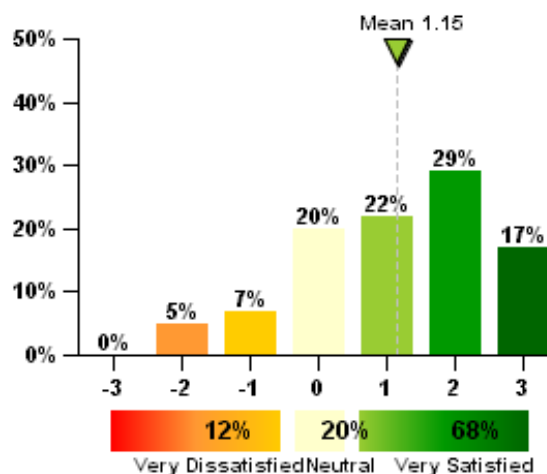
2.3 Cleanliness and Maintenance

How satisfied are you with general cleanliness of the overall building?



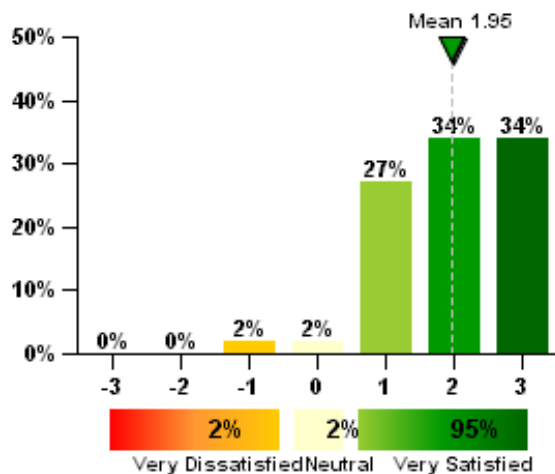
N=41

How satisfied are you with cleaning service provided for your workspace?



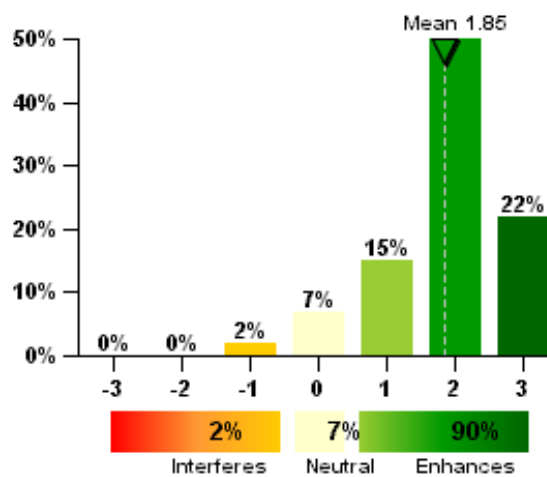
N=41

How satisfied are you with general maintenance of the building?



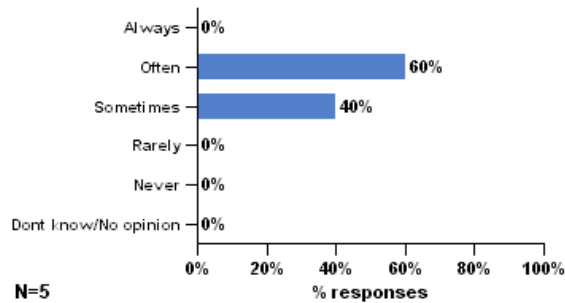
N=41

Does the cleanliness and maintenance of this building enhance or interfere with your ability to get your job done?

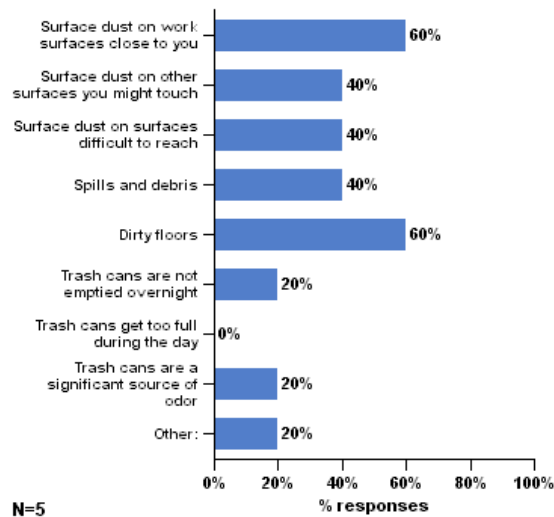


N=41

You have told us that you are dissatisfied with the cleaning service provided for your workspace. How often do you have significant problems?

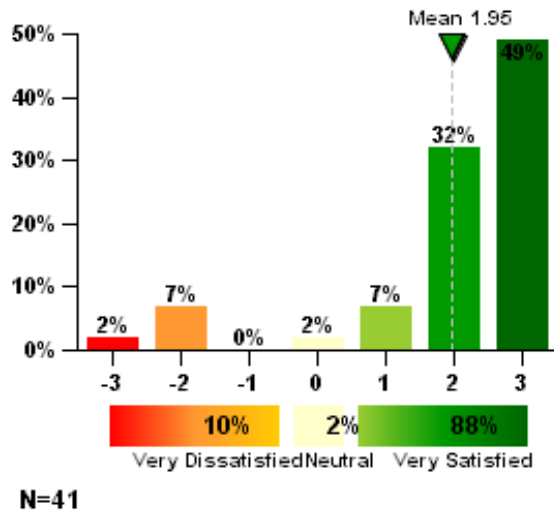


Which of the following contribute to this dissatisfaction? (check all that apply)

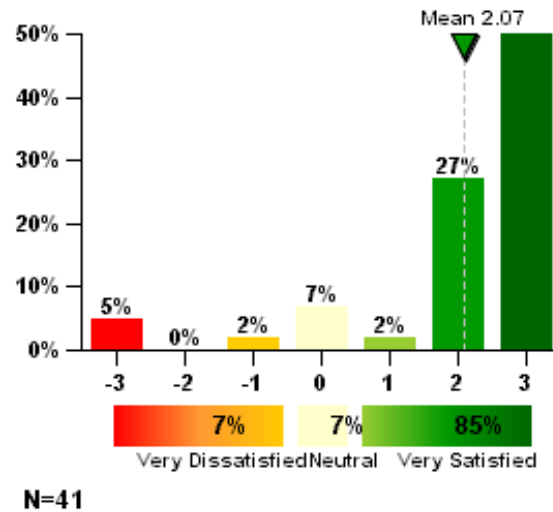


2.4 Lighting

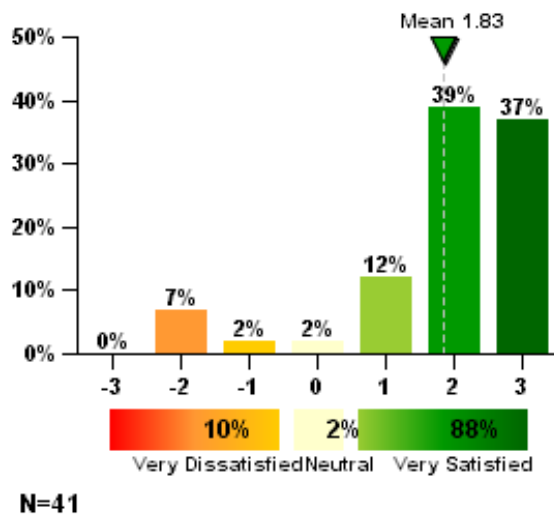
How satisfied are you with the amount of electric light in your workspace?



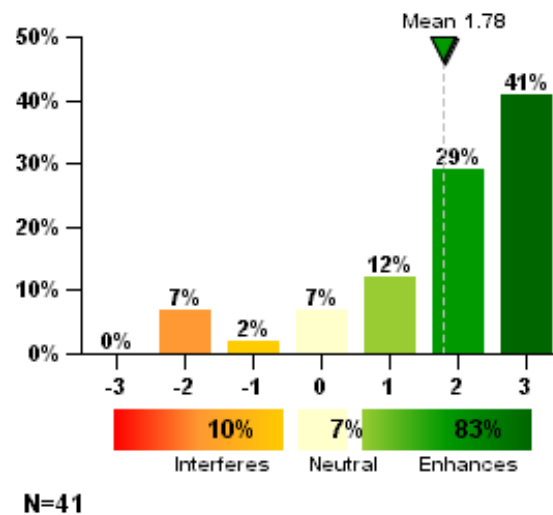
How satisfied are you with the amount of daylight (natural light) in your workspace?



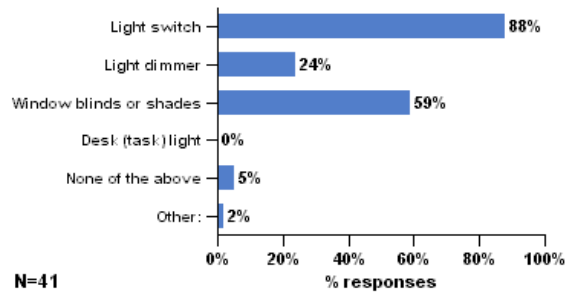
How satisfied are you with the visual comfort of the lighting (e.g., glare, reflections, contrast)?



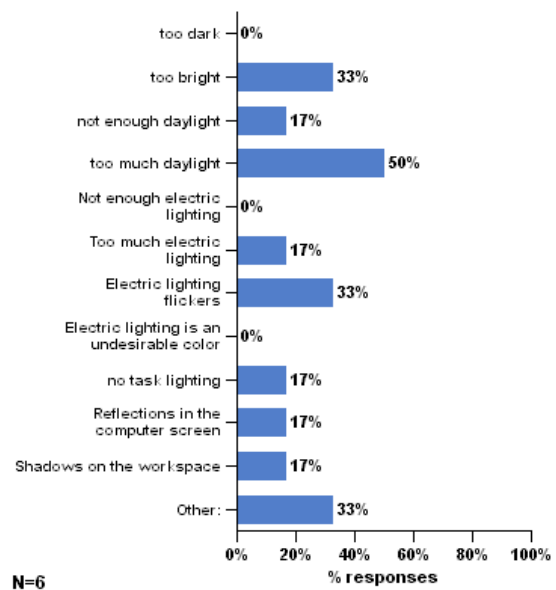
Overall, does the lighting quality enhance or interfere with your ability to get your job done?



Which of the following controls do you have over the lighting in your workspace? (check all that apply)

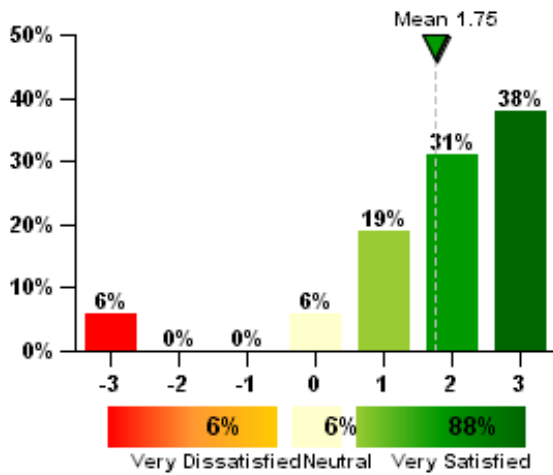


You have said that you are dissatisfied with the lighting in your workspace. Which of the following contribute to your dissatisfaction? (check all that apply)



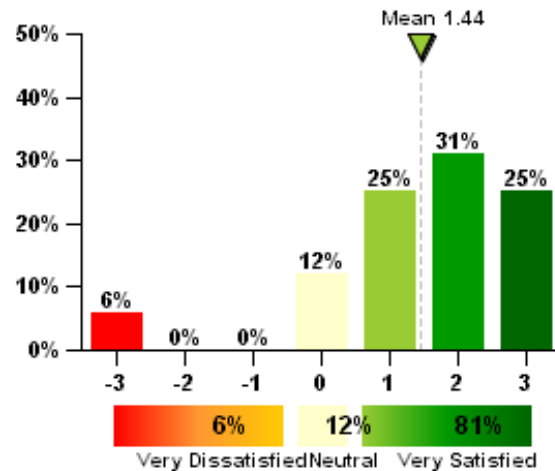
2.5 Office Furnishings

How satisfied are you with the comfort of your office furnishings (chair, desk, computer, equipment, etc.)?



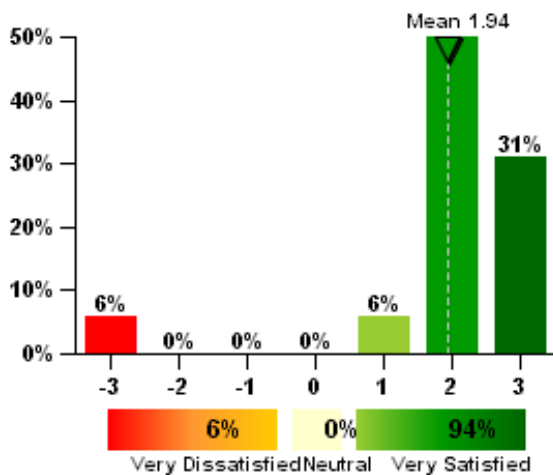
N=16

How satisfied are you with your ability to adjust your furniture to meet your needs?



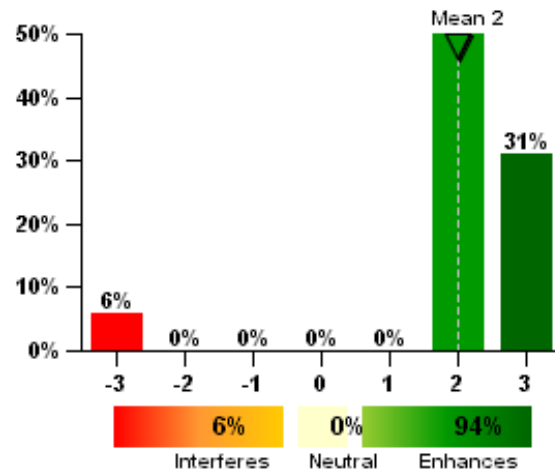
N=16

How satisfied are you with the colors and textures of flooring, furniture and surface finishes?



N=16

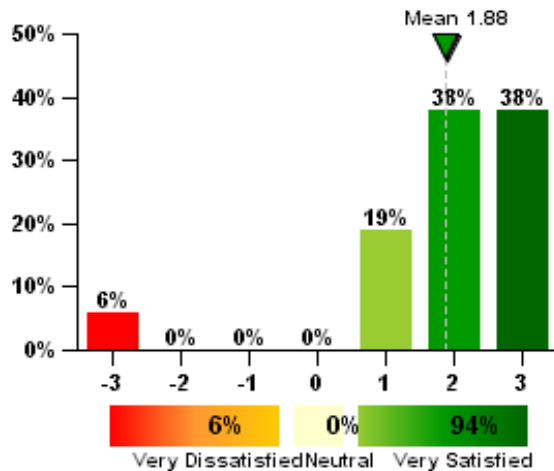
Do your office furnishings enhance or interfere with your ability to get your job done?



N=16

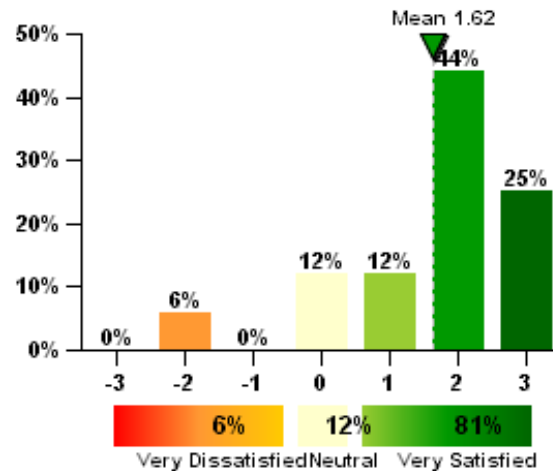
2.6 Office Layout

How satisfied are you with the amount of space available for individual work and storage?



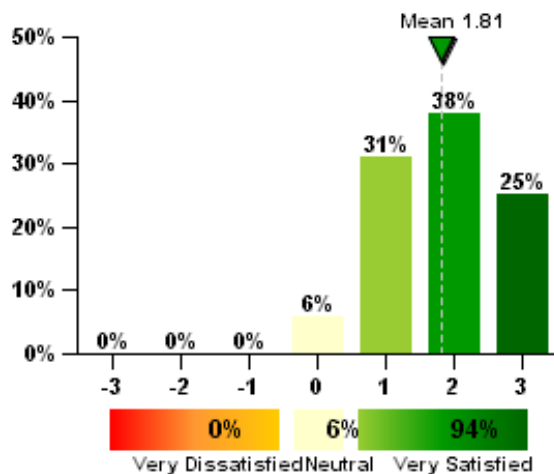
N=16

How satisfied are you with the level of visual privacy?



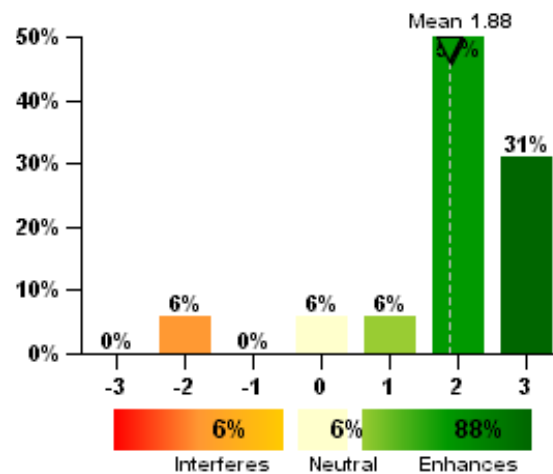
N=16

How satisfied are you with ease of interaction with co-workers?



N=16

Overall, does the office layout enhance or interfere with your ability to get your job done?



N=16

You have said that you are dissatisfied with the amount of space available for individual work and storage. Which of the following contribute to your dissatisfaction? (check all that apply)

Due to the limited number of responses to this question, its chart is not displayed

You have said that you are dissatisfied with the ease of interaction with co-workers. Which of the following contribute to your dissatisfaction? (check all that apply)

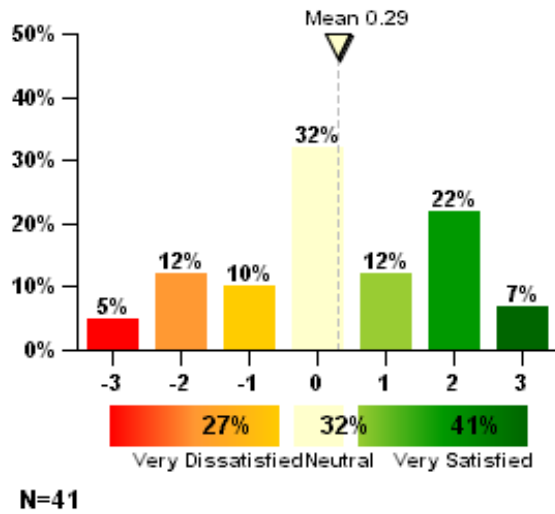
Due to the limited number of responses to this question, its chart is not displayed

You have said that you are dissatisfied with the level of visual privacy. Which of the following contribute to your dissatisfaction? (check all that apply)

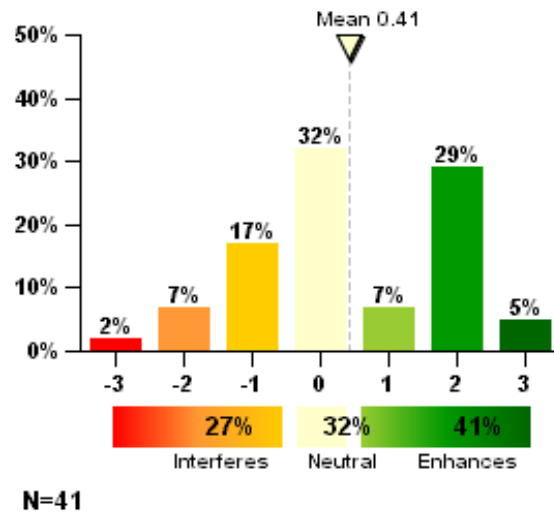
Due to the limited number of responses to this question, its chart is not displayed

2.7 Thermal Comfort

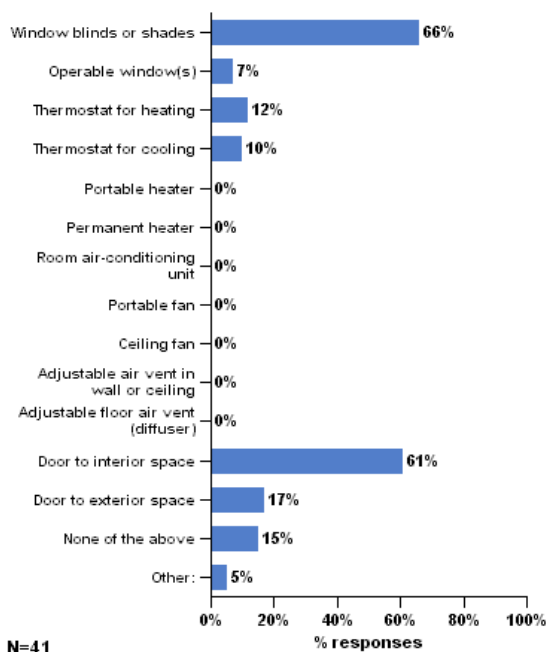
How satisfied are you with the temperature in your workspace?



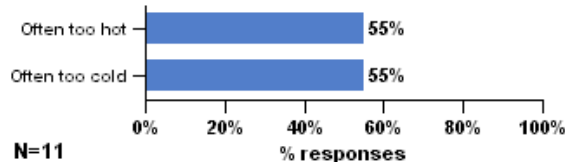
Overall, does your thermal comfort in your workspace enhance or interfere with your ability to get your job done?



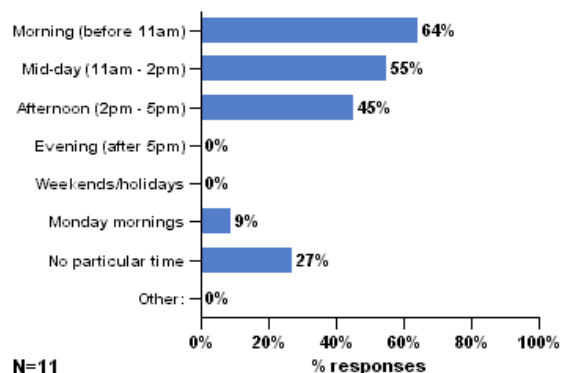
Which of the following do you personally adjust or control in your workspace? (check all that apply)



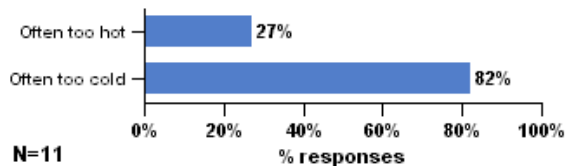
In warm/hot weather, the temperature in my workspace is: (check all that apply)



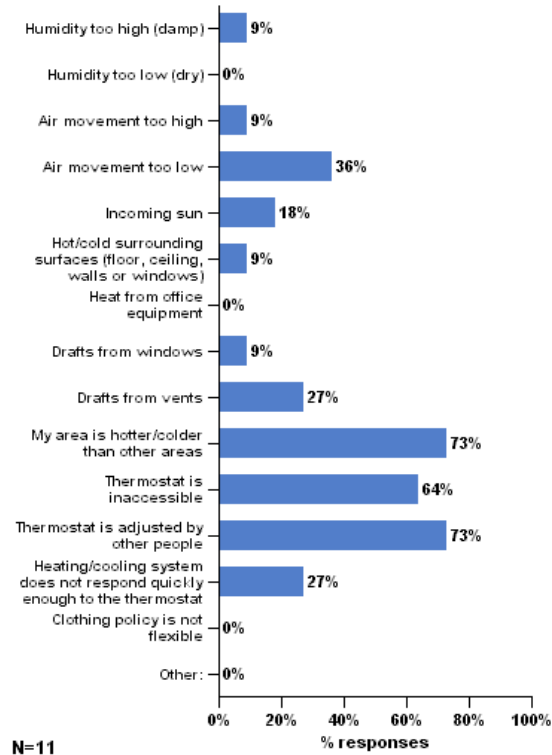
When is this most often a problem? (check all that apply)



In cool/cold weather, the temperature in my workspace is: (check all that apply)



How would you best describe the source of this discomfort? (check all that apply)



2.8 Air-Conditioning Thermostat

How satisfied are you with your thermostat for cooling?

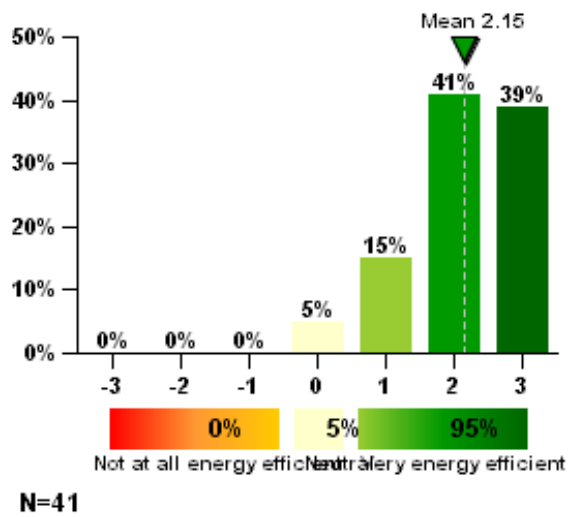
Due to the limited number of responses to this question, its chart is not displayed

You noted previously that you have access to a thermostat for cooling. On average during warmer months, how often do you adjust it?

Due to the limited number of responses to this question, its chart is not displayed

2.9 Building Features

Considering energy use, how efficiently is this building performing in your opinion?



2.10 Ceiling Fan Control

How satisfied are you with your fan?

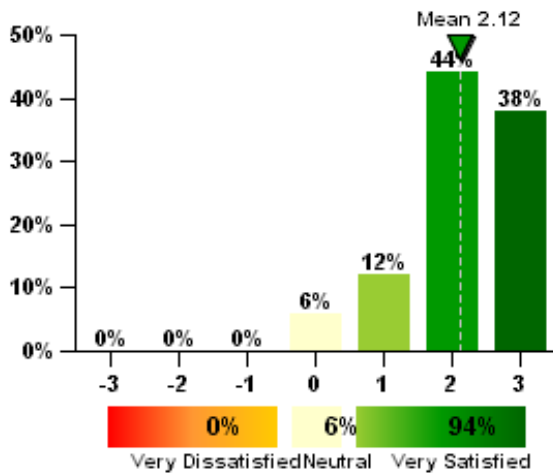
Due to the limited number of responses to this question, its chart is not displayed

You previously noted that you have access to a ceiling fan. How often do you adjust it?

Due to the limited number of responses to this question, its chart is not displayed

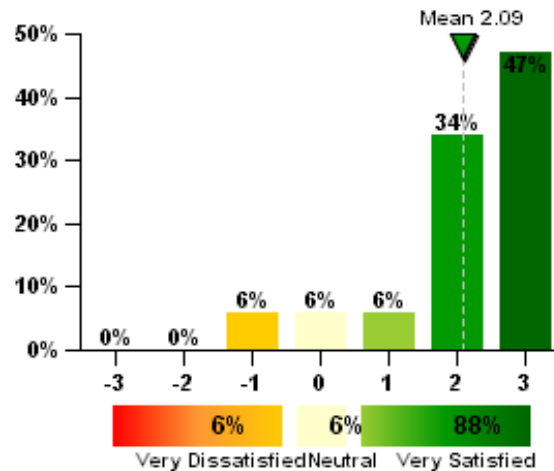
2.11 Classroom Furnishings

How satisfied are you with the comfort of your classroom furnishings (student furniture included)?



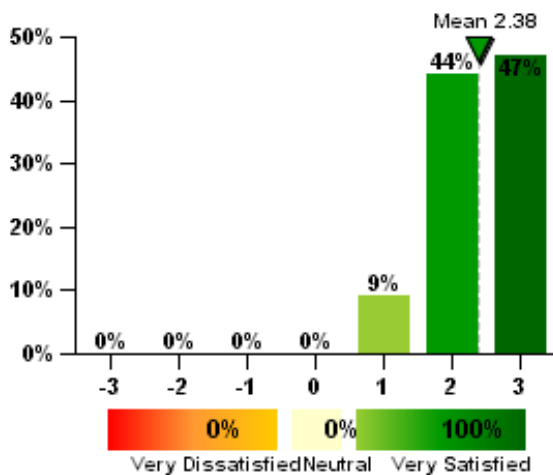
N=32

How satisfied are you with your ability to adjust or move your furniture to meet your needs?



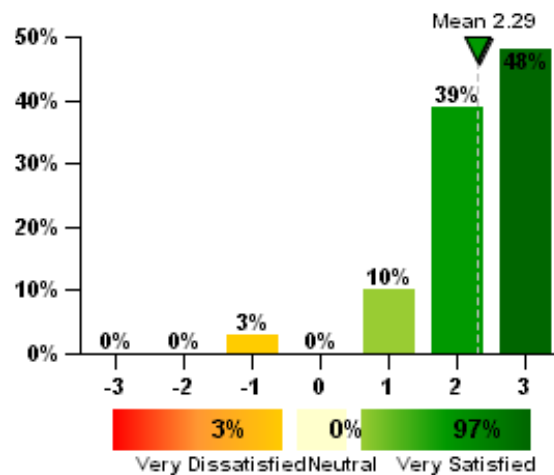
N=32

How satisfied are you with your classroom furnitures ability to be cleaned easily?



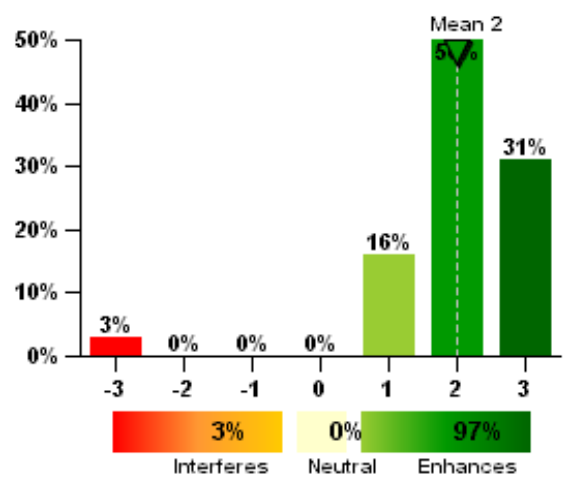
N=32

How satisfied are you with the colors and textures of flooring, furniture and surface finishes?



N=31

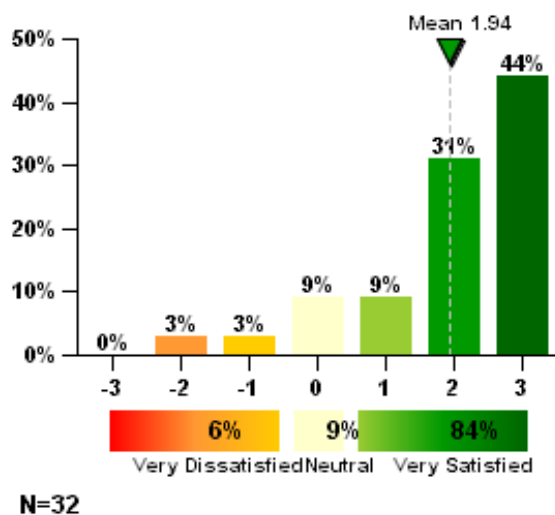
Do your classroom furnishings enhance or interfere with your ability to get your job done?



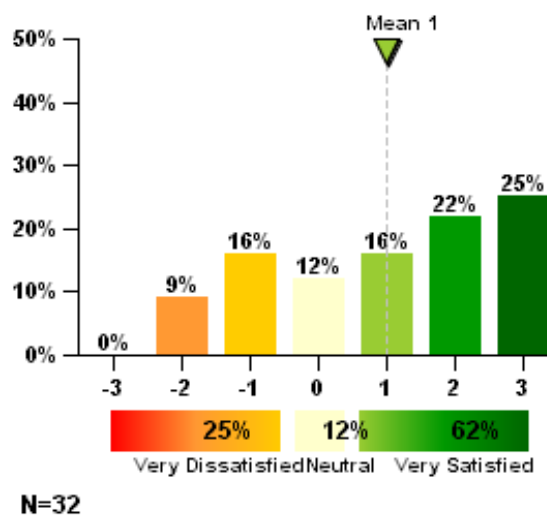
N=32

2.12 Classroom Layout

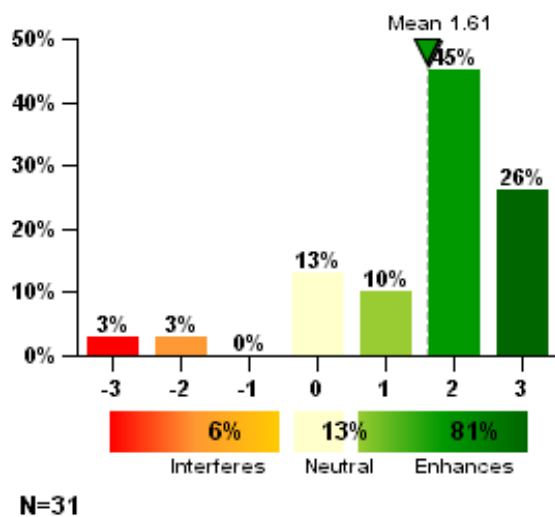
How satisfied are you with the amount and type of space available for your individual work and storage?



How satisfied are you with the amount and type of space available for student work and storage?



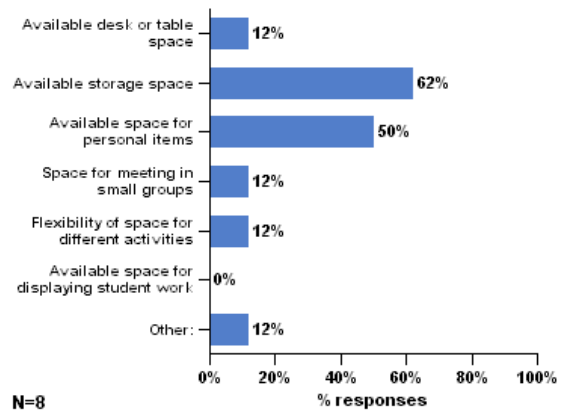
Overall, does the classroom layout enhance or interfere with your ability to get your job done?



You have said that you are dissatisfied with the amount or type of space available for your individual work and storage in the classroom. Which of the following contribute to your dissatisfaction? (check all that apply)

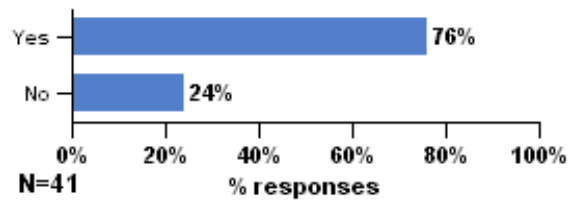
Due to the limited number of responses to this question, its chart is not displayed

You have said that you are dissatisfied with the amount or type of space available for student work and storage in the classroom. Which of the following contribute to your dissatisfaction? (check all that apply)



2.13 Classroom Workspace

Do you spend more than 10 hours a week in one or more classrooms?



2.14 Classroom Workspace Location

To which direction do the windows in your primary classroom face?

Due to the limited number of responses to this question, its chart is not displayed

Do you use multiple classrooms regularly, or only one?

Due to the limited number of responses to this question, its chart is not displayed

Does your primary classroom have windows?

Due to the limited number of responses to this question, its chart is not displayed

In a typical week, how many hours do you spend in classrooms in this building?

Due to the limited number of responses to this question, its chart is not displayed

Does your primary classroom have an exterior wall?

Due to the limited number of responses to this question, its chart is not displayed

2.15 Daylight

How satisfied are you with your ability to control the amount of daylight in your workspace?

Due to the limited number of responses to this question, its chart is not displayed

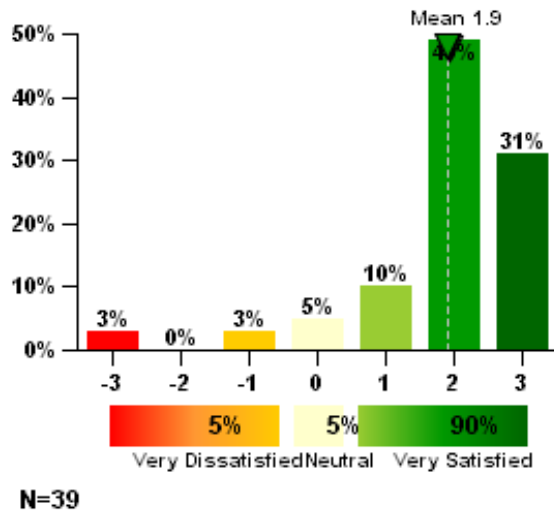
You have said that you are dissatisfied with the amount of daylight in your workspace. Which of the following contribute to your dissatisfaction?

(check all that apply)

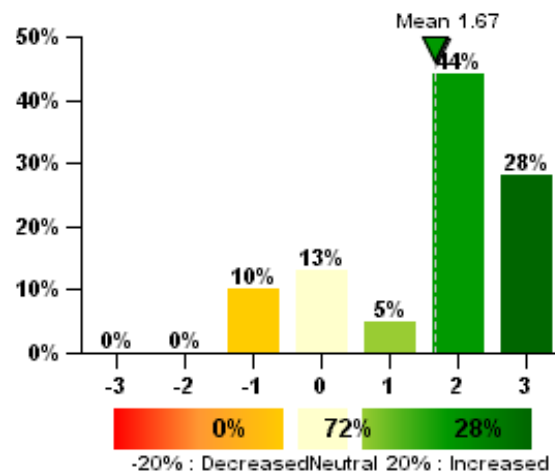
Due to the limited number of responses to this question, its chart is not displayed

2.16 General Comments

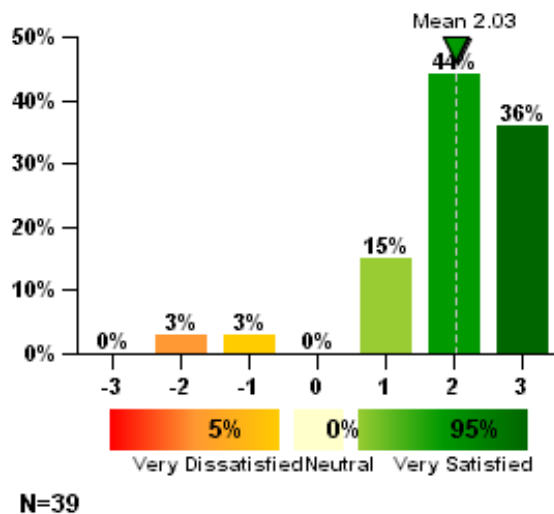
All things considered, how satisfied are you with your personal workspace?



Please estimate how your productivity is increased or decreased by the environmental conditions in this building (e.g. thermal, lighting, acoustics, cleanliness):



How satisfied are you with the building overall?



2.17 Heating Thermostat

How satisfied are you with your thermostat for heating?

Due to the limited number of responses to this question, its chart is not displayed

You noted previously that you have access to a thermostat for heating. On average during colder months, how often do you adjust it?

Due to the limited number of responses to this question, its chart is not displayed

2.18 Operable Windows

How satisfied are you with your window(s)?

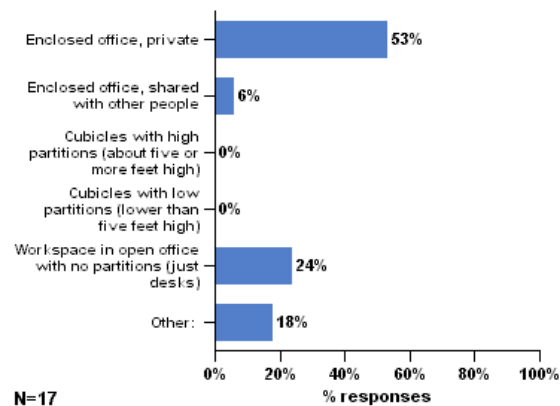
Due to the limited number of responses to this question, its chart is not displayed

You noted previously that you have access to a window/windows you can open. On average, how often do you adjust them?

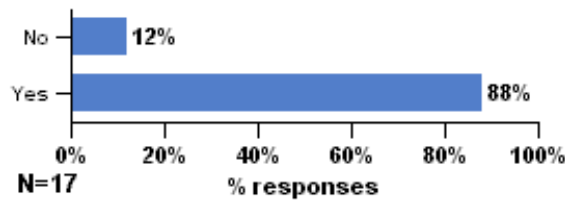
Due to the limited number of responses to this question, its chart is not displayed

2.19 Personal Workspace Description

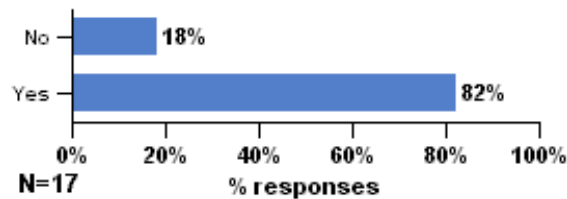
Which of the following best describes your personal workspace?



Are you near an exterior wall (within 15 feet)?

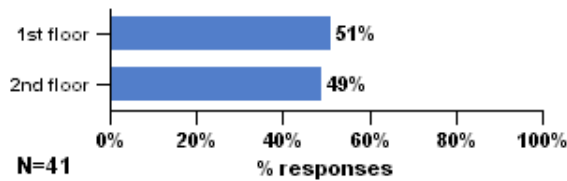


Are you near a window (within 15 feet)?

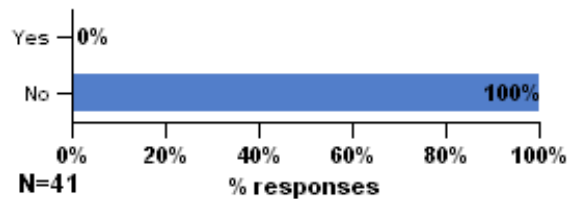


2.20 Personal Workspace Location

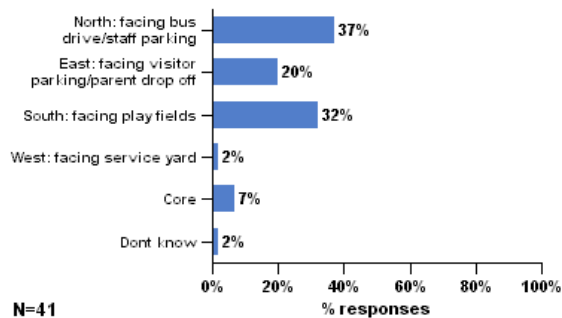
On which floor is your workspace located?



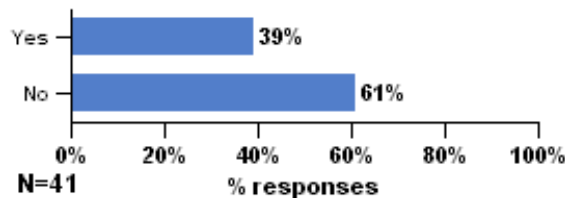
Are you in a portable classroom?



In which area of the building is your workspace located?

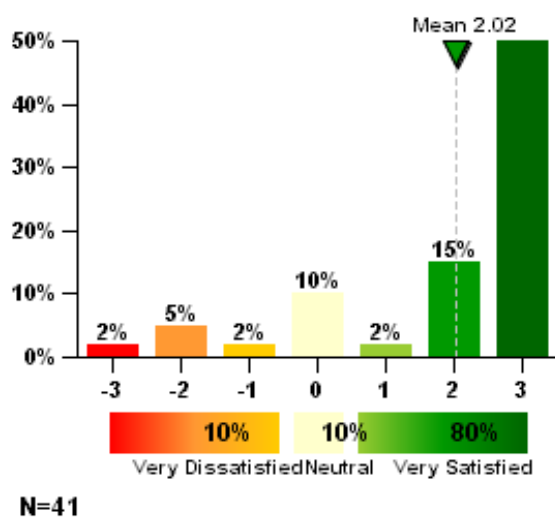


Do you spend more than 10 hours a week in an office or administrative space in the school?

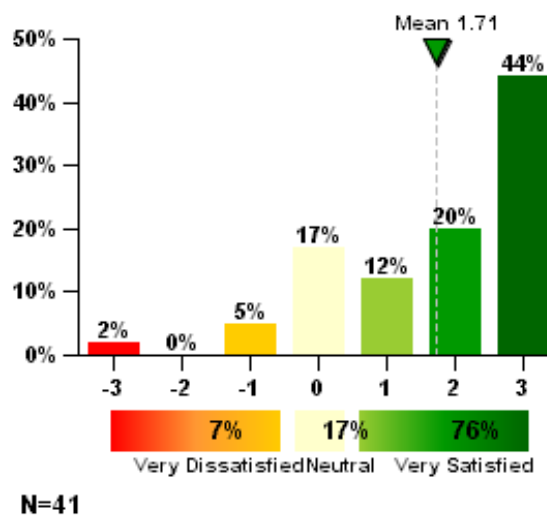


2.21 Views

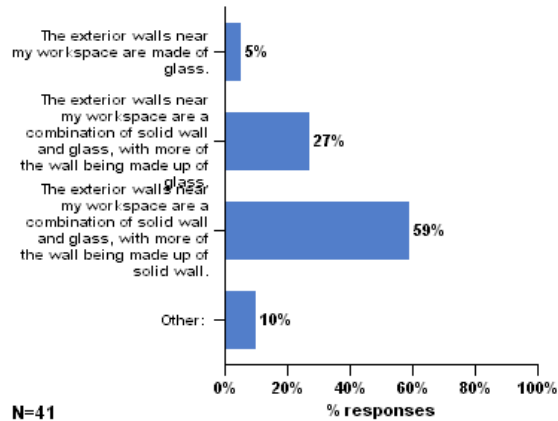
How satisfied are you with your access to a window view?



How satisfied are you with the content of your window view (i.e. the scene that you see when you look out)?



Please choose the description that best describes the exterior walls that separate your workspace from the outdoors.



You have said you are dissatisfied with your access to a window view. Which of the following contribute to this problem? (check all that apply)

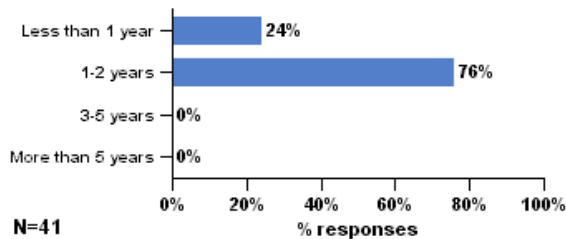
Due to the limited number of responses to this question, its chart is not displayed

You have said you are dissatisfied with the content of your window view. Which of the following contribute to this problem? (check all that apply)

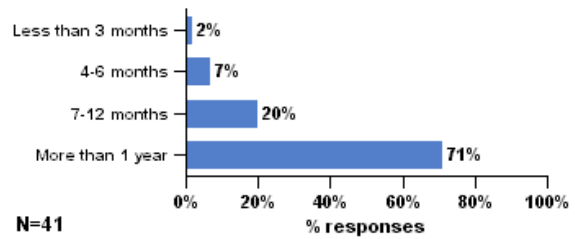
Due to the limited number of responses to this question, its chart is not displayed

3.1 Background

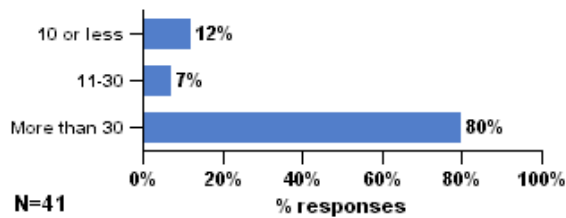
How many years have you worked in this building?



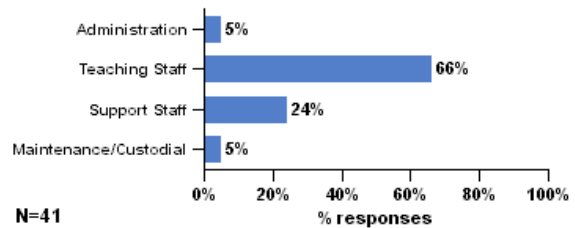
How long have you been working at your present workspace?



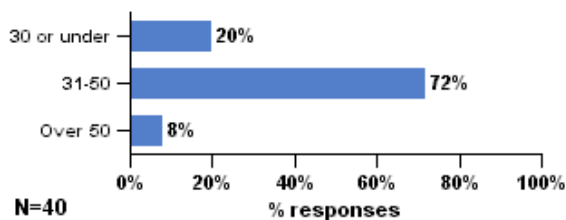
In a typical week, how many hours do you spend in your workspace?



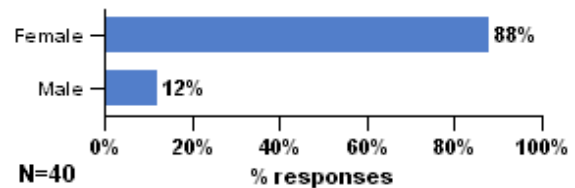
Which department do you work for?



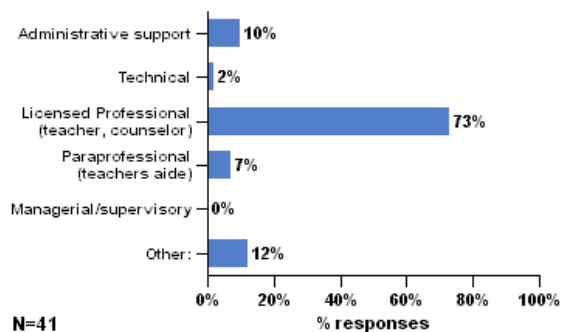
What is your age?



What is your gender?



How would you describe the work you do? (check all that apply)



3.2 Summary of Comments by Question

You have said you are dissatisfied with the acoustics in your workspace. Which of the following contribute to this problem?

- people above me, water in pipes, and hand dryer noise from above.
- loud elevator noise right next to my speech room
- Elevator noise

Please describe any other issues related to acoustics that are important to you.

- The classroom works better if the students can hear me---not the toilets flushing overhead and blow dryers blowing.
The noise from the cafeteria also finds its way into my room and the main hallway between my room and the library can create an overwhelming din.
- My office is situated right next to the elevator. Whenever it is in use the sound can be heard throughout the building, and my students and I would have to stop what we are doing until the elevator cuts off. Very disturbing to students trying to concentrate when they are being tested.
- I work in the library which is an open space, and I hear everything. We hear sounds from the first and second floor. Sometimes the noise is so loud I have to raise my voice so that the students can hear me when I'm reading to them.
- The office lobby is very noisy even when my windows are closed.

If there is an odor problem, which of the following contribute to this problem?

- Previous forest fire smoke

Please describe any other issues related to the air quality in your workspace that are important to you.

- Previous forest fire smoke was heavy, made my stomach upset and gave me a headache as well.

Which of the following contribute to this dissatisfaction?

- student tables are not cleaned

Which of the following controls do you have over the lighting in your workspace?

- All lighting
- windows - can put paper over them.

You have said that you are dissatisfied with the lighting in your workspace. Which of the following contribute to your dissatisfaction?

- sunshine
- some rooms do not work properly

- Early in morning sunlight from east shines in children's faces.

Please describe any other issues related to lighting that are important to you.

- For about 1 hour in the morning the sunlight is beaming in making it difficult to work on the computer.
- I cannot dim the lights enough on A.V mode to prevent the sunlight from blocking the display on the Smartboard.
- solar tubes and light switches do not work properly in some rooms
- The front wall is shadowed and the workstation (instructor desk) has inadequate lighting. Although I have two large windows, they give access to a hall---not natural light.
- If I'm working late at my desk, the light periodically goes off and I have to roll my desk over to the sensor and wave my arm to make it come back on.

Please describe any other issues related to office furnishings that are important to you.

- As previously stated: I have a counter top instead of a desk to work at. My work space is cluttered with items that would normally be in desk drawers, but I am forced to have them on the desk top. The drawers that I do have in the office, which are located on the other side of the room, cannot be used for files because they are too shallow. The office setup is very inconvenient and not conducive to an efficient work space.
- Wall plugs and computer outlets on opposite walls from desk configuration. Had to purchase extra long cords for computer
- Furniture in Principal's conference room is too large and makes it difficult to hold meetings without moving chairs.

Please describe any other issues related to the office layout that are important to you.

- Principal's office is far away from the AP's office. No heat or cooling in Principal's restroom.
- I have a counter top instead of a desk to work at. My work space is cluttered with items that would normally be in desk drawers, but I am forced to have them on the desk top. The drawers that I do have in the office, which are located on the other side of the room, cannot be used for files because they are too shallow. The office setup is very inconvenient and not conducive to an efficient work space.

Which of the following do you personally adjust or control in your workspace?

- Classroom Lights
- cover windows with paper in morning

Please describe any other issues related to being too hot or too cold in your workspace.

- Being at the front desk the temperature is always changing due to the front doors opening daily. Also the pollen and dust flows in as well making it difficult to stay healthy from allergies.
- Students ask to wear jackets in the classroom, there is no room to store them when they take them off. They end up on the floor being stepped and tripped on.

Considering energy use, how efficiently is this building performing in your opinion?

- have no idea. that info is not something we have access to
- I know what the building is supposed to do, but not sure how efficient is actually is.

Please describe any other issues related to classroom furnishings that are important to you.

- The dark paint is easily chipped and will require frequent touch-ups. Carpet stains easily.
- The flooring has been a concern as it can be slippery and hard on the feet---especially for me since I am on it all day, everyday. The work tables, which I requested, have been marvelous!
- I wish we had more bookshelves.

Please describe any other issues related to the classroom layout that are important to you.

- There isn't student storage space.
- Need space for students to hang backpacks.
- there is not enough storage for student belongings
- Need more plugs for electrical usage; location of plugs not user friendly
- The sound in the hall way travels into the library and it is very hard to teach if there is anything going on or the transitions are happening
- love the natural light
- The largest bank of restrooms is located above my classroom and at times the noise is deafening. It is hugely distracting to my students.
The storage is wonderful in the classroom and I also use a closet across the hall for large items that don't fit in my room.
Some vertical storage would have been nice.
The size and orientation of the class is excellent.
- Classroom was not designed for Starboard to be hooked up to wall. Therefore, it takes up a lot of space.
- There is no place for the students to keep their backpacks and other belongings such as coats, hats, etc. This is a concern for health matters and keeping track of their own things.
- sink setup is horrible. water gets everywhere when used.

You have said that you are dissatisfied with the amount or type of space available for your individual work and storage in the classroom. Which of the following contribute to your dissatisfaction?

- design and the inability to decrease the noise

You have said that you are dissatisfied with the amount or type of space available for student work and storage in the classroom. Which of the following contribute to your dissatisfaction?

- noise

You have said that you are dissatisfied with the amount of daylight in your workspace.

Which of the following contribute to your dissatisfaction?

- Early in morning sunrise shines in children's faces. Must be covered with posters or other paper.

Any additional comments or recommendations about your personal workspace or building overall?

- Noise is my biggest concern. Even guests visiting the building are noisy!
- The building is fine except for the acoustics in the library. It can get very loud because of hallway traffic from both upstairs and downstairs.
- There is a significant need for a student restroom to be directly located next to the cafeteria. Distracting noise level downstairs when students are walking directly above you. Front foyer is too loud and often prevents receptionist from having conversations to parents in person and /or on the phone.
- We still have issues with the lighting and solar tubes. We also have problems with those classrooms who are adjacent to empty or infrequently used classrooms. Those areas have problems with HOT/COLD.

Any additional comments or recommendations about your windows?

- My windows are not exterior windows and are opened when staff members or parents need to speak with me.

Which of the following best describes your personal workspace?

- Entire school
- classroom
- classroom

Please choose the description that best describes the exterior walls that separate your workspace from the outdoors.

- half glass half open
- Do not have exterior walls in my workspace
- solid wall
- My room is in the core of the building.

You have said you are dissatisfied with your access to a window view. Which of the following contribute to this problem?

- My window is an interior window---viewing a hallway.
- too open to inside of school

You have said you are dissatisfied with the content of your window view. Which of the following contribute to this problem?

- I view a hallway and the passing parade of students and faculty.

How would you describe the work you do?

- Custodial
- Front office Receptionist
- Speech/Language Pathologist
- Nurse
- Registrar/Attendance Clerk

3.3 Occupant Survey Methodology

This report presents the results of an Occupant Satisfaction Survey. Occupant responses are collected via the Internet and recorded to a secure server database using SQL technology (SQL is a standardized query language used for requesting information from a database). To protect the confidentiality of participants, the online report contains only aggregated, anonymous results.

The survey is comprised of a core survey and optional survey modules. The core survey includes modules for office layout, office furnishings, thermal comfort, air quality, lighting, acoustics, and building cleanliness and maintenance. This survey report includes information for the optional commute and daylighting modules. Core questions are the same across surveys and are used for benchmarking and trend analysis.

The survey has been extensively tested and refined. An established in-depth pre-testing method called cognitive interviewing was used by the Survey Research Center at the University of California, Berkeley to assess how well respondents were able to comprehend and accurately report answers to survey questions (Eisenhower, 2000). Cognitive interviews allowed researchers to examine the thought processes that affect the quality of answers provided to survey questions. The primary technique used was “concurrent think aloud” where respondents were asked to comment out loud about the thoughts that crossed their mind as they read, interpreted and answered each question. This technique was supplemented with paraphrasing (asking the respondents to put something in their own words) and systematic probing. Seven people participated in this testing. Results were used to refine the survey organization, question text, graphic design of the scales, and the process required to access the survey website.

The time to completion has been monitored, and occupants have evaluated the length of each section of the survey. Approximate time to completion for the core survey is 5-12 minutes; time to completion varies depending on the number of branching questions and comments answered. This length of time has not been regarded as an impediment to completion in most (but not all) of the buildings surveyed to date. Surveys that include several customized modules in addition to the core survey have had completion times of up to 20 minutes. Organizations that choose to implement longer surveys are briefed regarding the potential negative effect that longer time to completion can have on response and completion rates.

The survey implementation process typically begins with an email informing building and sent either by CBE or the sponsoring agency. Subjects can open the survey at their

convenience. After linking to the survey, respondents see a welcome screen informing them of the purpose of the survey. The welcome page also advises them of the amount of time it should take to complete the survey, and their rights as a research participant. Participation in the survey is voluntary and anonymous. Upon starting the survey, participants click through a series of questions asking them to evaluate their "satisfaction" with different aspects of their work environment. Satisfaction is rated on a 7-point scale ranging from "very satisfied" to "very dissatisfied" (see Figure 1). In most cases, respondents who indicate dissatisfaction (the lowest three points on the scale) with a particular aspect of their work environment are branched to a follow-up screen probing them for more information about the nature of their dissatisfaction. Respondents who indicate neutrality or satisfaction (the upper four points on the scale) move directly to the next survey topic. When applicable, respondents are also asked to assess the impact of environmental factors on their effectiveness in getting their job done.

A survey typically stays open for 1-2 weeks. The rate of participation is monitored; if few have responded, reminder emails may be sent. After the survey is closed, the data is cleaned. The responses of participants who answer less than 15 questions are removed from the final data set.

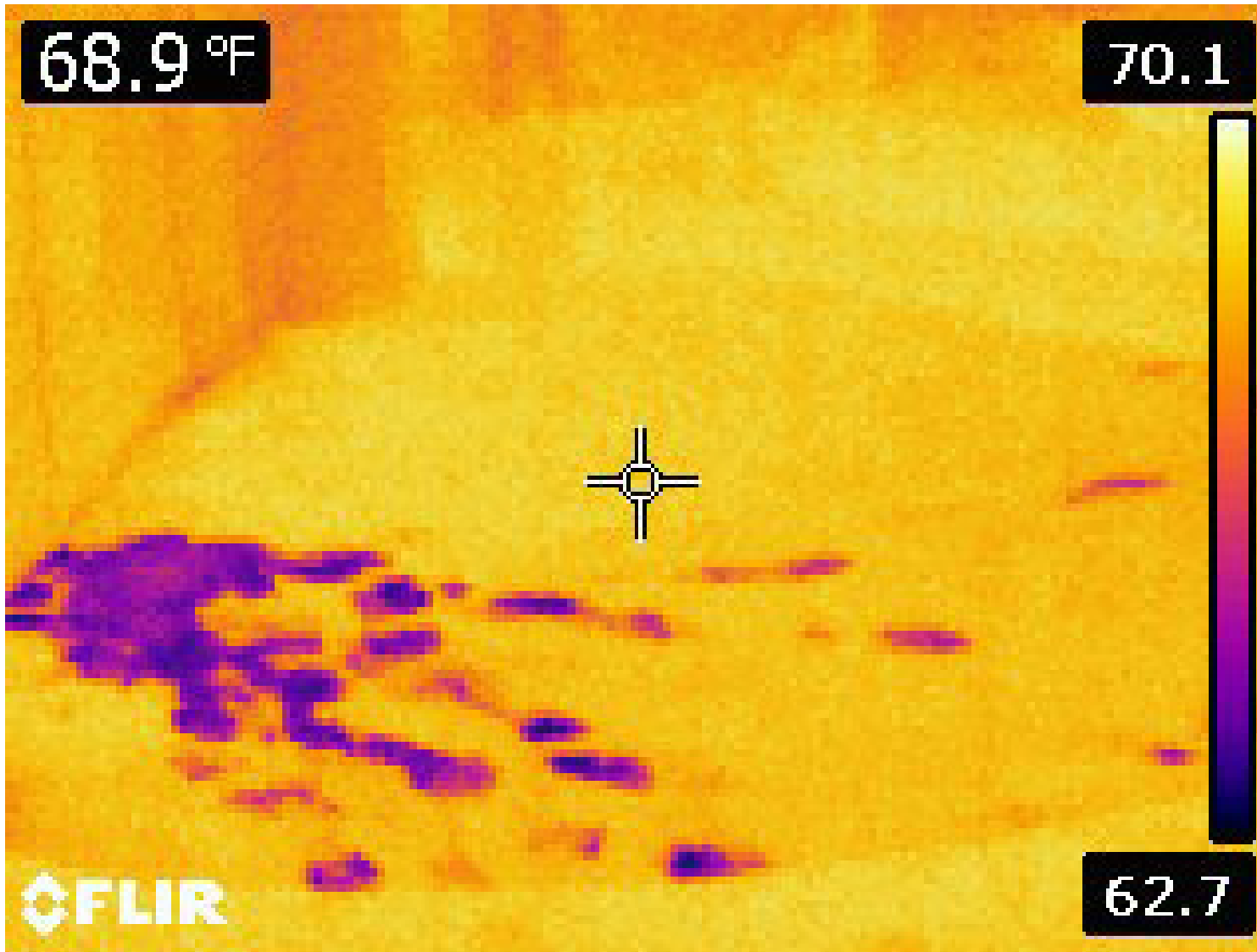
Satisfaction ratings are tabulated for each point on the scale, and are also summarized into three categories: satisfied (top three points), neutral (middle point) and dissatisfied (bottom 3 points). This summary is particularly useful to managers that need to see a top-level overview of occupant feedback. Comments are also listed in totality for each question.

For more information, please send us an e-mail or contact us at (510) 642-4984.

3.4 How to Get the Raw Data

CBE can provide you the raw data for your survey in a tab delimited or comma delimited format. This will include the question text and answer text for each response. Each user is assigned a unique user ID so that you can rectangularize the data if you so choose. The data files can be quite large, too large for Microsoft Excel. You will need a robust statistical package (e.g. SPSS or Stata) or a database package (Microsoft Access or MySQL) to use these files.

Appendix C- Examples and Case Studies
Kirksey- Confidential Office Building Case Study, 2014



Confidential
Office Building
post-occupancy
evaluation
Kirksey
ARCHITECTURE



What is a POE?

A post-occupancy evaluation (POE) is executed to answer crucial questions about a building's performance. A POE can address questions such as: does the building perform as it was designed? What corrective measures can be implemented to improve performance? How can building features be designed more effectively in the future?

Quantitative and qualitative measurements taken in a POE study allow for a systematic evaluation of an occupied building. POEs ultimately allow designers and clients to review the effectiveness of design features and building performance, and to understand the factors that influence performance.

In the summer of 2014, Kirksey Architecture analyzed this corporate campus using these methods:

- ▶ Administering in person surveys to employees
- ▶ Recording visual observations and conversations on-site
- ▶ On-site measurements at predetermined locations and set times which documented:
 - Air movement (fpm)
 - Relative Humidity (%)
 - Air and surface temperature (°F)
 - Sound Levels (dB)
 - CO2 Levels (ppm)
 - Illuminance (lux)

These objective measures are important because they supply quantifiable performance data as well as providing clues about the source of air quality or thermal comfort problems recorded in occupant survey results. CO2 levels, light levels, and temperature also correlate with critical, but less quantifiable qualities of productivity, health and well being.

Questions in the survey included objective factors such as gender, location within the building, and age group, as well as subjective factors measuring satisfaction with interior environmental conditions. Subjective conditions were measured on a seven point scale ranging from extremely dissatisfied to extremely satisfied.

Results from data collection are provided in the following categories: energy performance, water performance, thermal comfort, indoor air quality, acoustics, daylighting, and design and space functionality. Each section concludes with a note on lessons learned from the analysis.



The Campus

Amidst the forest canopy sits the existing office building designed and built by Kirksey Architecture in 1983. This existing building is the subject of this Post-Occupancy Evaluation study. Kirksey is currently designing the renovation for this building as well as an addition to the building and master planning for the overall campus. This study has allowed us to hear feedback from almost all current occupants, 32 surveys in total, and also to identify key areas and systems that would greatly benefit from the renovation.

Based upon quantitative data and qualitative assessments we recommend the following:

- ▶ Fritted glass as an exterior window treatment could be considered to enhance visual privacy from the outside while maintaining the views to the outside.
- ▶ Maps are often read on the walls in offices and corridors and the lighting design could accommodate this activity better.
- ▶ Occupants are very active in controlling their visual comfort; new blinds could be on

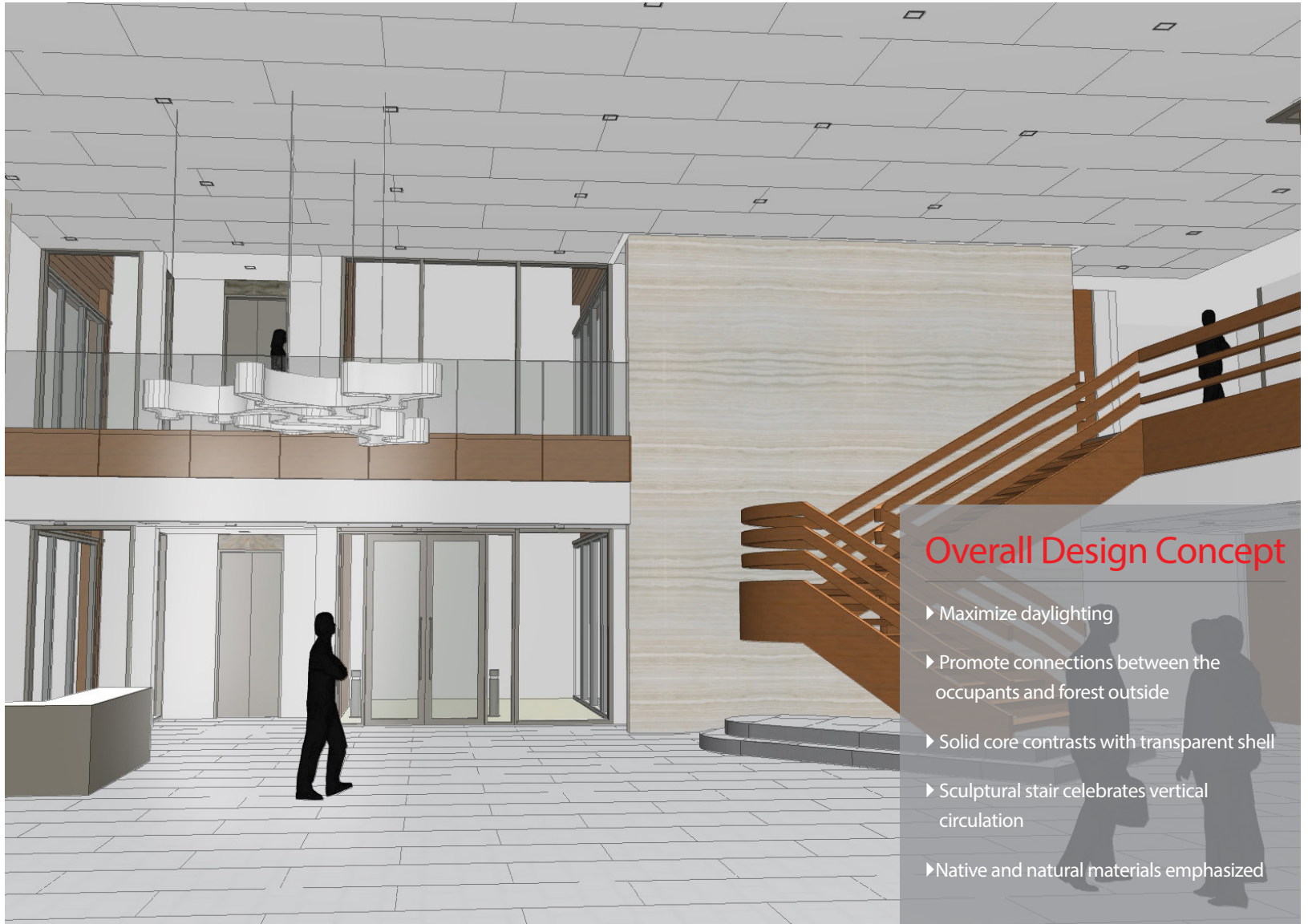
photosensors with the possibility to manually override to give occupants the highest degree of controllability and comfort.

▶ The existing building's chillers are probably oversized. The new building should have less cooling capacity installed and absorb some of the extra capacity from these existing chillers.

▶ Demand control ventilation with CO2 monitoring would help keep the indoor air quality at healthy levels.

- ▶ Building Square Footage: 20,984 Sq. Ft.
- ▶ Site Square Footage: 174,240 Sq.Ft.
- ▶ Occupancy: 35

* Measurements for the post occupancy evaluation occurred on Monday, May 12, 2014.

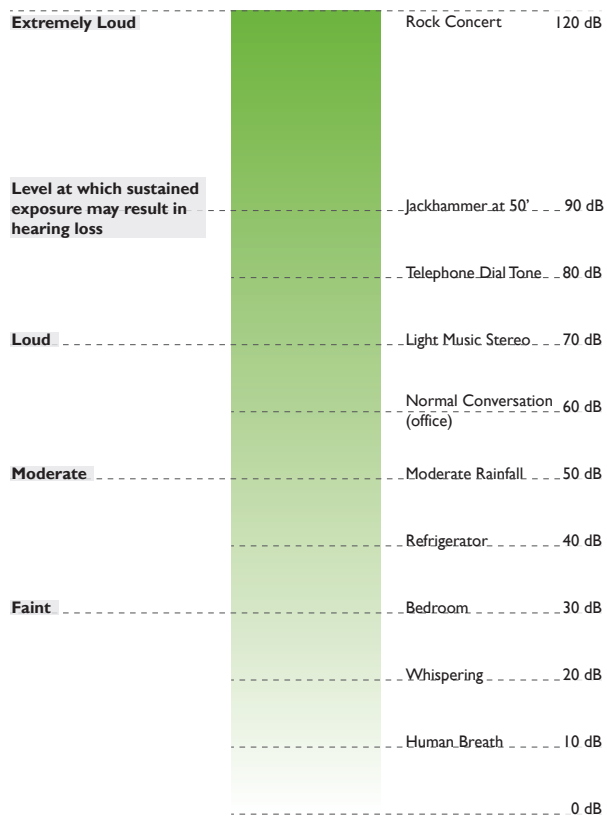


Overall Design Concept

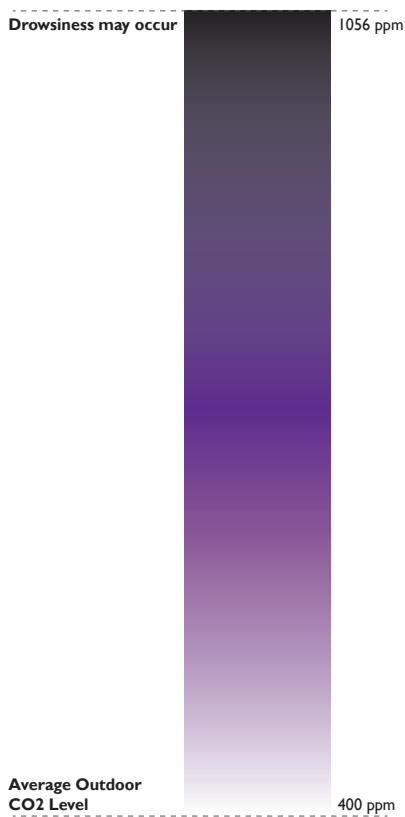
- ▶ Maximize daylighting
- ▶ Promote connections between the occupants and forest outside
- ▶ Solid core contrasts with transparent shell
- ▶ Sculptural stair celebrates vertical circulation
- ▶ Native and natural materials emphasized

Human Comfort Standards

Sound Level



CO2 Level



Illuminance Level

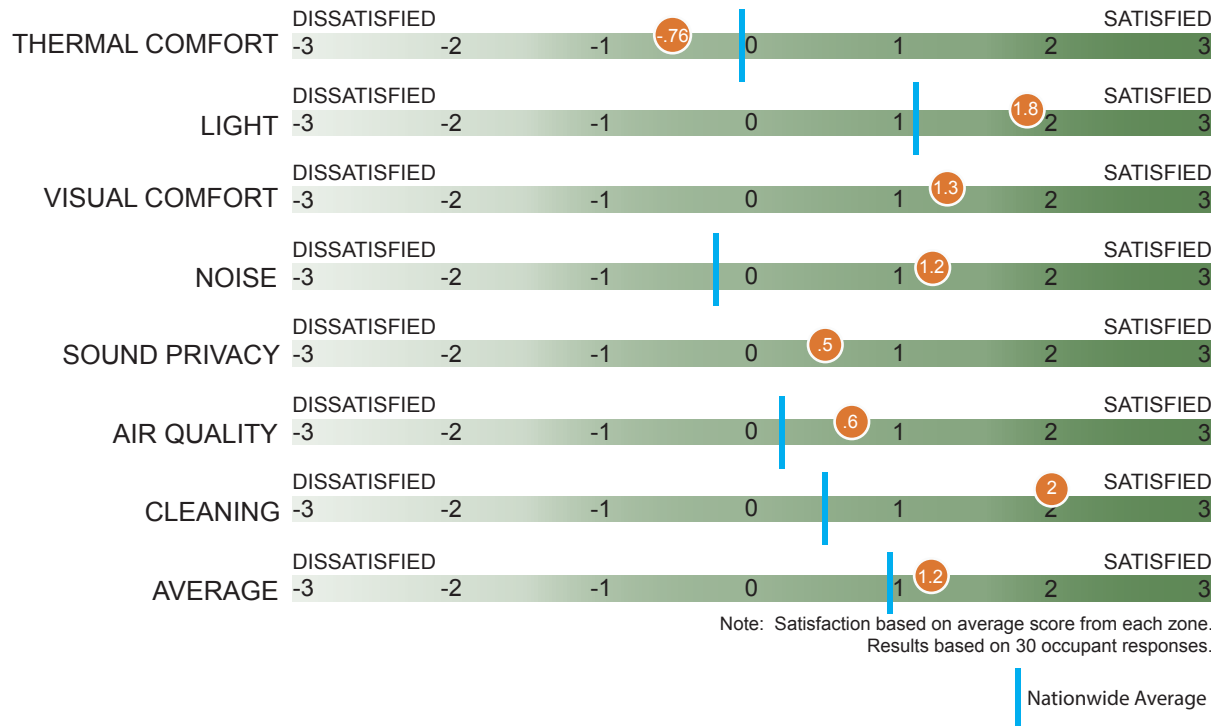


Temperature



Overall Survey Responses

Overall Satisfaction by Category



Overall Satisfaction

Personal workspace: 90% occupant satisfaction (37% extremely satisfied)

Building overall: 78% occupant satisfaction (20% extremely satisfied)

Ease of interaction with coworkers:

83% satisfaction, 43% extremely satisfied

Workspace is a private office:

70% of respondents

Workspaces within 15 feet of window:

83% of respondents

Satisfaction with Lighting

70% of respondents

Satisfaction with size of workspace:

80% satisfied, 40% extremely satisfied

Office layout's effect on reported occupant productivity:

33% enhances

53% neither enhances nor interferes

13% interferes

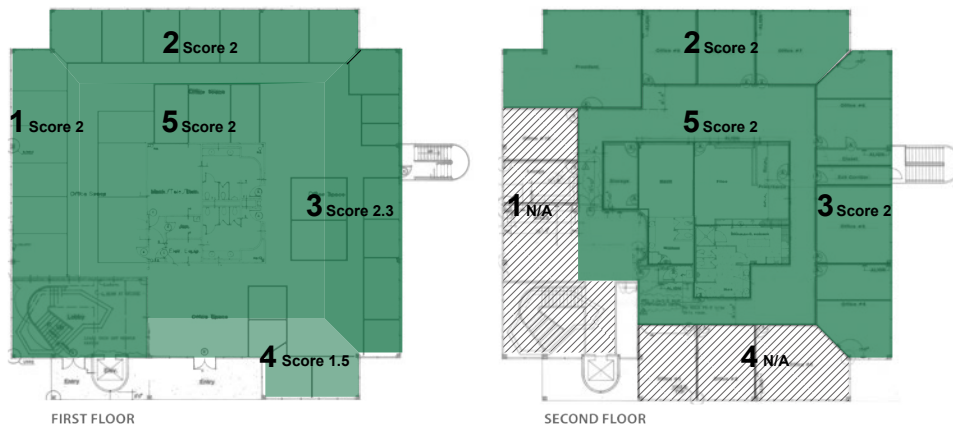
Indoor Air Quality

Since people spend an average of 90% of their time indoors, maintaining a healthy indoor environment should be a priority for any regularly occupied building. Indoor air pollution can have mild to dramatic effects on occupant health, including aggravating ailments such as asthma and allergies. Improper ventilation often results in high CO2 levels which can impact health, well-being, and productivity. High CO2 levels have been shown to cause drowsiness and poor decision-making. Proper ventilation and air circulation are critical for indoor air quality.

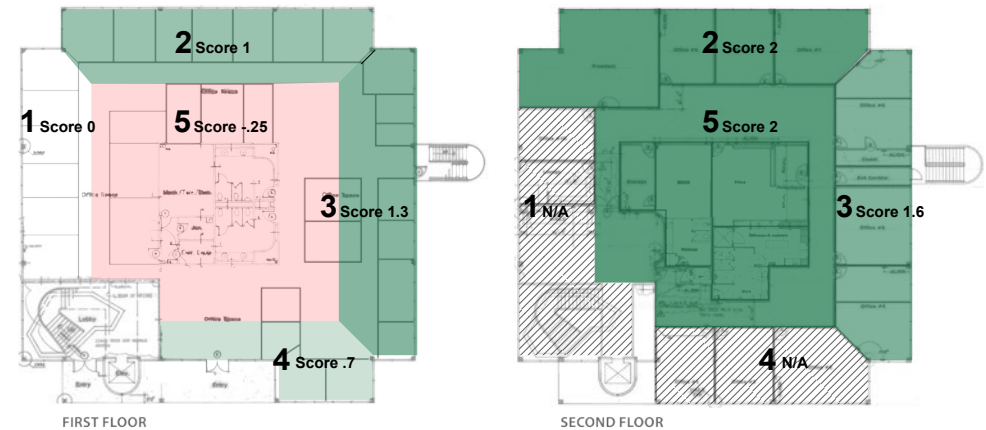
Survey Responses

- ▶ 47% of respondents are satisfied with indoor air quality, and 17% are extremely satisfied
- ▶ 32% of respondents said air quality related symptoms improved away from work
- ▶ Occupants have expressed dissatisfaction with kitchen odors and stuffy air, which relates to the low score of -0.25 in Zone 5 of the first floor.

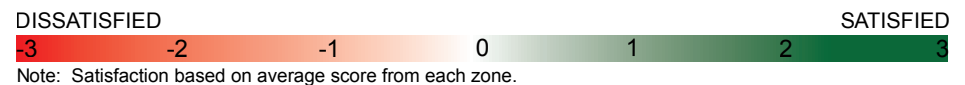
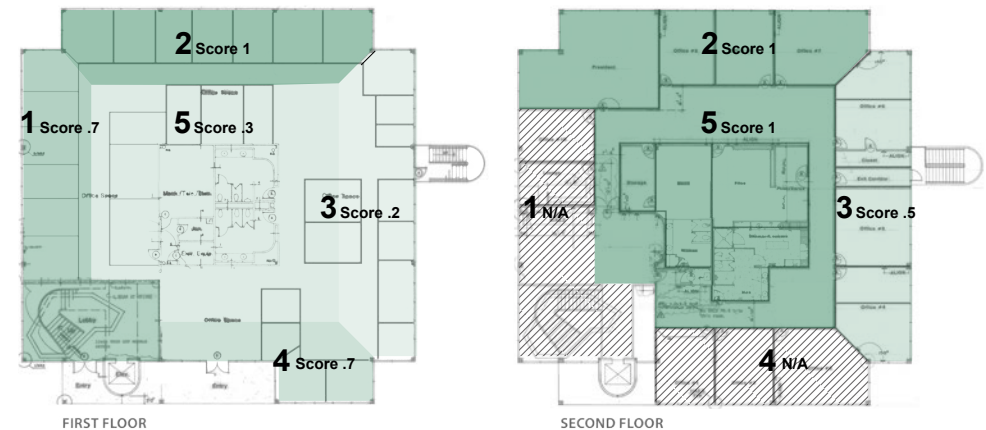
Cleanliness Satisfaction



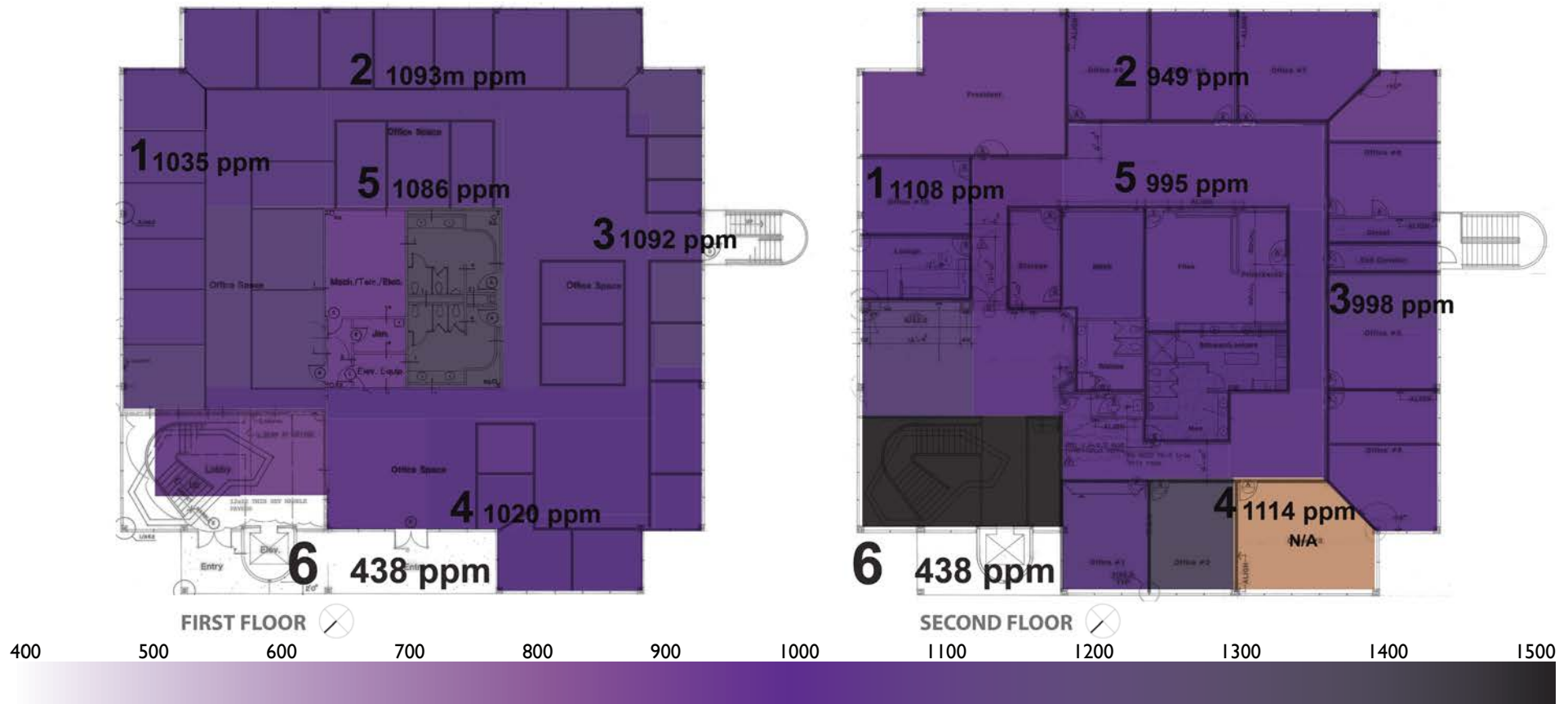
Air Quality Satisfaction



Indoor Air Quality Related Symptoms Improved While Away from Work



Carbon Dioxide Measurements



Value Gradient (PPM)

Summary

- ▶ CO2 is high throughout the building.
- ▶ Air quality reports the second highest level of dissatisfaction of all factors surveyed.
- ▶ The upstairs average from 50 readings is 1011 ppm and the downstairs average from 62 readings is 1013 ppm.
- ▶ The rest room downstairs and the upstairs atrium have the highest CO2 measurements.
- ▶ The periphery of the building has slightly lower CO2 concentrations overall.
- ▶ A few surveys responded that dust and black material falls out of the ducts sometimes.
- ▶ Pictures reveal dust on window sills and significant air gaps in the glass storefront doors. This implies that the building is not a very tight envelope.
- ▶ Partitions were recently added to the first floor which may have affected overall air flow.

Insights

- ▶ The double height atrium space has very high CO2 readings, 1500 ppm, even though this space is close to the periphery and to the entry door.
- ▶ The first floor reported high levels of dissatisfaction with odors from the kitchen creating an unpleasant environment. We recommend separately exhausting the kitchen.
- ▶ The comments about dust falling out of the ducts as well as others suggest that the system needs to be cleaned.
- ▶ The generally high CO2 levels indicate a lack of fresh air distribution in occupied spaces. This could be the result of an oversized system. Oversized systems shut off more often, affecting ventilation.
- ▶ We recommend retro-commissioning for the whole building.
- ▶ CO2 monitoring with demand control ventilation would help to ensure CO2 levels do not exceed safe levels.

Lighting Quality

Proper daylighting integrated with artificial lighting can offer significant energy savings. Spaces that are predominantly daylit tend to enhance performance and mood in their occupants. Benefits of daylighting are maximized by using occupancy and daylight harvesting sensors to ensure energy savings.

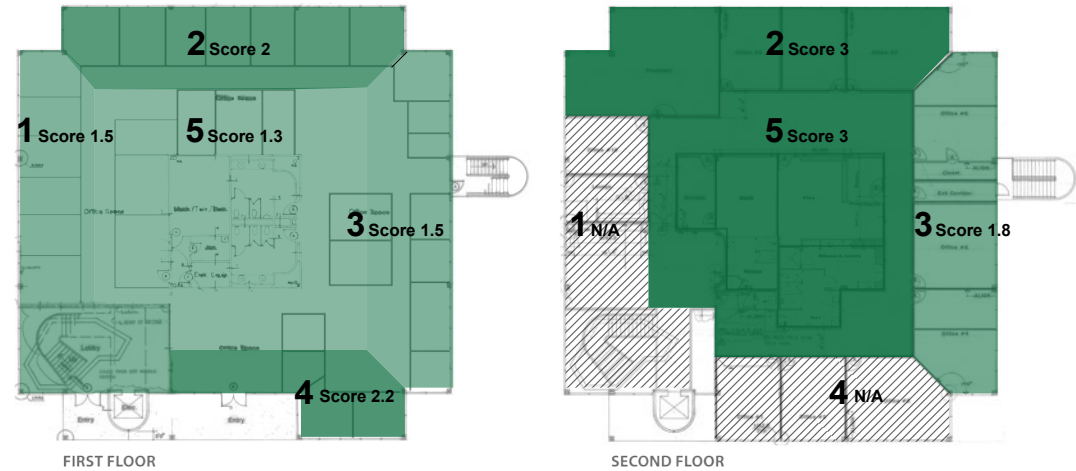
Views can also increase occupant comfort and have a positive impact on mood.

Glare from the sun or overhead lighting can be uncomfortable for occupants working on a computer for an extended period of time. Task lighting allows a user to illuminate to the user's desired lighting needs, which impacts satisfaction and productivity.

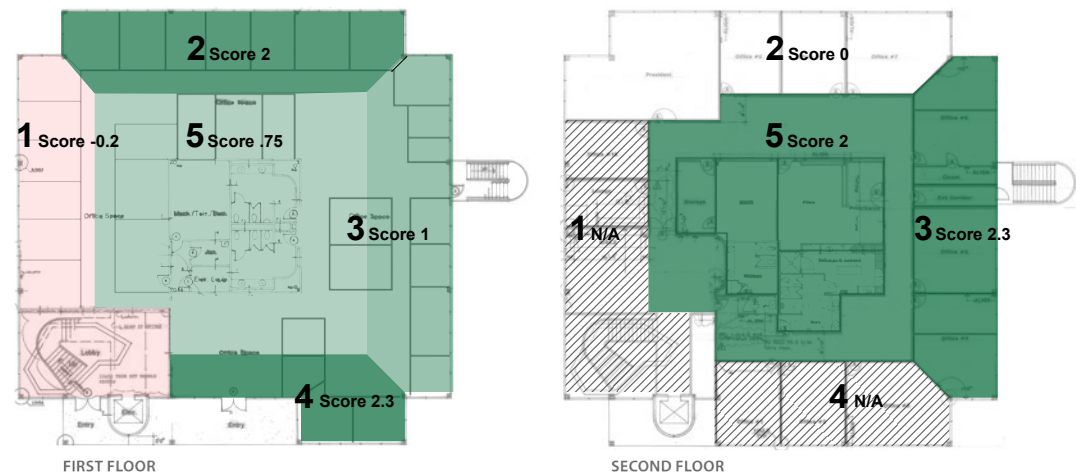
Survey Responses

- ▶ 82% of occupants are satisfied with the amount of lighting in their workspace; of these, 58% are extremely satisfied
- ▶ 66% are satisfied with the visual comfort of lighting as it relates to glare, reflections, and contrast; of these, 37% are extremely satisfied
- ▶ 33% feel that the lighting conditions enhance their ability to do work. 47% do not recognize any change in work ability
- ▶ 93% are satisfied with the visual privacy
- ▶ Fluorescent lighting is a factor in the low score on the first floor in Zone 1, not solely natural light levels.

Light Satisfaction



Visual Comfort Satisfaction



Illuminance Levels

Illuminance Levels



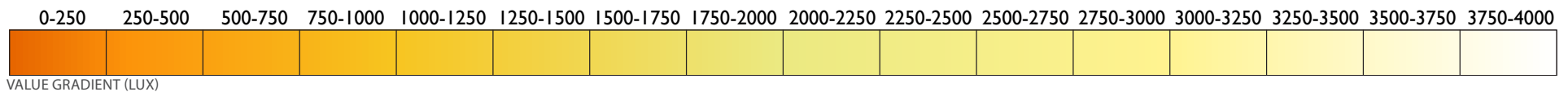
FIRST FLOOR

1. 156 lux 2. 3600 lux 3. 126 lux 4. 2200 lux



SECOND FLOOR

1. 2100 lux 2. 25 lux 3. 2100 lux 4. 2080 lux



Summary

- ▶ Lighting amount and quality are the parameters with the highest overall level of satisfaction.
- ▶ Illuminance readings within the core of the building are low.
- ▶ Most respondents use their blinds regularly to control their environment.
- ▶ In terms of visual comfort, some respondents dislike the fluorescent lighting, and therefore turn the lights off and use task lighting instead.
- ▶ A few respondents mentioned that they would prefer tinted windows so people on the outside of the building can't see in, particularly at night.
- ▶ Light switches for certain spaces are located in an adjacent office, which is not ideal.

Insights

- ▶ Tree locations and the height of the tree canopy seem to influence the illuminance ratings.
- ▶ Overall the occupants are very active in controlling their lighting.
- ▶ Lighting in corridors and offices should allow for map reading on the walls.
- ▶ Since occupants are active in controlling their visual comfort, window shades on photo sensors with manual override would provide a good combination of controllability and energy savings.
- ▶ Automatic lighting controls that adjust with available daylight (daylight harvesting) would save energy and enhance visual comfort.

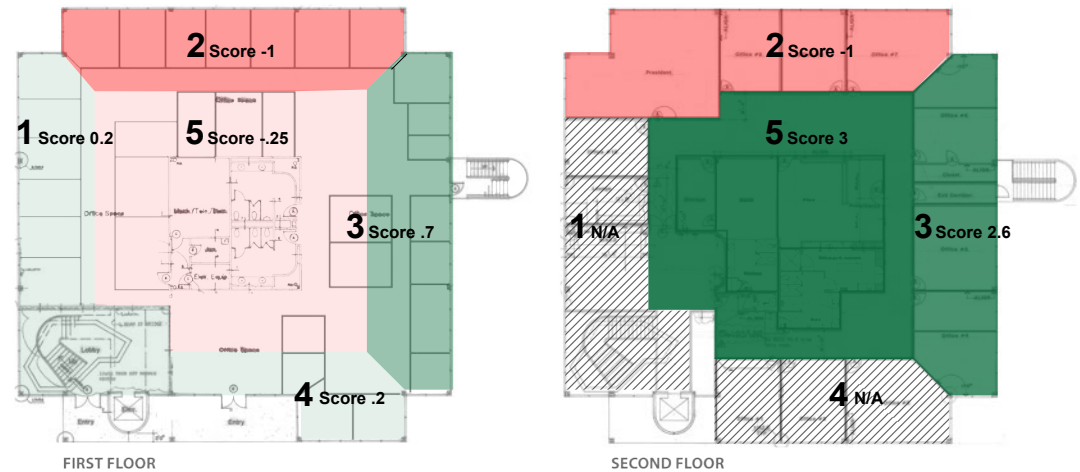
Acoustic Quality

The acoustic quality of an indoor space can greatly affect occupant comfort and productivity. This is especially evident in projects located by major highways or streets in which high levels of noise are produced. Workstations should be designed with privacy and concentration in mind, including designing less noisy HVAC systems. Sound-absorbing materials and white noise that masks other sounds can also improve acoustic quality.

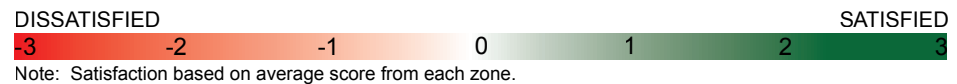
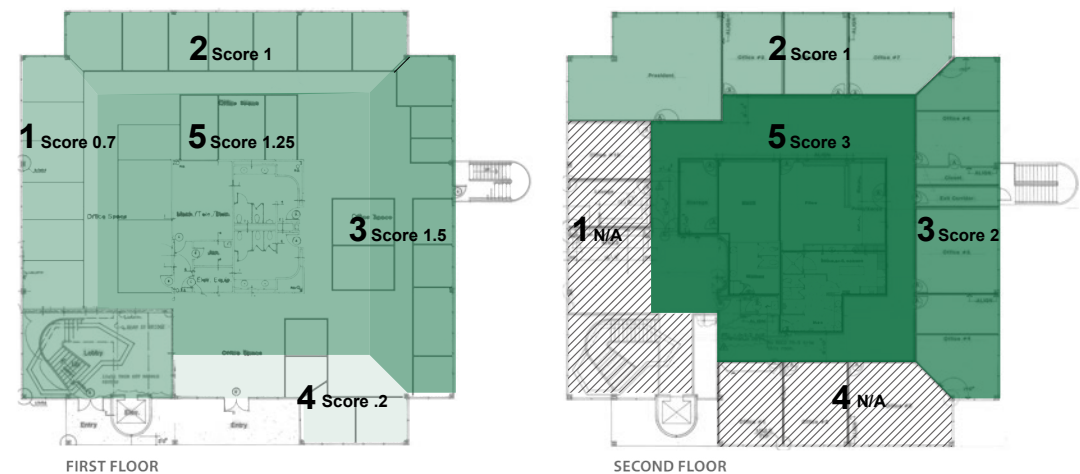
Survey Responses

- ▶ Only 47% of occupants are satisfied with the sound privacy; on the first floor only 39% of occupants are satisfied with the level of privacy
- ▶ Many commented in the surveys that hearing speakerphones through the walls was distracting
- ▶ Despite the low levels of satisfaction reported, only 10% of occupants feel that the acoustic quality affects their productivity at work

Sound Privacy Satisfaction

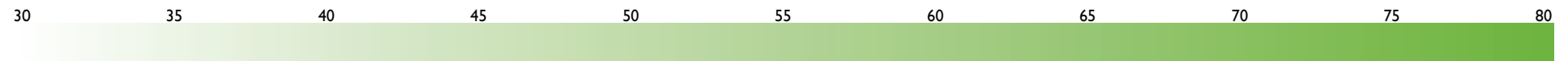
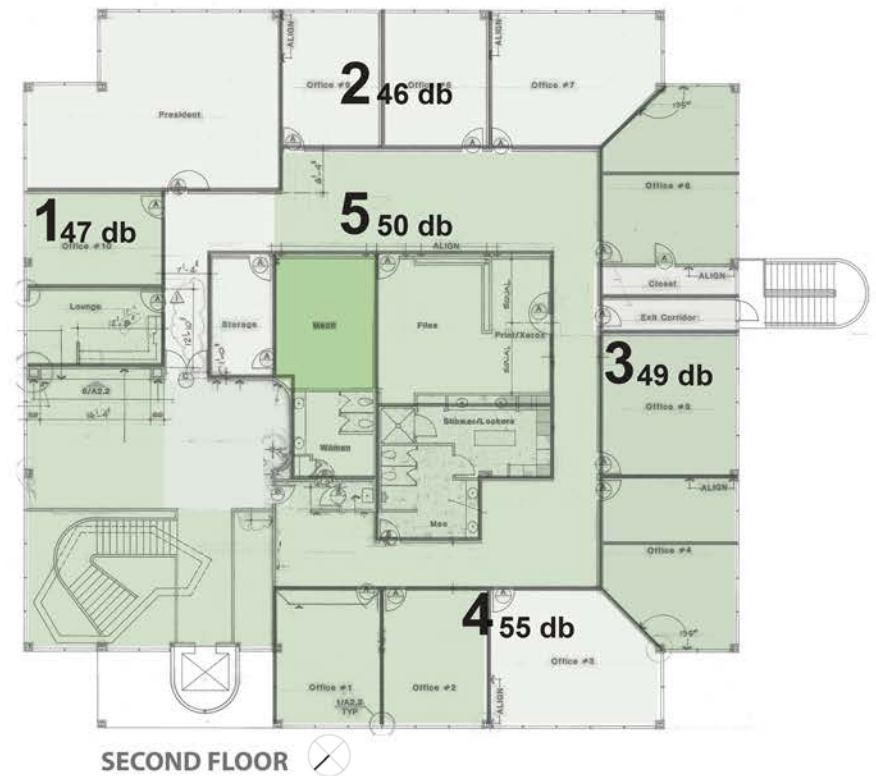


Noise Satisfaction



Sound Levels

Sound Measurements



VALUE GRADIENT (DB)

Summary

- ▶ Sound Privacy has the lowest overall level of satisfaction of all factors studied, particularly on the first floor.
- ▶ The average noise level on the second floor is 47 db and 48 db on the first floor.
- ▶ The double height space by the stairs does not seem to conduct noise through the space.
- ▶ The corridors are louder than the offices.

Insights

- ▶ The new floor to ceiling partitions on the first floor, as opposed to the full height enclosed offices on the second floor, may create the disparity between sound privacy satisfaction on the first floor and the second.
- ▶ Zone 2 had the loudest noise level and the highest level of dissatisfaction for sound privacy on both floors
- ▶ The mechanical rooms had the loudest readings; interestingly, one of the quietest readings was adjacent to the mechanical room, which implies a high degree of soundproofing within the original walls.
- ▶ We recommend better soundproofing between offices for new construction.

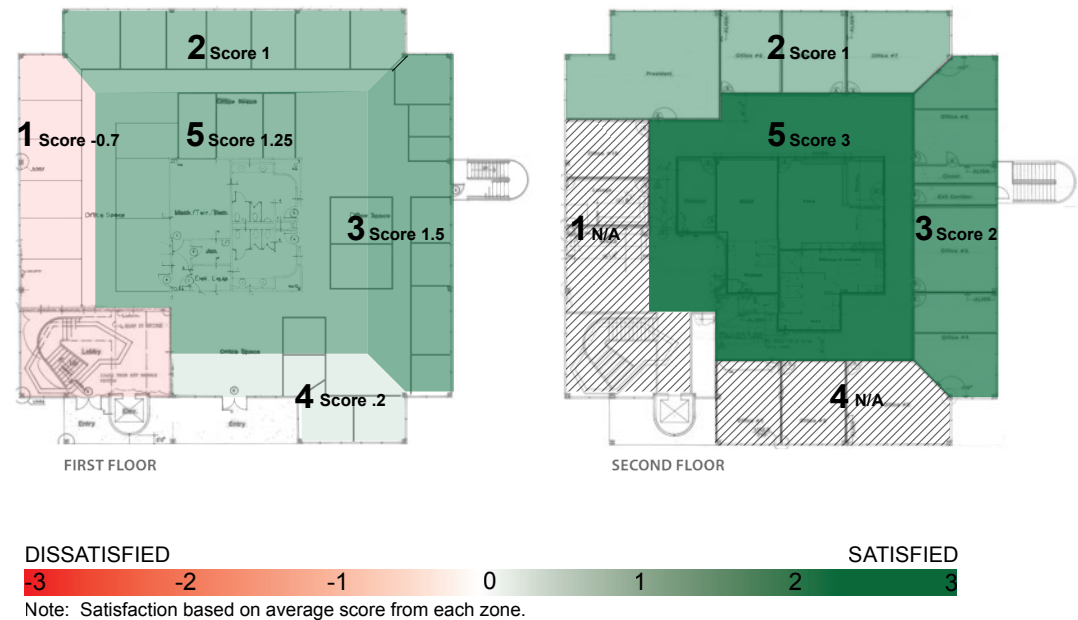
Thermal Comfort

Thermal comfort levels vary by person and can often be improved by personal thermal controls. The factors that influence thermal comfort are clothing levels, air temperature, relative humidity, air flow, and radiant temperature. Every individual within an office space will possess a different thermal comfort threshold, which makes it impossible to please everyone within a large space. Thermal comfort can also greatly impact performance and mood. ASHRAE standards aim for 80% satisfaction with thermal conditions.

Survey Responses

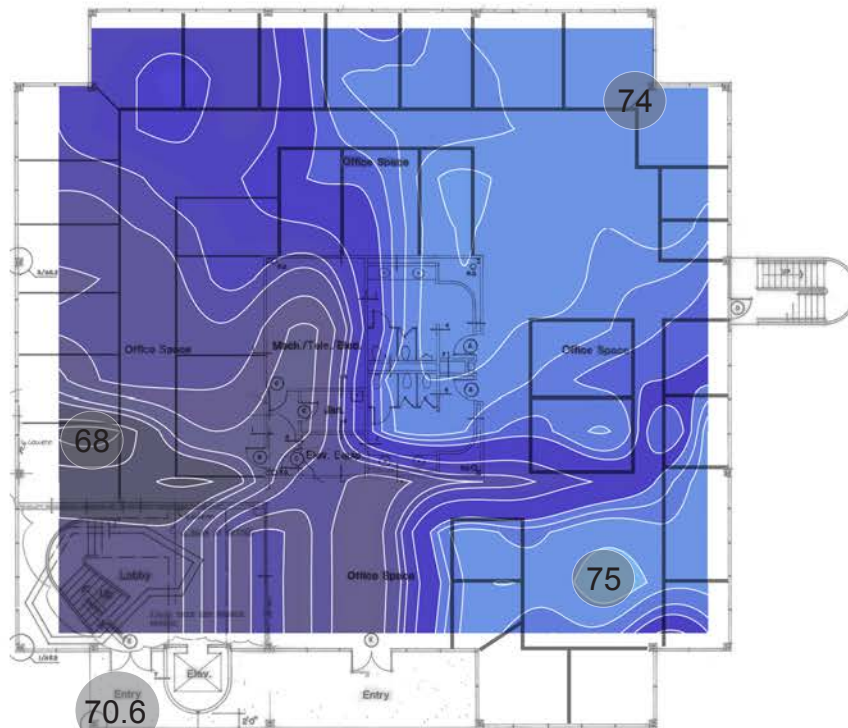
- ▶ Overall, 68% of occupants are satisfied with the temperature of their workspace
- ▶ Occupants feel that they have very little control over the temperature in their workspace; 40% of occupants use a portable heater, and 27% use a portable fan
- ▶ In the summer, 43% of occupants are too cool and 21% are too warm
- ▶ In the winter, 50% are too cool and 7% are too warm
- ▶ 53% of occupants do not feel that thermal comfort enhances or interferes with their work
- ▶ 15% of all males reported thermal discomfort. 30% of females reported thermal discomfort
- ▶ 60% of the occupants on the first floor expressed discomfort. Of those who expressed discomfort, all were female

Thermal Comfort Satisfaction

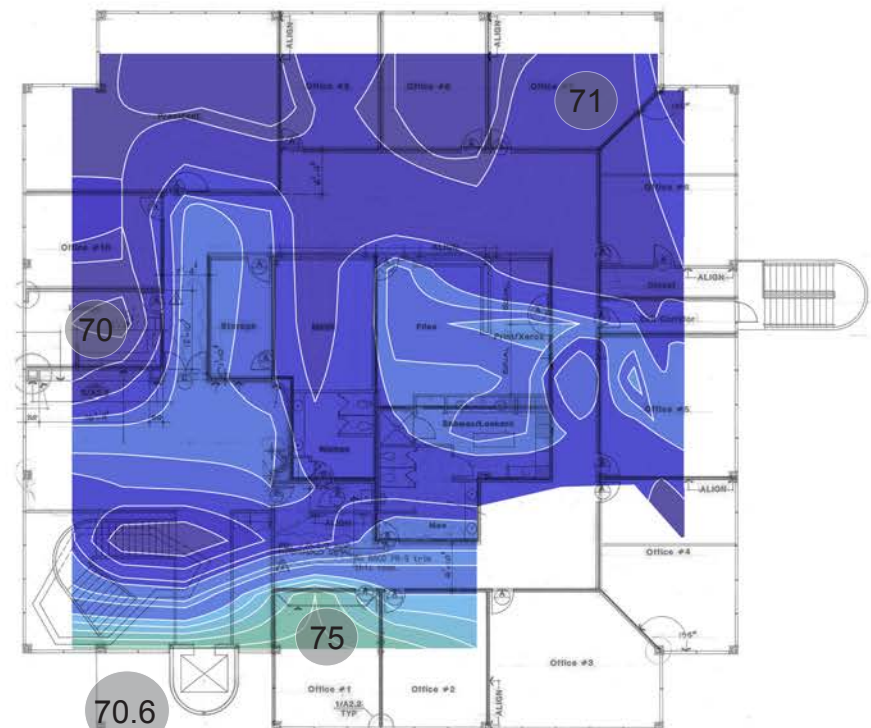


Air Temperature

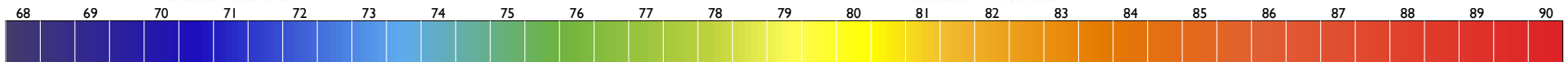
Thermal Mapping



FIRST FLOOR



SECOND FLOOR



Value Gradient (°F)

Summary

- ▶ The north and north east areas of the first floor are where occupants report the highest level of discomfort, 0.7, which correlates to the coldest temperature readings within the building.
- ▶ The warmer temperatures and higher levels of satisfaction correlate with the side of the building that is slightly less shaded on the ground floor. Overall, the first floor is noted to be colder by the occupancy surveys.
- ▶ All females on the first floor expressed discomfort, possibly indicating a lower setpoint than needed for their comfort.
- ▶ Many occupants use portable fans and heaters to provide thermal comfort.

Insights

- ▶ Heat rises-the hottest levels were in an office close to both the elevator and the double-height space.
- ▶ Both floors have wide temperature ranges-the first from 68-75 and the second from 70-76.
- ▶ The heat spikes near equipment.
- ▶ Partitions and new offices have been built within the last three months, so the mechanical system has probably not been changed to accommodate this new layout.
- ▶ Uneven ventilation could account for some of the thermal discomfort.

Infrared Images

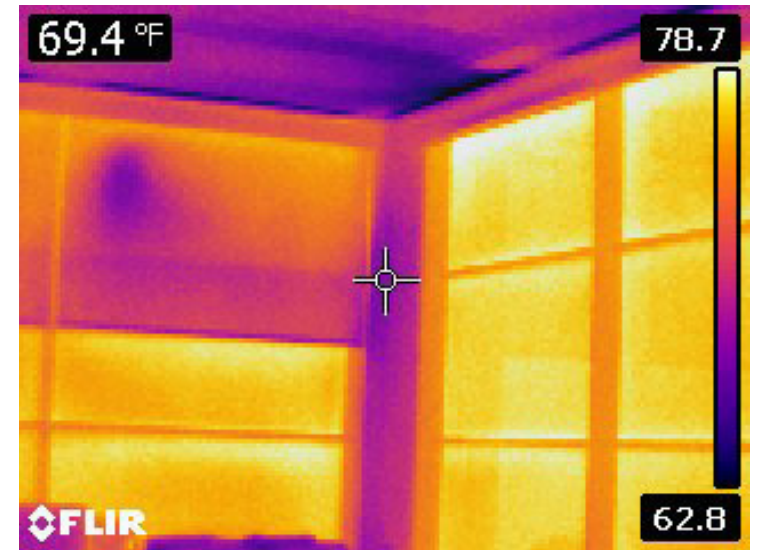
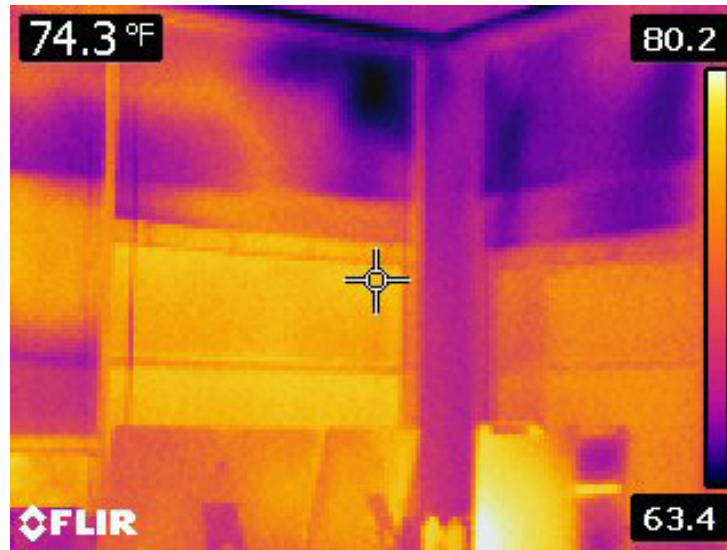
Thermal imaging is used to check on thermal bridging and air leakage points as well as identifying other key areas where improvements can be made.

The four images on the right show the overall conditions found in most perimeter rooms and highlight the design concept of a highly glazed building envelope.

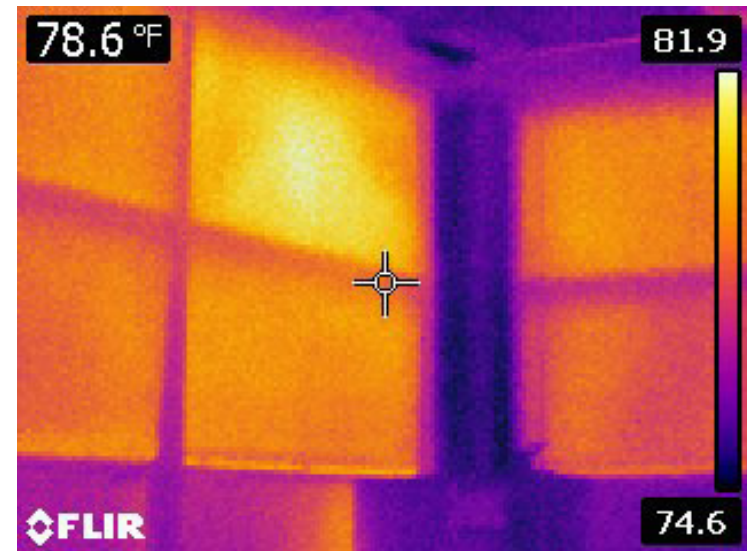
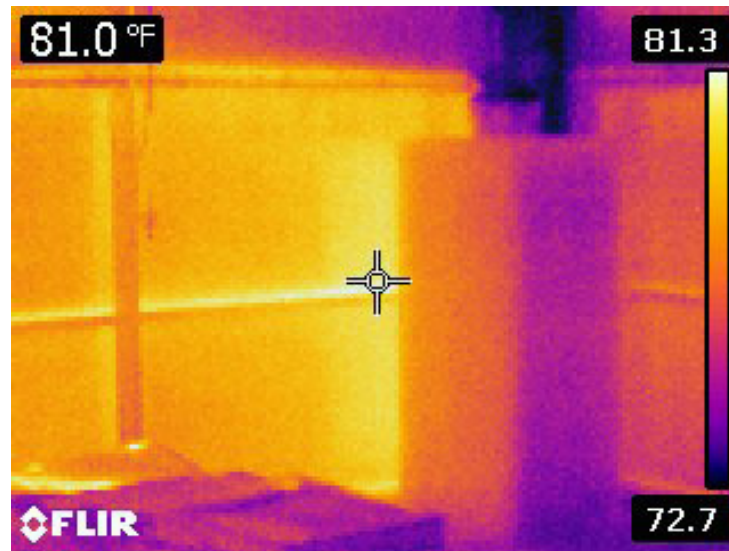
▶Blinds contribute to about an 8 degree difference in the glass temperature.

▶Cool air is brought into the room close to the windows to help offset solar heat gains.

▶All images show how the users control their environment by using blinds.

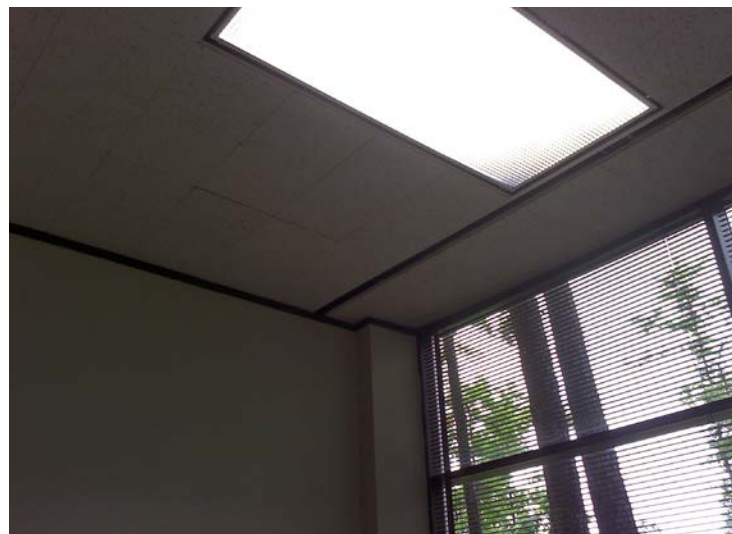
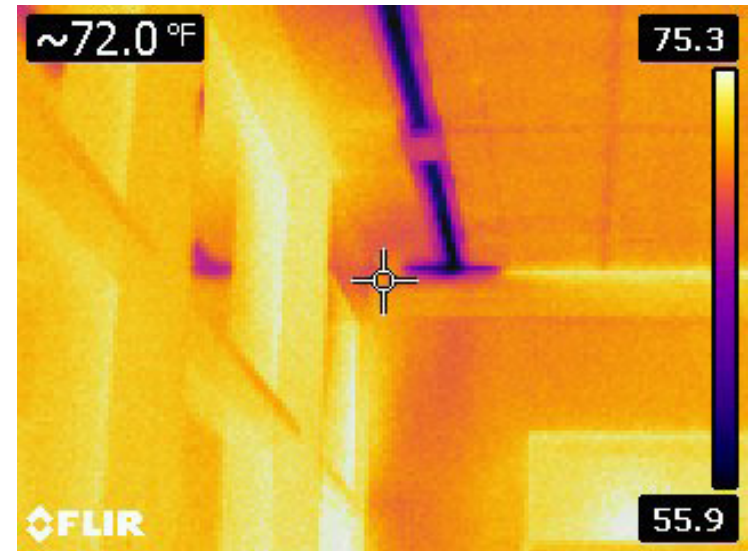
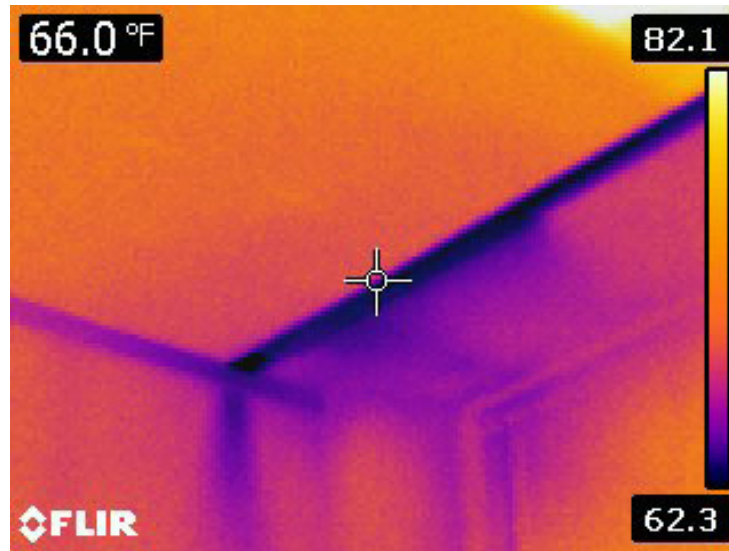


Infrared Images



Infrared Images

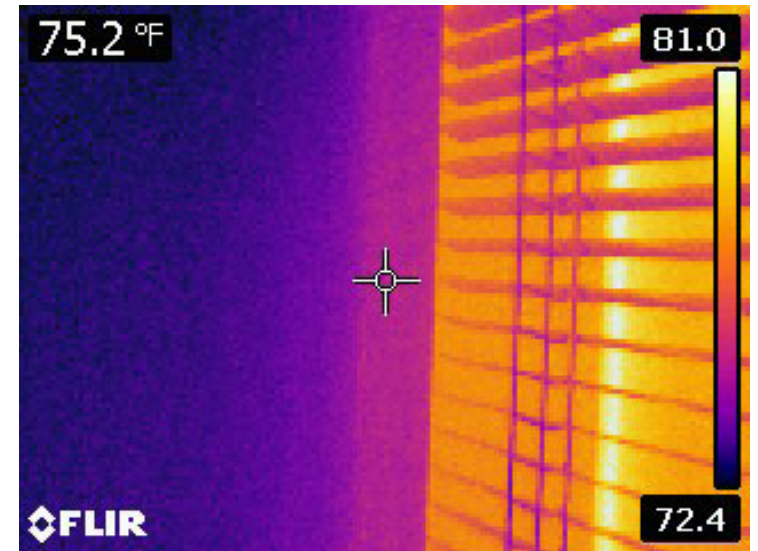
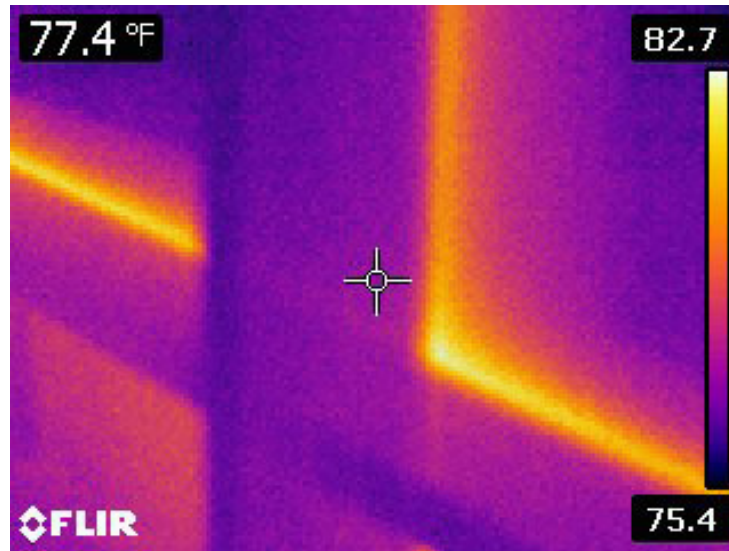
The two images on the right show the effectiveness of the diffusers along the windows.



Infrared Images

Window technology has developed greatly in the time since this building was built. However, the windows are still effective and thermal bridging is minimal.

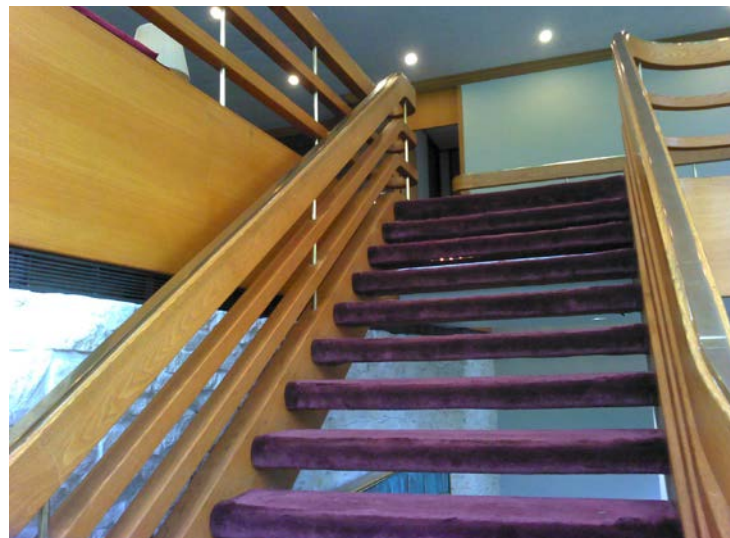
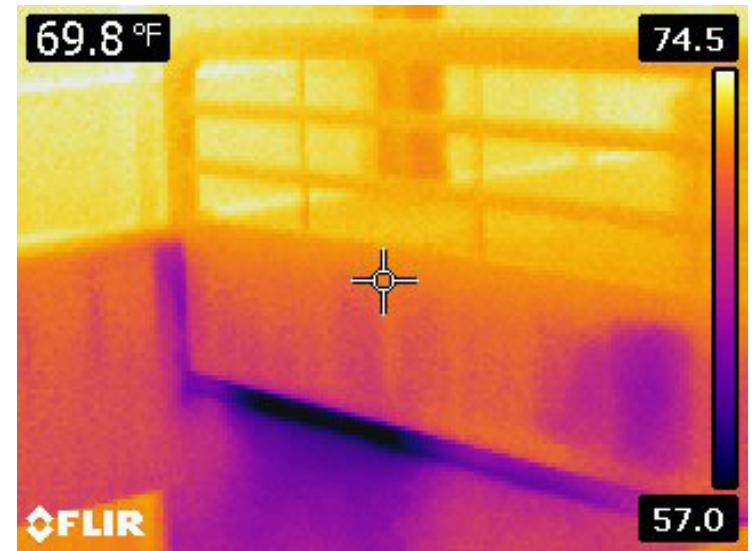
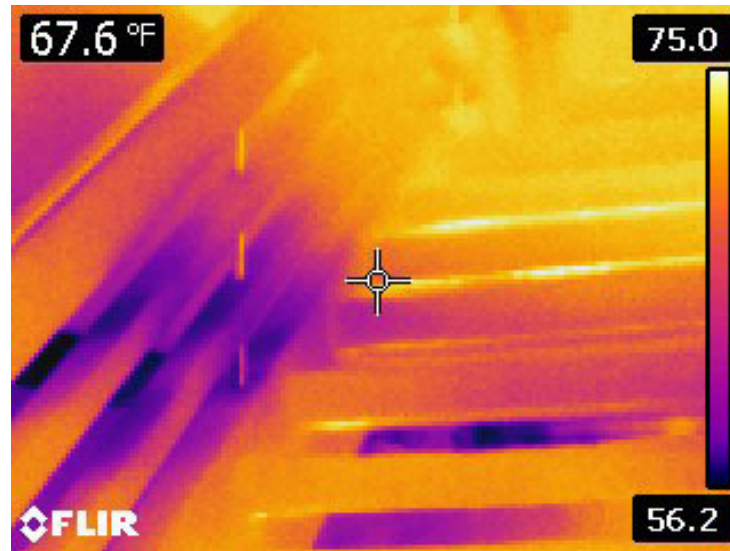
► The window assembly, the blinds, and perimeter cooling creates a 9 degree temperature difference between inside and outside.



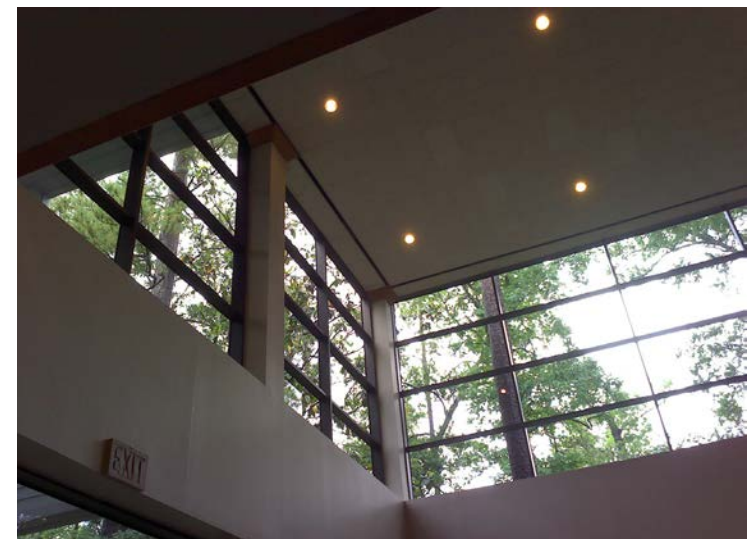
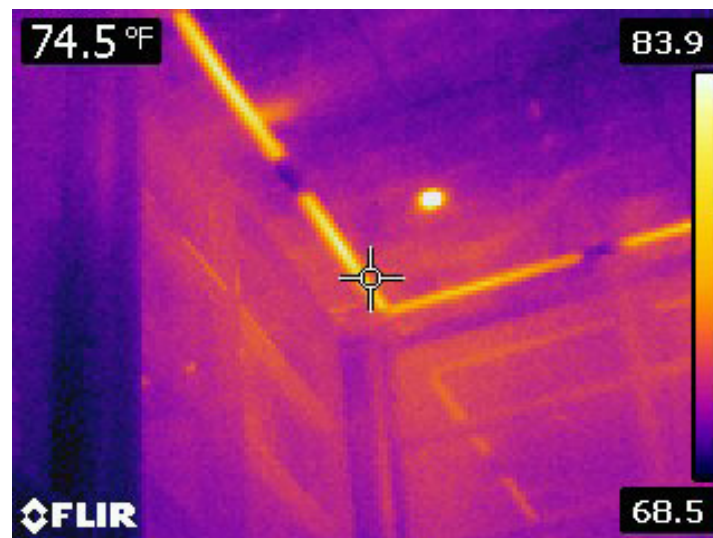
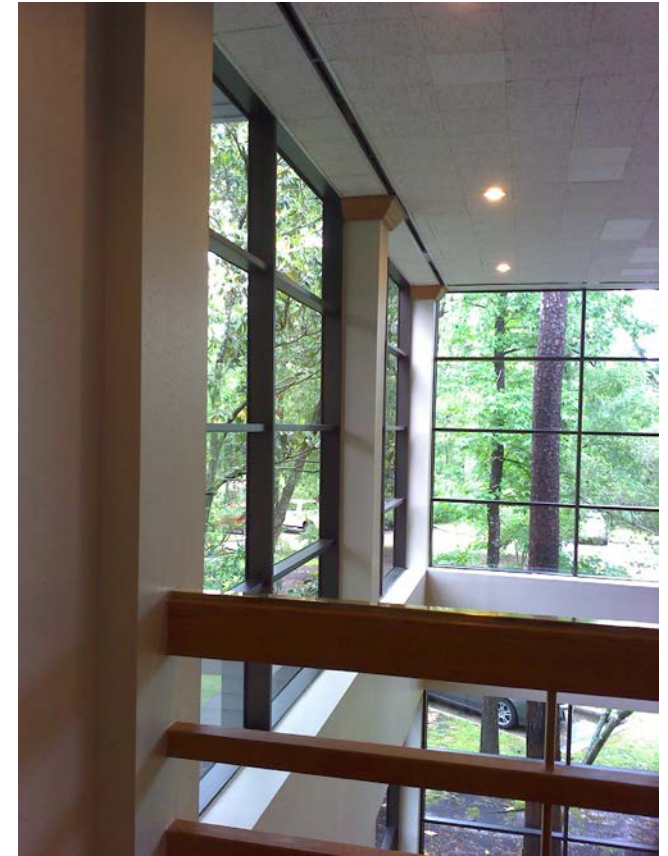
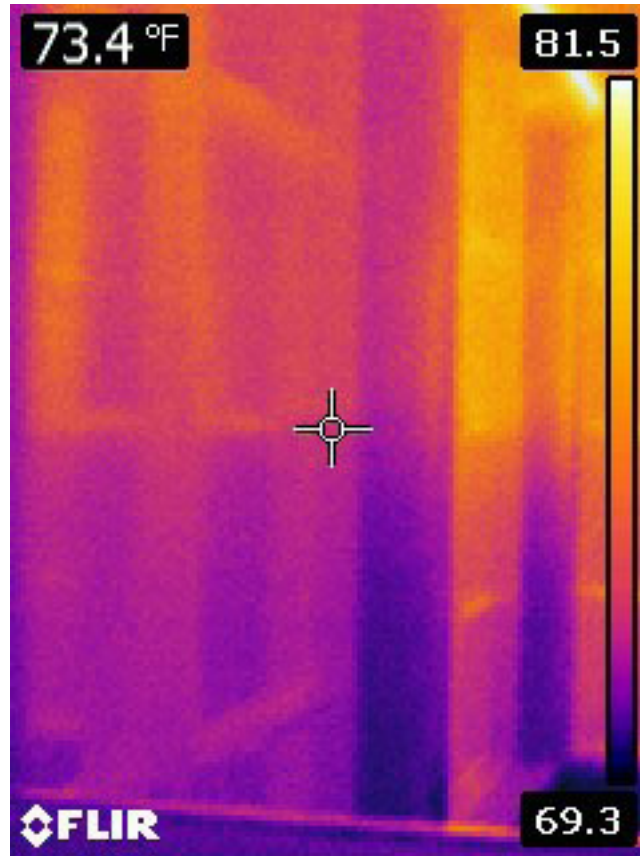
Infrared Images

The two images on the right show how mid-level air conditioning supply ducts help to keep the double-height space comfortable.

► Hot air rises and reaches a temperature of approximately 74 degrees at the finished floor level of the second floor.

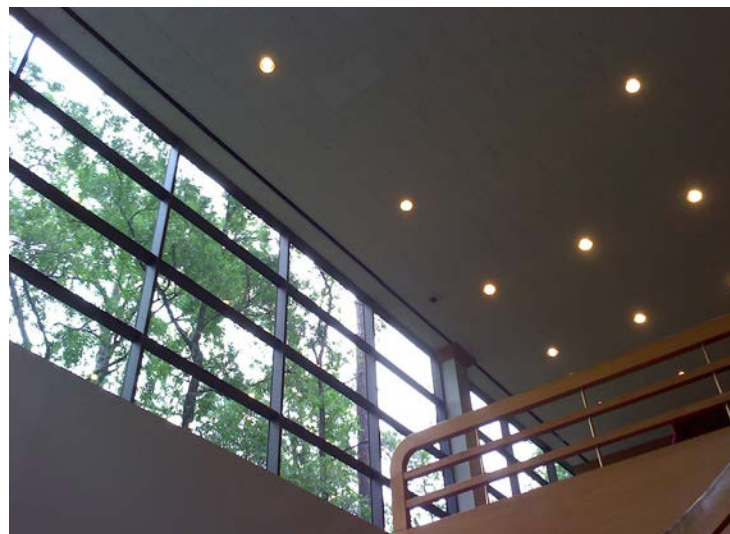


The images on the right show how heat is rising through the atrium space. Interestingly, the supply air from the ducts is warm, which means that the heat is on even though the outside air temperature is a comfortable 70 degrees.



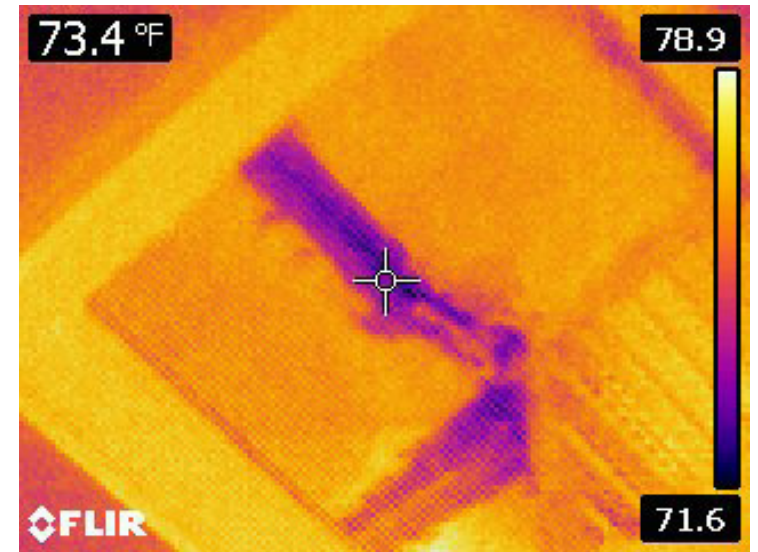
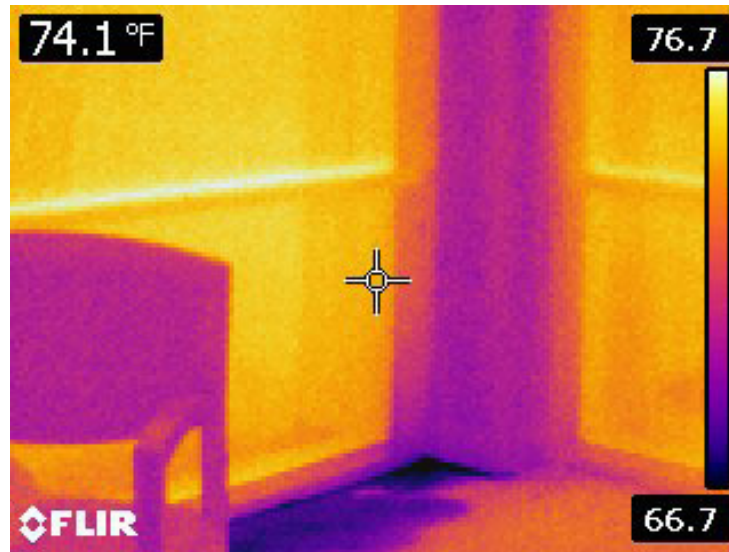
Infrared Images

The image on the near right shows the zoning of the HVAC system. The double height space is being heated, and cooled at the same time.

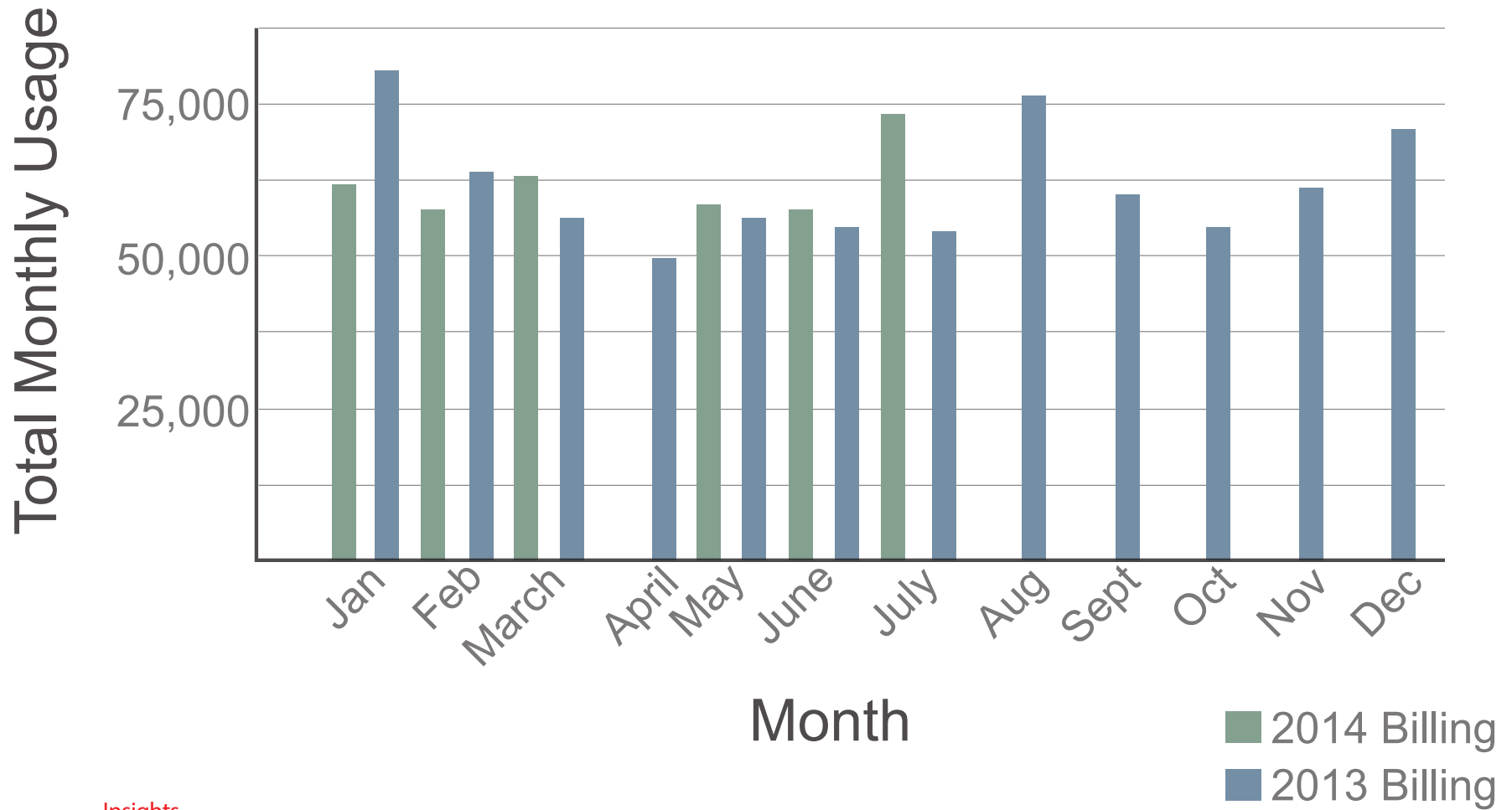


Infrared Images

Right hand image shows combined supply air with light fixture. We recommend all these fixtures be replaced with separate light fixtures and supply grilles.



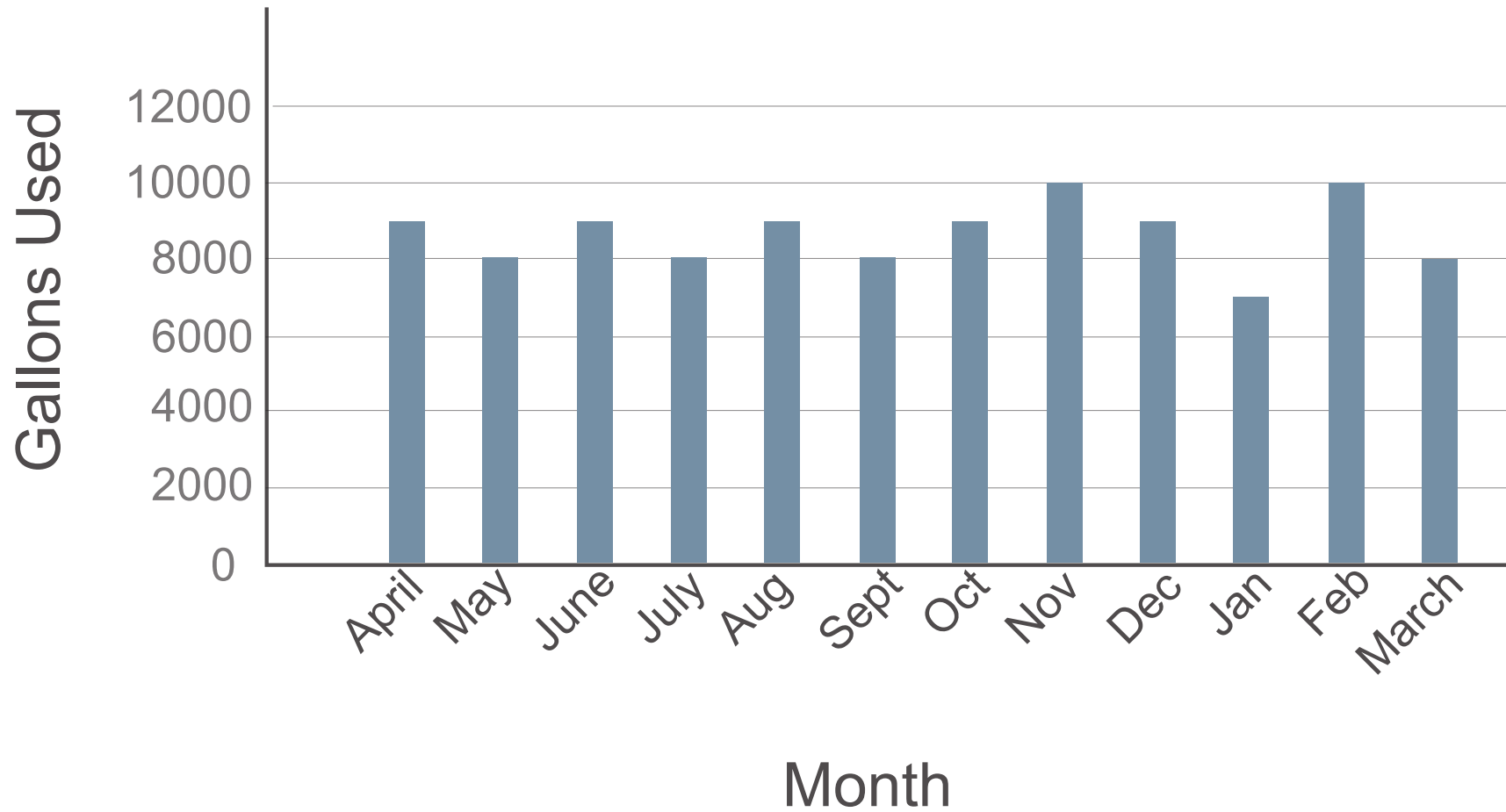
Utility Data



Insights

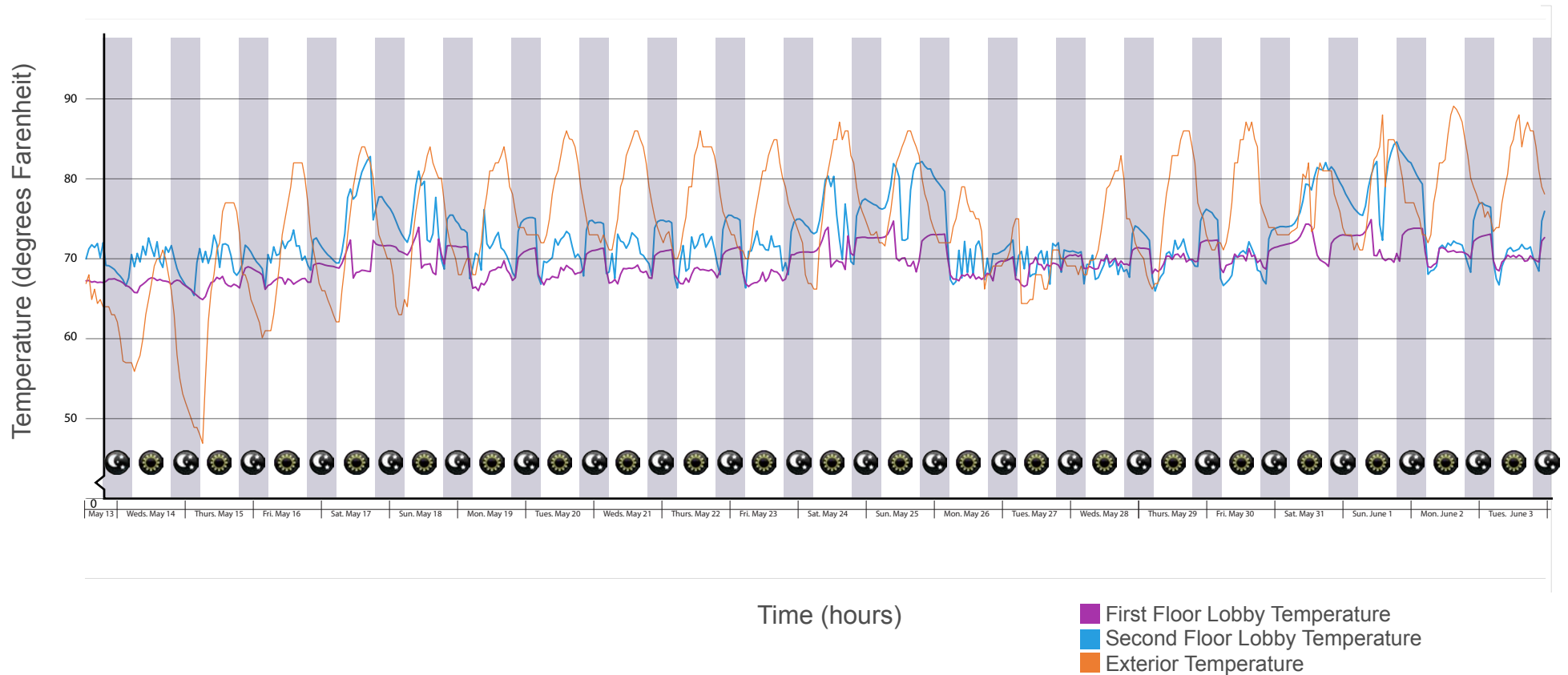
- ▶ The building EUI (Energy Use Intensity) is 103. This is close to the average EUI of an office building in Houston.

Water Usage



Temperature Graphs

First Floor, Second Floor, and Exterior Air Temperature

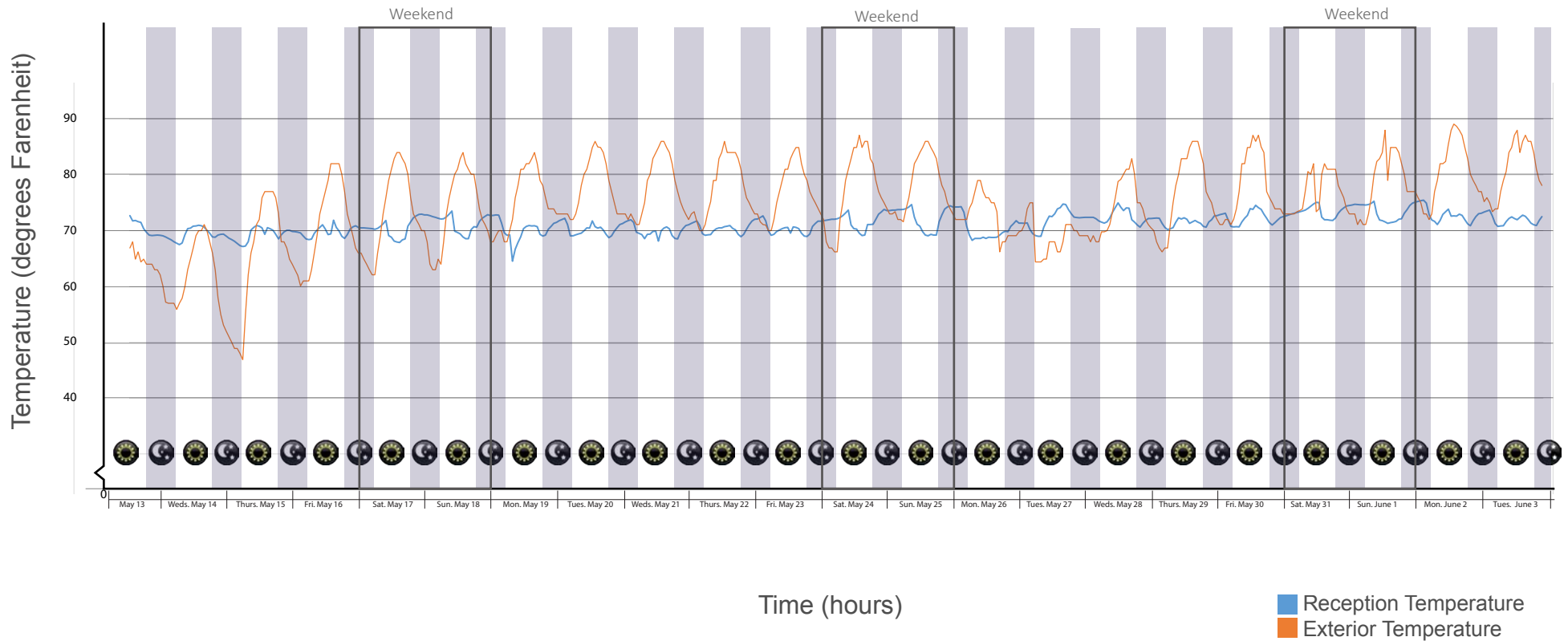


Insights

- Datalogger results from the lobby show stratification between 1F-5F during regular hours. Lowering heat gains (eg. improved glazing) and improving airflow through zoning must be considered during Renovation. Also, significant stratification in weekend readings (10F-14F) suggest that Second Floor, unlike the First, must be following an unoccupied setpoint.

Temperature Graphs

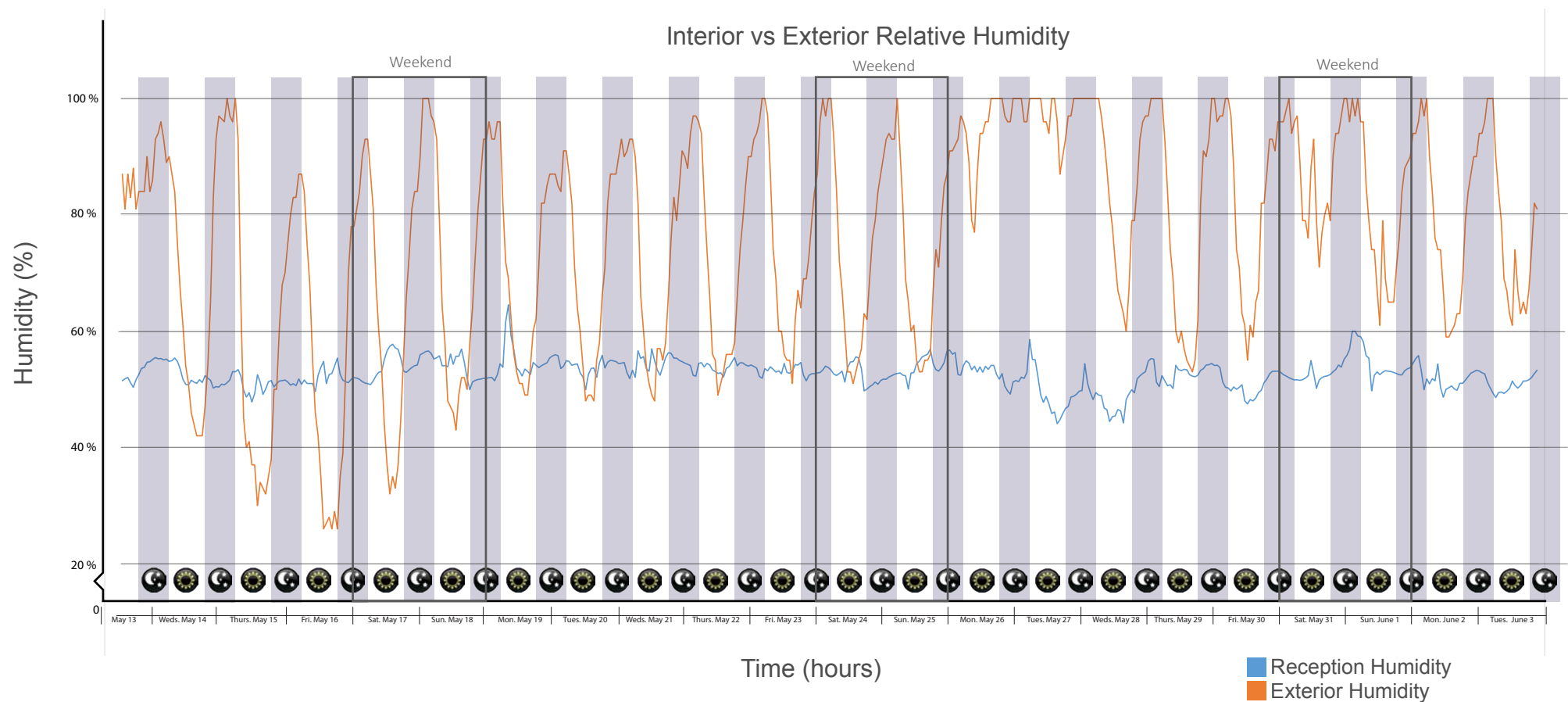
Reception vs Exterior Air Temperature



Insights

- Datalogger results from reception verify that cooling is always on, even during unoccupied times and on weekends. The setpoint may be too low (70F) for thermal comfort.

Humidity



Building Envelope

- ▶ The building envelope has fairly significant air gaps in between doors and some windows that allow particulates from outside to come inside, as seen in the photographs to the right.
- ▶ Despite the implications of outside air being introduced to the building through these gaps, CO2 readings are high throughout the building overall.



Water

- ▶ Evidence of water damage is shown in the photographs to the right.
- ▶ Some surveys reported musty and stuffy odors. Potentially, the water damage could be contributing to the high levels of dissatisfaction with air quality as well.



Conclusion

Overall Design Concept

- ▶ Daylighting, visual privacy, and interaction between occupants are seen as very successful
- ▶ Thermal discomfort and dissatisfaction with air quality are key areas of improvement
- ▶ Occupants are overall satisfied with colors and textures of flooring, furniture, and other finishes in the building
- ▶ The building is approximately 30 years old, and new changes within the building have exacerbated the need for changes to the HVAC system for thermal comfort and indoor air quality and to acoustical methods to increase sound privacy between offices.

Notable Findings

- ▶ The tree canopy height and the density of trees and their position next to the building significantly affect both temperature and daylighting measurements.
- ▶ Overall, most occupants have access to window views and actively adjust systems as needed to provide comfort.
- ▶ Occupants use portable heating and cooling devices, which implies significant issues with thermal comfort.
- ▶ Windows do provide effective thermal breaking.
- ▶ While the windows provide occupants with very high levels of satisfaction to views, they also cause security concerns. In survey responses, visual privacy from outside is needed.
- ▶ CO2 levels are a major concern in this building. We recommend demand control ventilation with CO2 monitoring for future HVAC design to ensure a safe and productive indoor environment.

Appendix C- Examples and Case Studies
Skidmore, Owings & Merrill LLP- Confidential Research Laboratory

This evaluation of a client's existing space was conducted with the Center for the Built Environment's (CBE) survey. Building occupants were asked to complete an online survey. The results were compiled in this case study, along with observations, photos and general building characteristics.

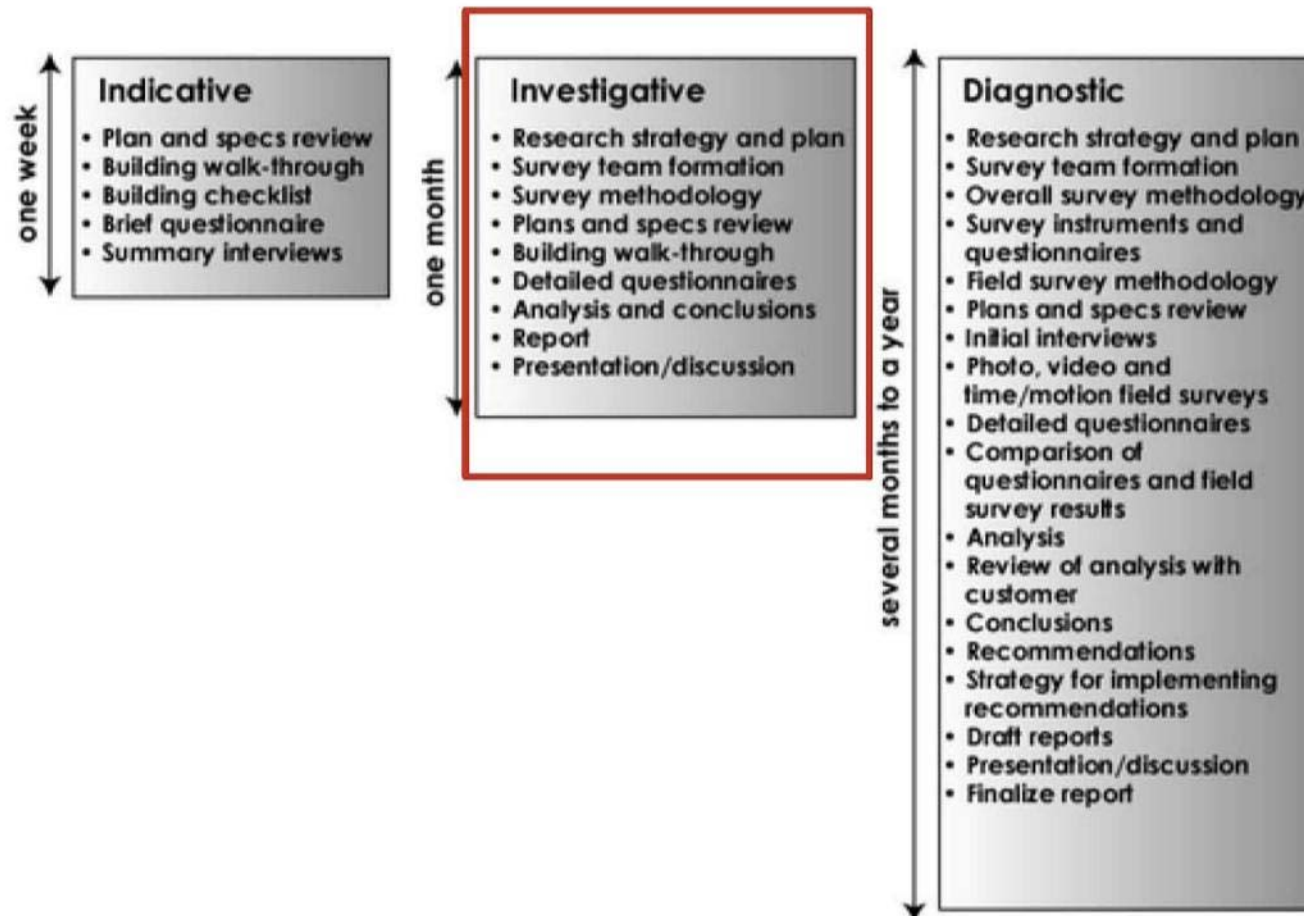
Purpose of Evaluation

- Obtain reliable and relevant evidence
- Use the best available research in making better design decisions
- Measure functionality and appropriateness of design, conformance with performance criteria
- Test the application of new concepts
- Credibly confirm project performance

Types of POE

Depth and quality of data obtained

Strength and validity of conclusions and recommendations obtained



Investigative POE Methodology

- Occupant perception survey
- Observational analysis, photo documentation
- Building characteristics data

Timeline

Phase 1: Existing Building Conditions Evaluation, *Pre-Occupancy Evaluation (PROE)*

- February-March 2012: Survey Developed with CBE & SOM
- March-April 2012: Survey Distributed to Occupants
- April-May 2012: Survey Analyzed
- June-July 2012: Results discussed internally at SOM

Phase 2*: Post Occupancy Evaluation (POE)

- July 2012-August 2012: Hypothesize
- August-September 2012: Evaluate & Modify Survey Tool
- March-April 2013: Survey Distributed to Occupants
- April-May 2013: Survey Analyzed
- June 2013: Report Findings

* not included in this report

A stylized, light gray human figure is centered in the background. It has a circular head, a rounded torso, and two vertical legs. The figure is semi-transparent, allowing the text to be seen through it.

Survey Demographics & Overall Percentiles

Questions:

- How is the building performing from the occupants' perspective?
- What is contributing to this level of perceived performance?

Survey Demographics

How many years have you worked
at your present workspace?

78%

More than one year

In a typical week, how many hours
do you spend in your workspace?

57%

More than 40

What organization do you work for?

Department 1

3%

Department 2

41%

Department 3

56%

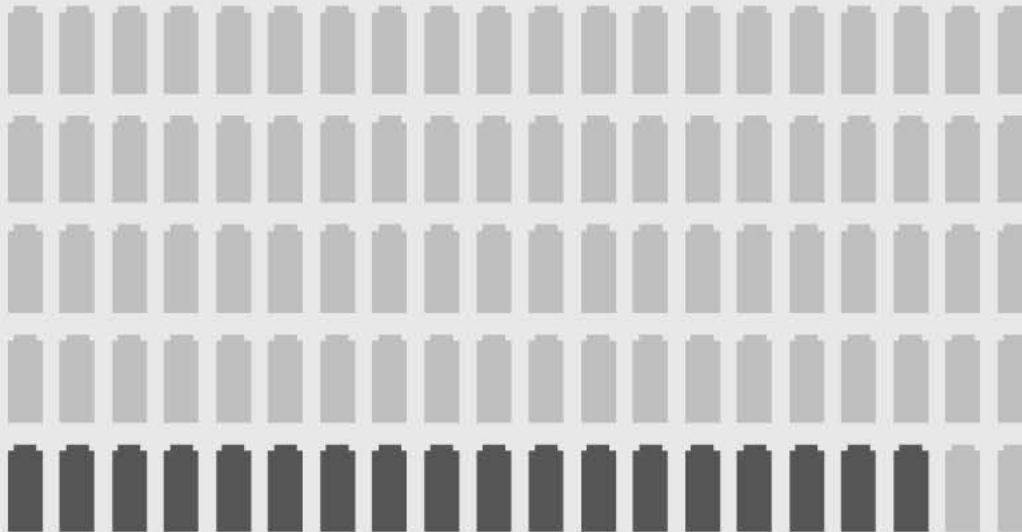
40% response rate
Sample size 68

Overall Percentile of Confidential Lab Building



47% Satisfied Overall Building

CBE Data
Among 100
similar
buildings



18th Percentile

Phase 1

Categories of Performance Criteria Assessed:

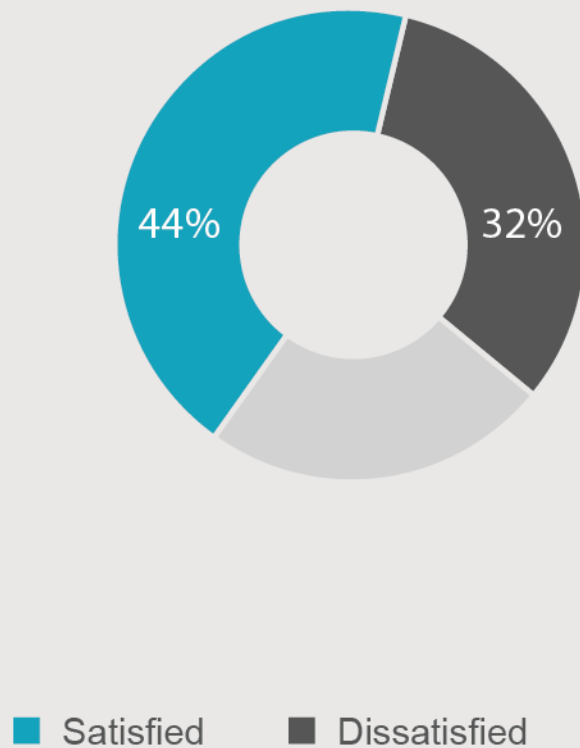
1. Acoustic Quality
2. Lighting
3. Air Quality
4. Thermal Comfort
5. Office Layout
6. *Laboratory Layout
7. Furnishings
8. Maintenance



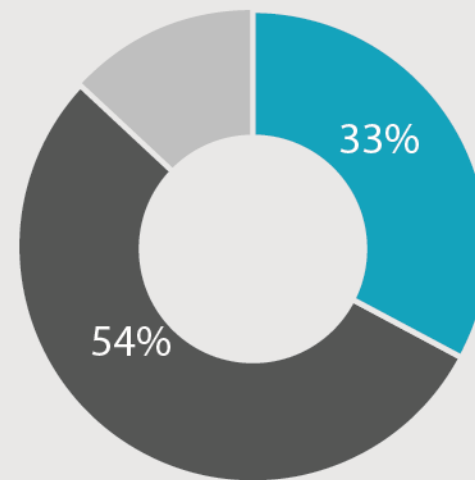
Acoustic Quality

Acoustic Quality: characteristic assessment

How satisfied are you with the noise level in your workspace?

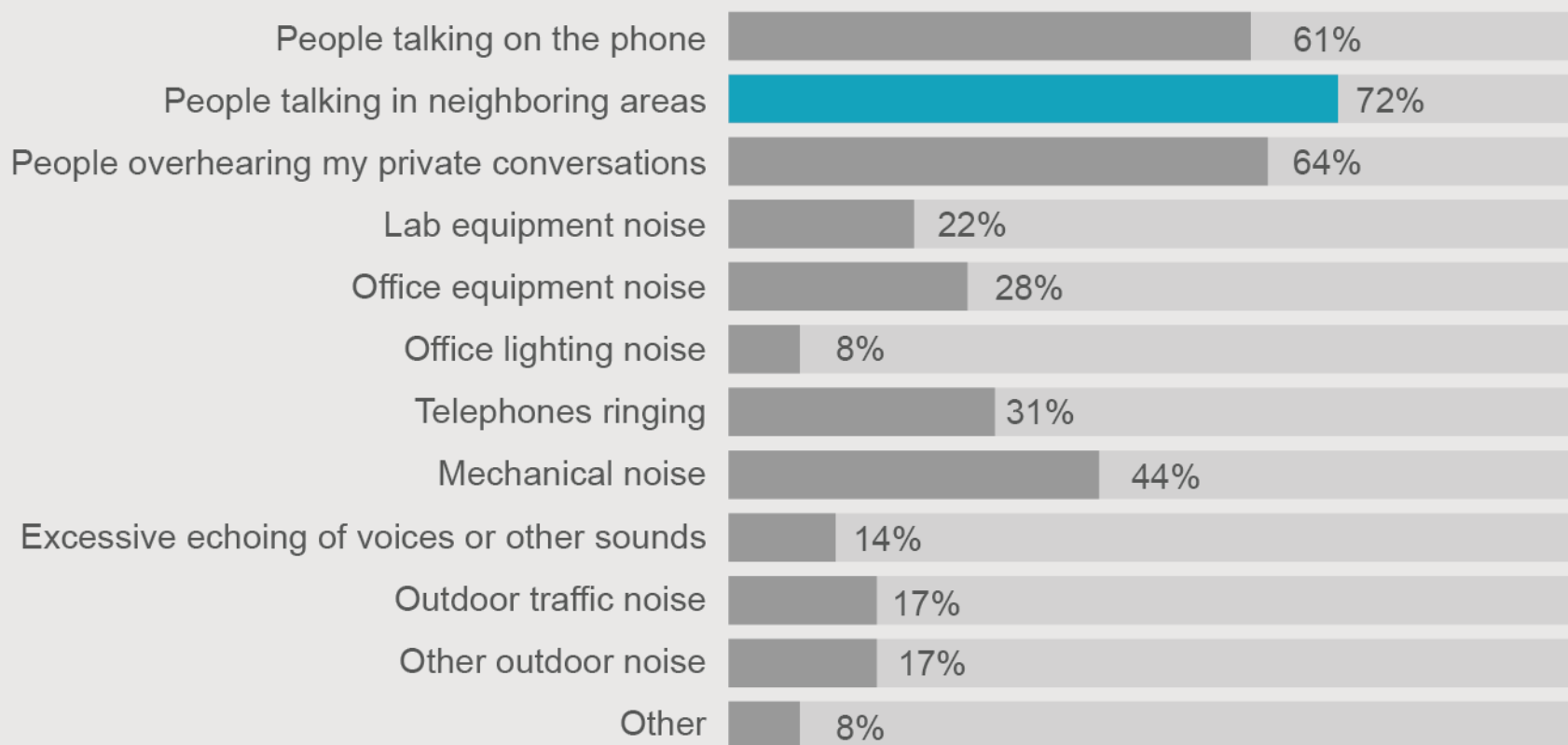


How satisfied are you with the sound privacy in your workspace?



Acoustic Quality: component assessment “source” discovery

You have said that you are dissatisfied with the **acoustics** in your workspace, which of the following contribute to this problem?





Lighting

Lighting: characteristic importance metric

89% feel daylight is very important

Lighting: characteristic and component assessment

66% are satisfied with the
natural lighting from the windows





Air Quality

Air Quality: characteristic assessment

Air is stuffy/ stale

Major Problem

67%

Minor Problem

12%

Air is not clean

Major Problem

50%

Minor Problem

12%

Air smells bad

Major Problem

62%

Minor Problem

25%

Contaminants are a safety hazard

Major Problem

20%

Minor Problem

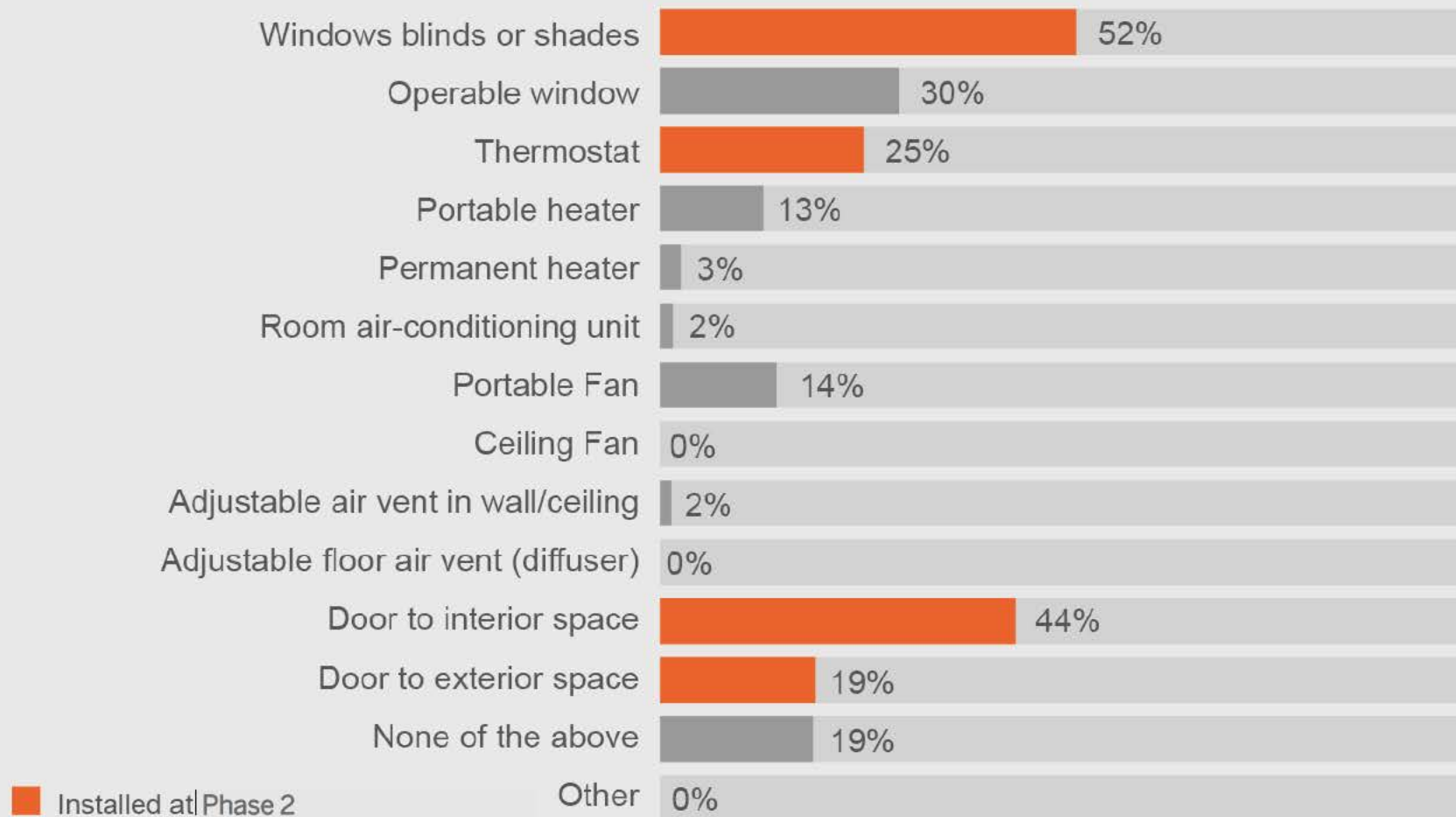
60%

Thermal Comfort



Workspace: component assessment

Which of the following do you personally adjust or control in your workspace?



Thermal Comfort: general comments relative to performance criteria



The background features a solid orange color. Overlaid on this are several geometric shapes in a lighter shade of orange. These include a large square in the upper left, a vertical rectangle in the lower left, and a diamond shape in the lower right. The text 'Office Layout' is centered over these shapes.

Office Layout

Layout: component assessment

40% are satisfied with the meeting spaces

"Since the conference room is also a kitchen area, it is often stinky and unclean."

"If there is a meeting in the conference room which is also used as a break room, there is no place to take a break."



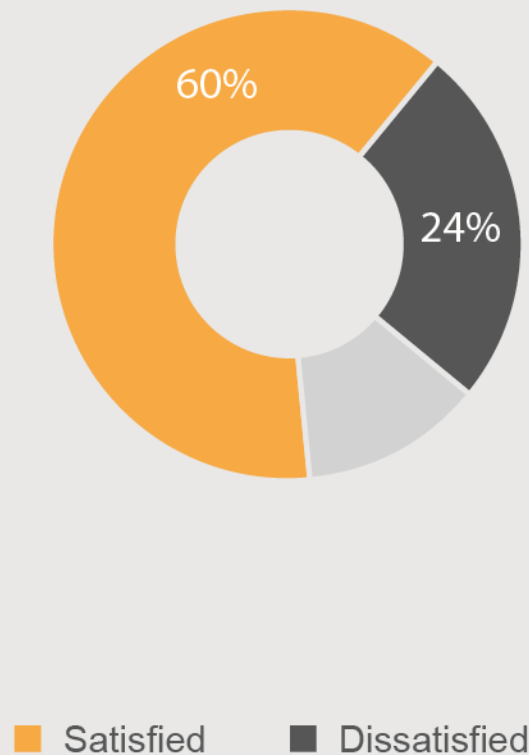
"There is no break room. The break room is a conference room."

Layout: characteristic importance metric

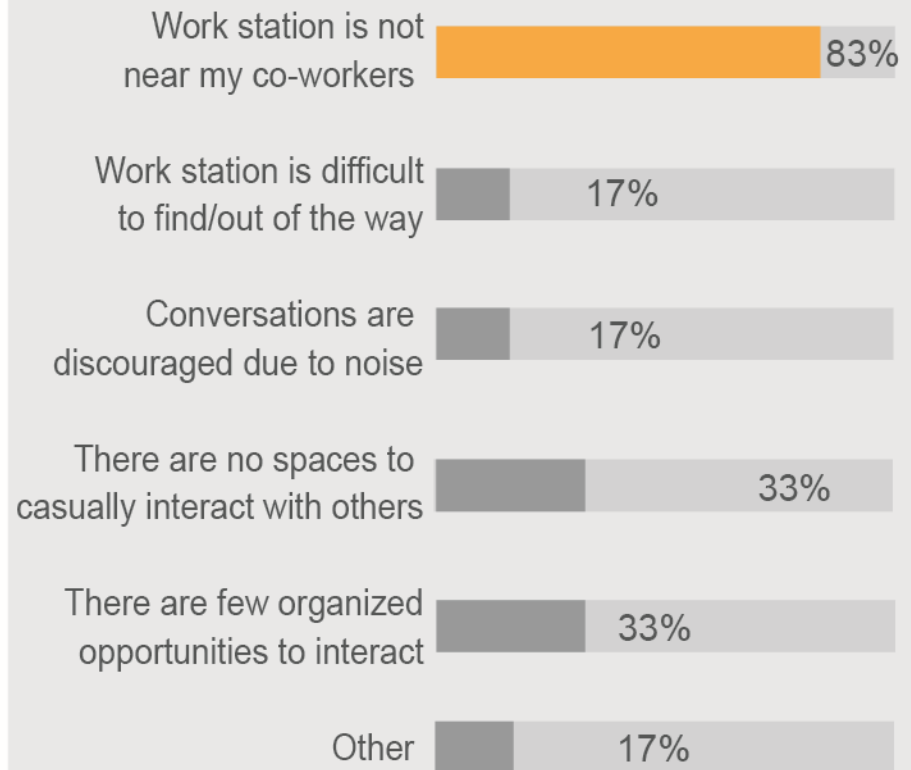
78% feel chance encounters
with colleagues are very important

Layout: component assessment

How satisfied are you with the ease of interaction with co-workers?



You have said you are dissatisfied with the ease of interaction with your co-workers, what contributes?





Laboratory

Laboratory Layout: component assessment

Space for meeting with other people

Major Problem

67%

Minor Problem

17%

Size of lab for the number of people that use it

Major Problem

80%

Minor Problem

20%

Size of lab for the amount of equipment in it

Major Problem

67%

Minor Problem

17%

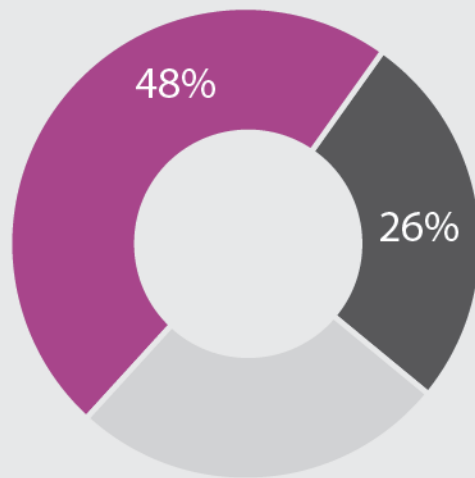
Laboratory Layout: characteristic importance metric

62% feel the proximity of lab to office
is very important



Laboratory Layout: characteristic evaluation

How satisfied are you with the flexibility of the lab layout?



■ Satisfied ■ Dissatisfied

How conveniently located are the support rooms you need?

39% say convenient

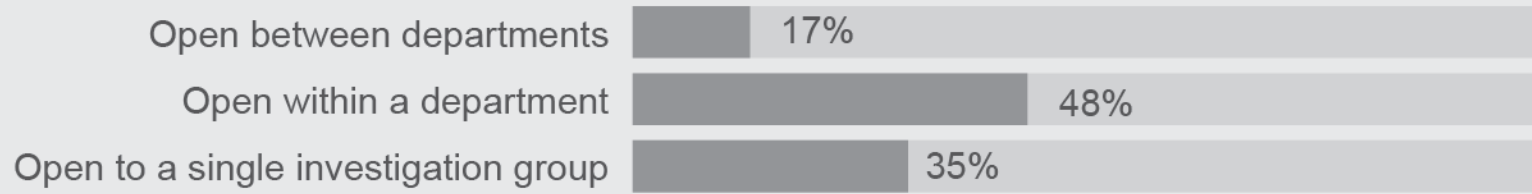
How easy is it to get around the lab to access what you need?

61% say easy



Laboratory Layout: characteristic assessment

Identify the ideal degree of openness for your work environments **lab space** specific to your position:



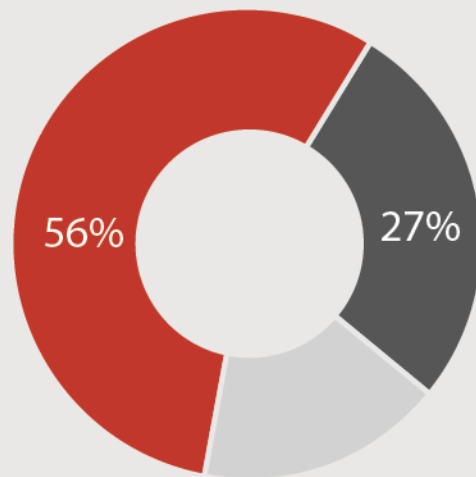
***Data could be helpful during Design**

A stylized, minimalist icon of an office chair in a light orange color. The chair features a high backrest, a horizontal seat, a central vertical column, and a five-spoke base with circular casters. The word "Furnishings" is written in white, sans-serif font across the middle of the chair's backrest.

Furnishings

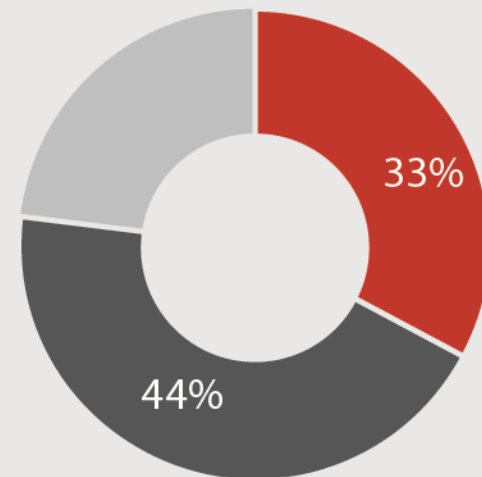
Office Furnishings: characteristic and component assessment

How satisfied are you with the **comfort** of your office furnishings (chair, desk, equipment)?



■ Satisfied ■ Dissatisfied

How satisfied are you with the **colors and textures** of flooring, furniture, and surface finishes?



Furnishings: general comments relative to performance criteria



Confidential Lab Building in Core Survey Categories: Overall Satisfaction

Overall satisfaction



33%
Thermal Comfort



39%
Acoustic Quality



40%
Cleanliness
& Maintenance



41%
Air Quality



44%
Furnishings



51%
Lab



61%
Lighting



69%
Layout

Confidential Lab Building Core Survey Categories: Overall Productivity

Overall enhances your ability to get your job done



32%
Acoustic Quality



32%
Cleanliness
& Maintenance



33%
Furnishings



35%
Thermal Comfort



36%
Air Quality



51%
Lighting



53%
Lab



57%
Layout

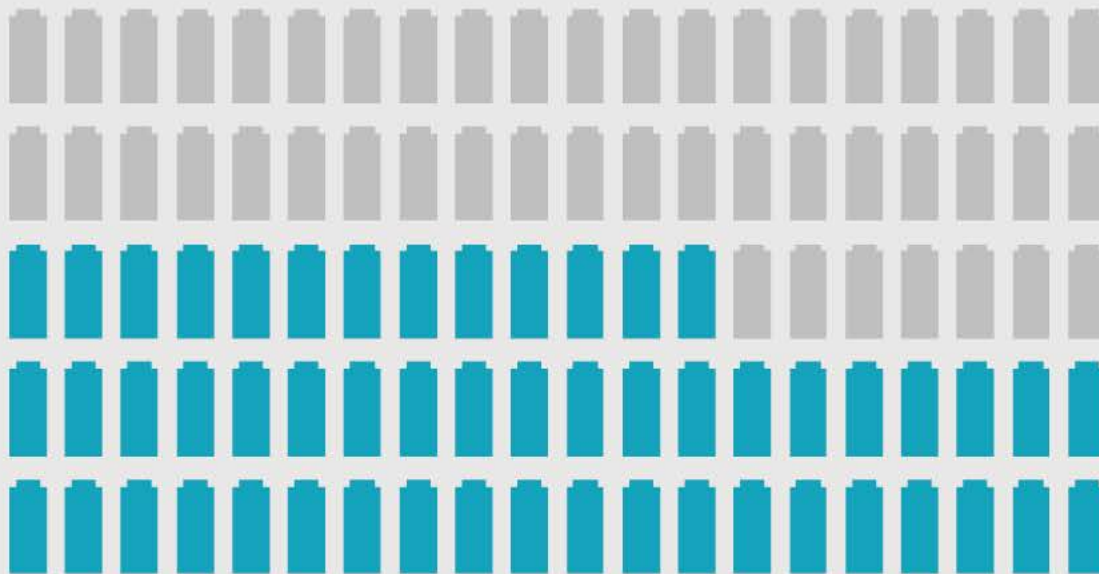
Why is POE beneficial?

1. Knowledge serves as a distinguishing factor for the firm
2. Trust in design solutions now come from having real numbers from the field to back ideas proposed to clients
3. Success can be measured against broad performance standards to convey the value of SOM design
4. Potential applicability of findings in other contexts and building sectors
5. Validates successes and failures
6. Evaluation can help decide whether innovative building components should be considered as additional capital investment
7. Potential applicability of findings in other contexts and building sectors
8. Increases designers accountability and authority with clients
9. Validity of underlying premises used in recurrent designs can be tested
10. Offer the possibility of better projects with more carefully documented outcomes

Percentile Ranking of Confidential Lab Building in Core Survey Categories



39% Satisfied Acoustic Quality



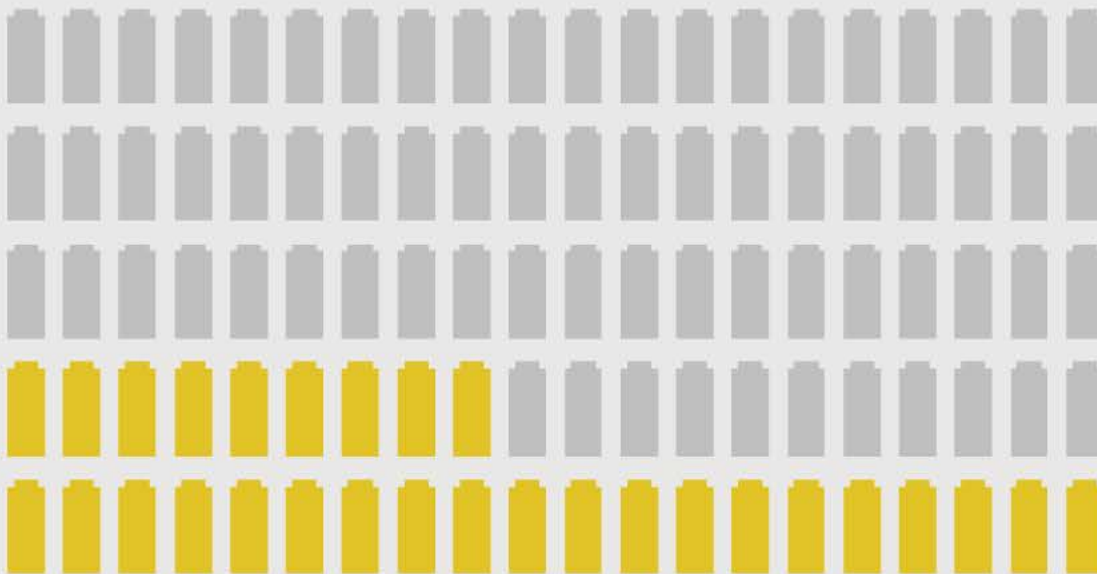
53rd Percentile

 Phase 1

Percentile Ranking of Confidential Lab Building in Core Survey Categories



61% Satisfied Lighting



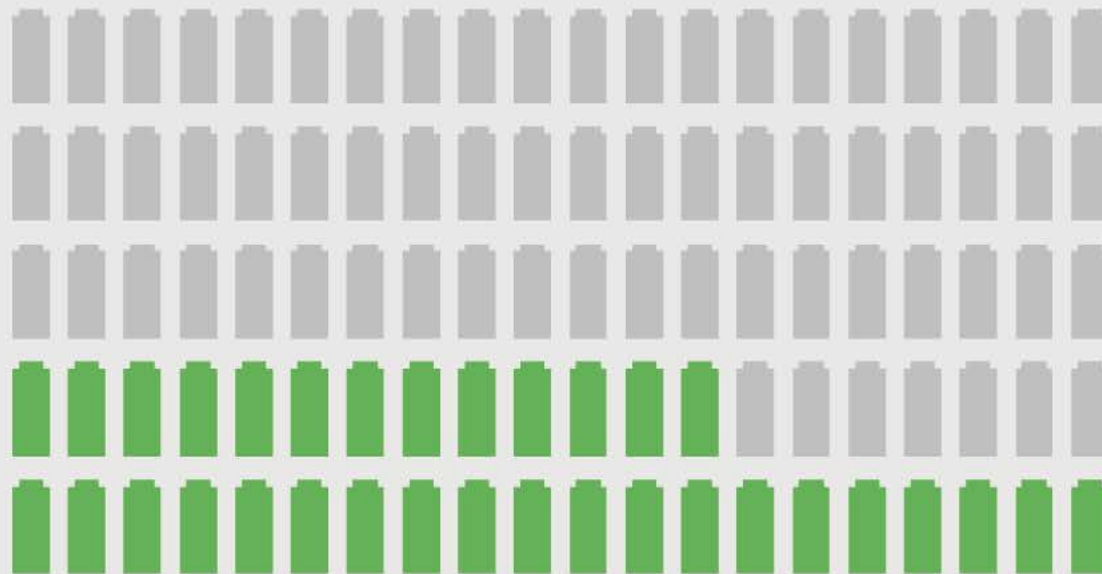
29th Percentile



Percentile Ranking of Confidential Lab Building in Core Survey Categories



41% Satisfied Air Quality



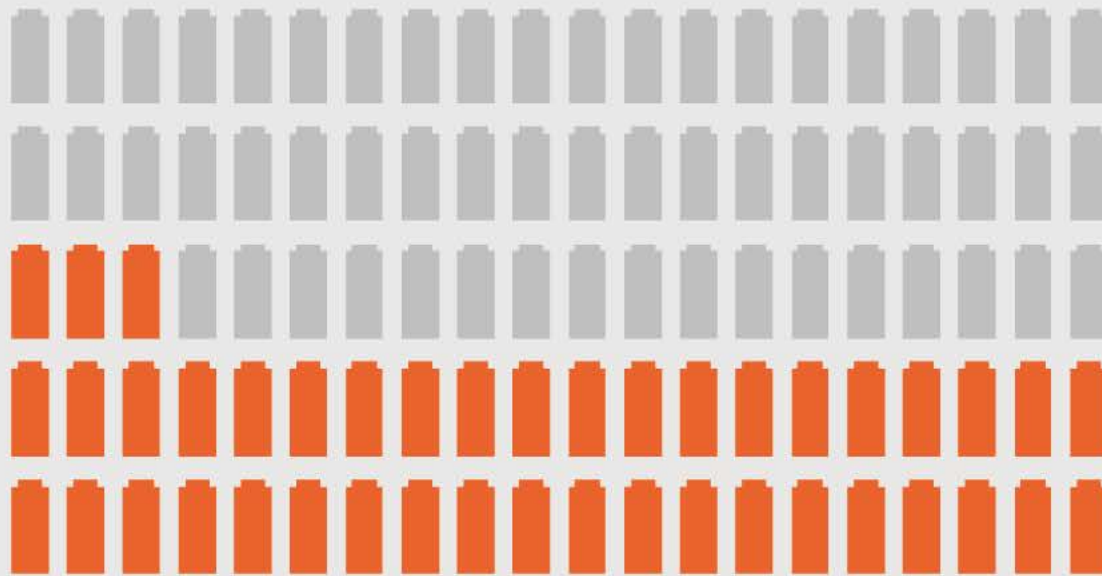
33rd Percentile

Phase 1

Percentile Ranking of Confidential Lab Building in Core Survey Categories



33% Satisfied Thermal Comfort



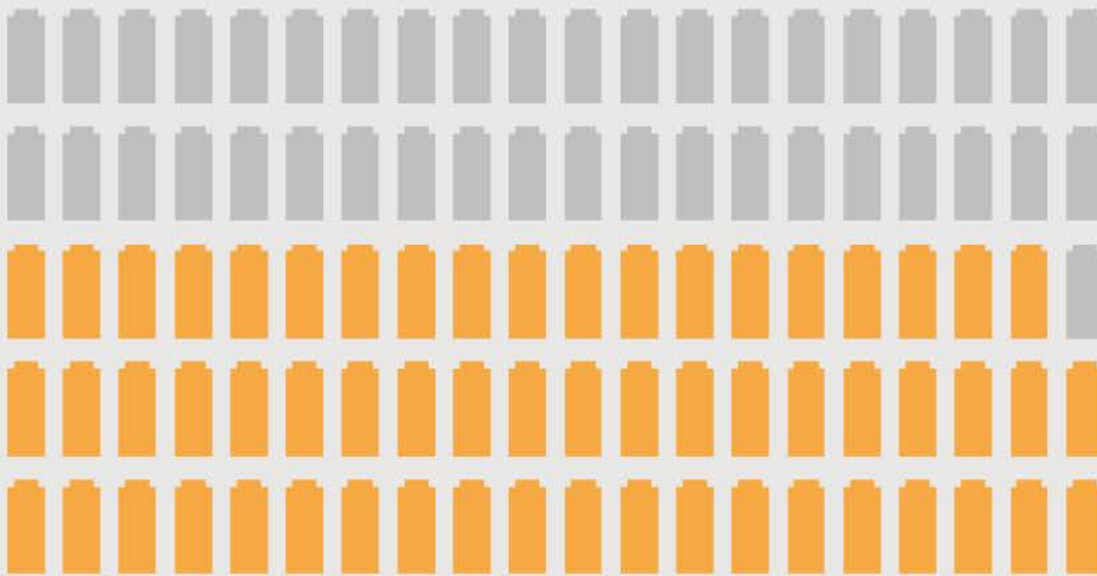
43rd Percentile



Percentile Ranking of Confidential Lab Building in Core Survey Categories



69% Satisfied Office Layout



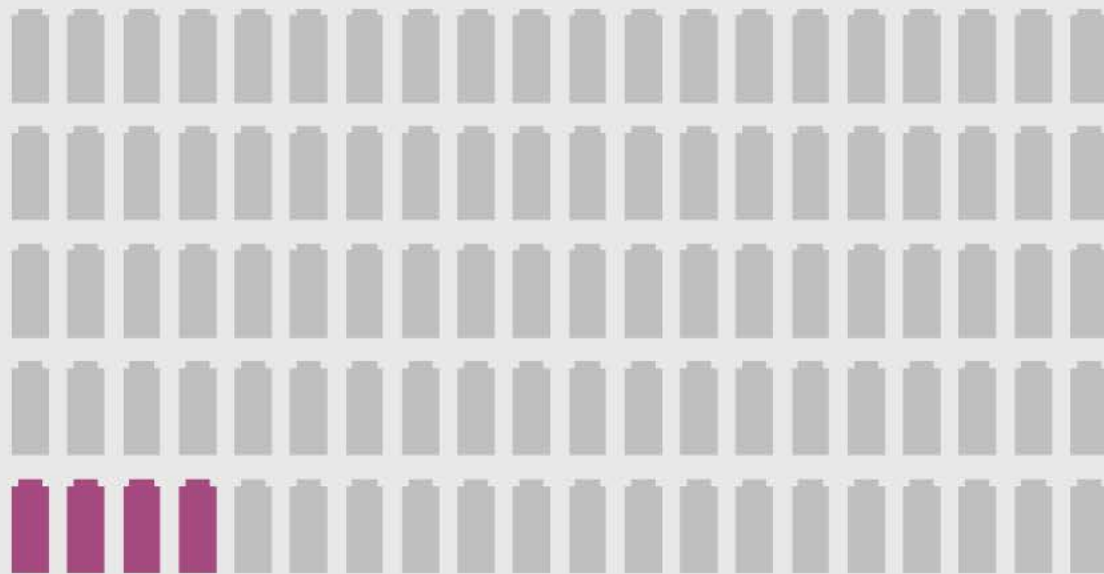
59th Percentile



Percentile Ranking of Confidential Lab Building in Core Survey Categories



51% Satisfied Lab Layout



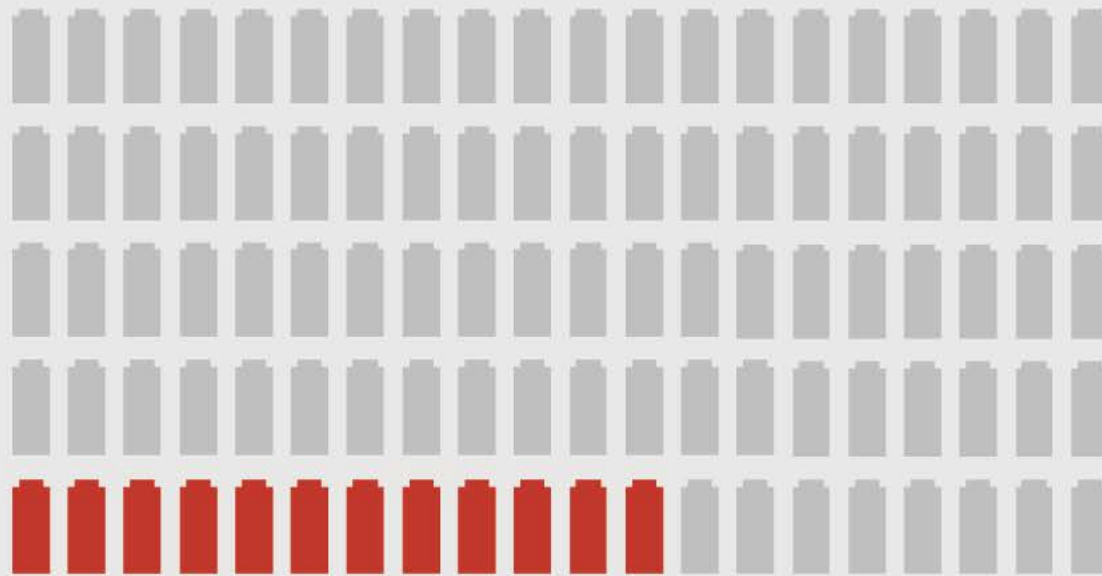
4th Percentile

Phase 1

Percentile Ranking of Confidential Lab Building in Core Survey Categories



44% Satisfied Furnishings



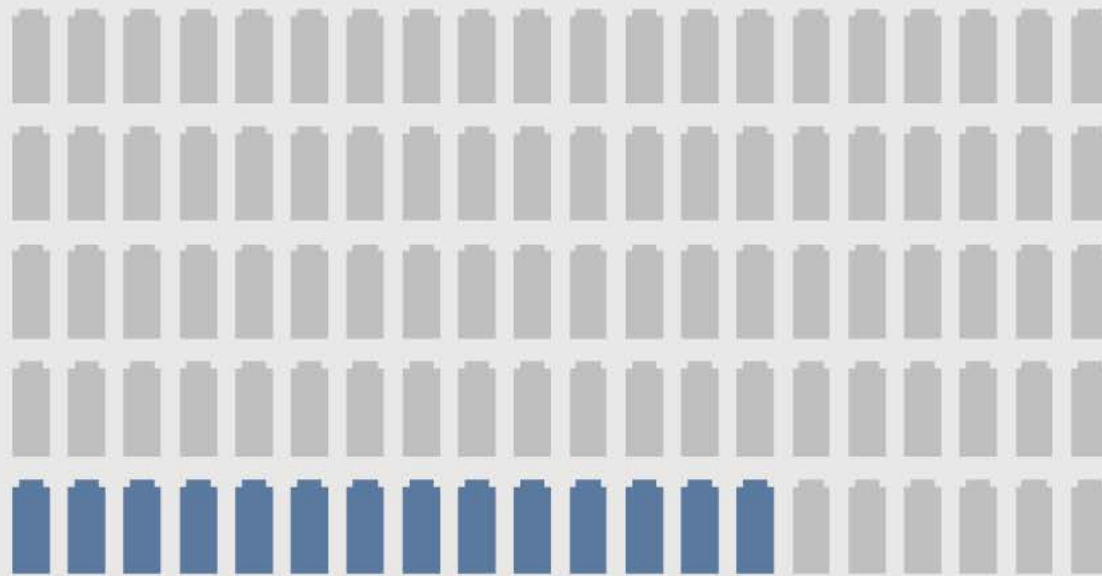
12th Percentile

 Phase 1

Percentile Ranking of Confidential Lab Building in Core Survey Categories



40% Satisfied Cleanliness and Maintenance



14th Percentile

Appendix D- Resources

- 62.1 User's Manual: ANSI/ASHRAE Standard 62.1-2013: Ventilation for Acceptable Indoor Air Quality. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2013. Print.
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- Craven, David, Earle Arney, and Daniel Winder. "BCO Guide to Post Occupancy Evaluation." BCO. The British Council for Offices', Nov. 2011. Web.
- General Services Administration (GSA) design standard compliance for end user satisfaction, sustainability, and operational effectiveness, August 13, 2014
- Indoor Air Quality Guide: Best Practices for Design, Construction, and Commissioning. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 2009. Print. <https://www.ashrae.org/resources--publications/bookstore/indoor-air-quality-guide>
- "Occupant Indoor Environmental Quality (IEQ) Survey." *Center for the Built Environment: Research*. The Regents of the University of California, n.d. Web. <http://www.cbe.berkeley.edu/research/survey.htm>
- *Performance Measurement Protocols for Commercial Buildings*. Atlanta: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 2010.
- "Reports and Publications." *Center for the Built Environment: Research*. The Regents of the University of California, n.d. Web. <http://www.cbe.berkeley.edu/research/publications.htm>
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- Sci-Network: An Insight Into Post Occupancy Evaluation. "Post Occupancy Evaluation: An Insight into Current POE-related Policies and Practices by European Public Authorities to Drive Sustainable Construction and Innovation." Sustainable Construction & Innovation through Procurement Network, June 2012. Web. http://www.sci-network.eu/fileadmin/templates/sci-network/files/Resource_Centre/Reports/SCIN_POE_final_report_-_June_2012.pdf
- "Sustainable Building Performance." *High Performance Buildings*. U.S. General Services Administration, n.d. Web. <http://www.gsa.gov/portal/content/103961>