

BUILDING THE BUSINESS CASE:

Health, Wellbeing and Productivity in Green Offices

OCTOBER 2016



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This report is an output of the World Green Building Council's *Better Places for People* campaign.

It draws on the valuable leadership of over 50 global building developers, designers and architects, occupiers, and Green Building Councils.

A list of all those individuals and organisations that have been involved in the process and contributed to the report is available on the back cover.

WorldGBC is very grateful for everyone's contribution.

WELCOME FROM OUR CHAIR BETH AMBROSE

Beth has been a valuable chair of the Offices Working Group. She is a Director within the Upstream Sustainability Services team at JLL, based in London, UK.



It's been a delight, in my role as Chair of the WorldGBC Offices Working Group, to work with the fantastic WorldGBC team, together with all the expert members of our group, in helping to drive the property industry momentum on healthy, green buildings. Seeing the tremendous growth in levels of awareness, dialogue and activity on this topic around the world is a real encouragement and inspiration.

It's a testament to the enthusiasm and hard work of all those involved in the green buildings sector that we now hear of so many stories of companies, both large and small, choosing to adopt new office design standards, changing their working practices and trialing new technologies; all with the aim of improving the workplace environment for the wellbeing benefits of their own staff, tenants or clients.

I would like to wholeheartedly thank all the contributors to this latest milestone report which provides a window into these stories. Each in turn are contributing to the culture change being felt across the built environment. As Winston Churchill said, "We shape our buildings; thereafter they shape us."

Beth Ambrose

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EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

Employers, building owners, designers, developers, and investors throughout the world are learning, in response to an increasing body of evidence, that office design affects the health and wellbeing of occupants in many ways and so it is a smart business move to create green buildings that are healthy.

Staff are the most valuable resource in most organisations, typically accounting for 90% of business operating costs, so even a 1% improvement in productivity can have a major impact on the bottom line and competitiveness of any business.



Building developers, owners, and investors are also discovering the business value of delivering to their markets healthy, green buildings. In a survey of 200 Canadian building owners, for example, 38% of those who reported increased value said healthy buildings were worth at least 7% more than normal ones, 46% said they were easier to lease, and 28% said they commanded premium rents.

This World Green Building Council report, *Building the Business Case: Health, Wellbeing and Productivity in Green Offices*, shows the global momentum behind green buildings that are healthy and marks a significant milestone in our *Better Places for People* campaign.

It provides best practice examples of healthy, green offices, showing that employers who care about the environmental impact of their buildings as well as the health and wellbeing of their staff, and take action to improve the quality of the workplace, are rewarded by improved productivity and loyalty, which can be worth many times more than their investment.

Some examples from the report:

Cutting sick days by two thirds

Skanska, Doncaster, United Kingdom

BREEAM-UK 'OUTSTANDING'

Skanska UK saved £28,000 (\$36,000) in 2015 in absenteeism costs, and reduced the green payback period of an office move from 11 to 8 years by achieving 3.5 times fewer building-related sick days alongside increased employee comfort and satisfaction.

New healthy workplace is worth €42m

Delta Development Group, Amsterdam, Netherlands

BREEAM-NL 'EXCELLENT'

Heerema, the occupant, could see a €42 million net present value over 20 years due to increased productivity, staff retention, and reduced absenteeism, according to KPMG.

Doubling call centre productivity

Saint-Gobain, Malvern, PA, United States of America

LEED Platinum - Core & Shell and Interior

Saint-Gobain call centre staff in their new North American headquarters have achieved a 97% increase in sales-generated leads and 101% increase in leads per call since moving into the building.

More collaboration and less absenteeism

Medibank, Melbourne, Australia

Six-Star Green Star - Office Design V3

Medibank, Australia's largest health insurer, reports that 80% of staff are working more collaboratively, absenteeism is down 5% and two-thirds of staff report feeling healthier in their new office, which includes 26 types of workspaces, edible gardens and sports facilities.

This report, and the case studies and spotlights presented within it, further strengthens the business case for firms to take action to create green working environments that enhance the health, wellbeing and productivity of their employees, and which result in clear and tangible benefits to their bottom line.

HOW TO ACT ON HEALTHY, GREEN OFFICES

Organisations of all sizes stand to benefit by creating green buildings which improve the health and wellbeing of their occupants. WorldGBC has developed, and continues to refine, a simple three-pillar Framework to help individuals, whether they are sustainability executives, HR professionals, facility managers, from the tenant side or owner/manager side, to assess and quantify the health, wellbeing and productivity of the people in their building, and therefore, the buildings themselves.

ENVIRONMENT

Measure eight features of a green workplace to determine how they affect its occupants. Each element can be measured objectively and assessed in light of a green building rating system and building code.

EXPERIENCE

Survey occupants to match the measures of the environmental features with how occupants feel about their workplace and whether they feel the environment supports or detracts from their wellbeing and productivity.

ECONOMICS

Measure six economic factors, likely already collected at a corporate level and/or by HR staff, and track these over time as improvements are made to the office environment.

Over twenty national Green Building Councils around the world are championing the cause of healthy green buildings, through certification and rating tools, research and stakeholder engagement to show how organisations all over the world are profiting from increasing the health and wellbeing of the people in their green buildings. Research from organisations, such as Harvard University's T.H. Chan School of Public Health, supported by United Technologies (UTC), is transforming the way we understand the interaction between human health and wellbeing and the green workplace.

CALL TO ACTION

We hope businesses, building owners, designers, and developers will be inspired by these case studies, which show how organisations all over the world are profiting from increasing the health and wellbeing of the occupants of their buildings. The WorldGBC calls on them to take action and unlock the business benefits of creating *Better Places for People*.



MAIN REPORT



INTRODUCTION: BUILDING THE BUSINESS CASE

BUILDING MOMENTUM

In 2014, the World Green Building Council (WorldGBC) published “*Health, Wellbeing & Productivity in Offices: The next chapter for green building*”, a report which generated significant buzz in office stakeholder circles and put the subject of healthy, green buildings firmly in the global real estate spotlight.

The report set out initial research, evidence, and case studies that the design of an office has a significant impact on the health, wellbeing and productivity of its occupants. It also found that there was often a virtuous circle of good design that works for both people and planet. The report highlighted, however, that a low carbon and resource efficient building is not always automatically healthier for occupants – a green building can enhance the health and wellbeing of its occupants, but only when there is careful consideration into both the environmental and health and wellbeing attributes of a building, such as fresh air supply. The report also shared design best practice that supports better health and productivity outcomes, and importantly a proposed Framework which enables a project team to track both the performance of the building and the outcomes for the building users.

AIMS OF THIS REPORT

Through the WorldGBC's worldwide network of over 70 Green Building Councils (GBC), we are seeing significant momentum in global action to create healthy, green buildings, through increased interest in healthy building principles and the health and wellbeing credits in existing green building certification programme. This is a progress report which aims to build further momentum by sharing some pioneering projects and the impact they have made.

We will look at who is doing what on health, wellbeing, and productivity in buildings, where the market is and where it's going. You will find seven geographically-dispersed case studies showing that companies large and small are seeing specific business benefits in healthy, green buildings. You will also find seven spotlights on specific countries, companies, and research leaders.

Building on the 2014 Offices report, this update therefore aims to:

Communicate how companies are using health and wellbeing principles and the Metrics Framework in practice

Share the research, results, and challenges they are developing and experiencing

This report aims to achieve impact through two means:

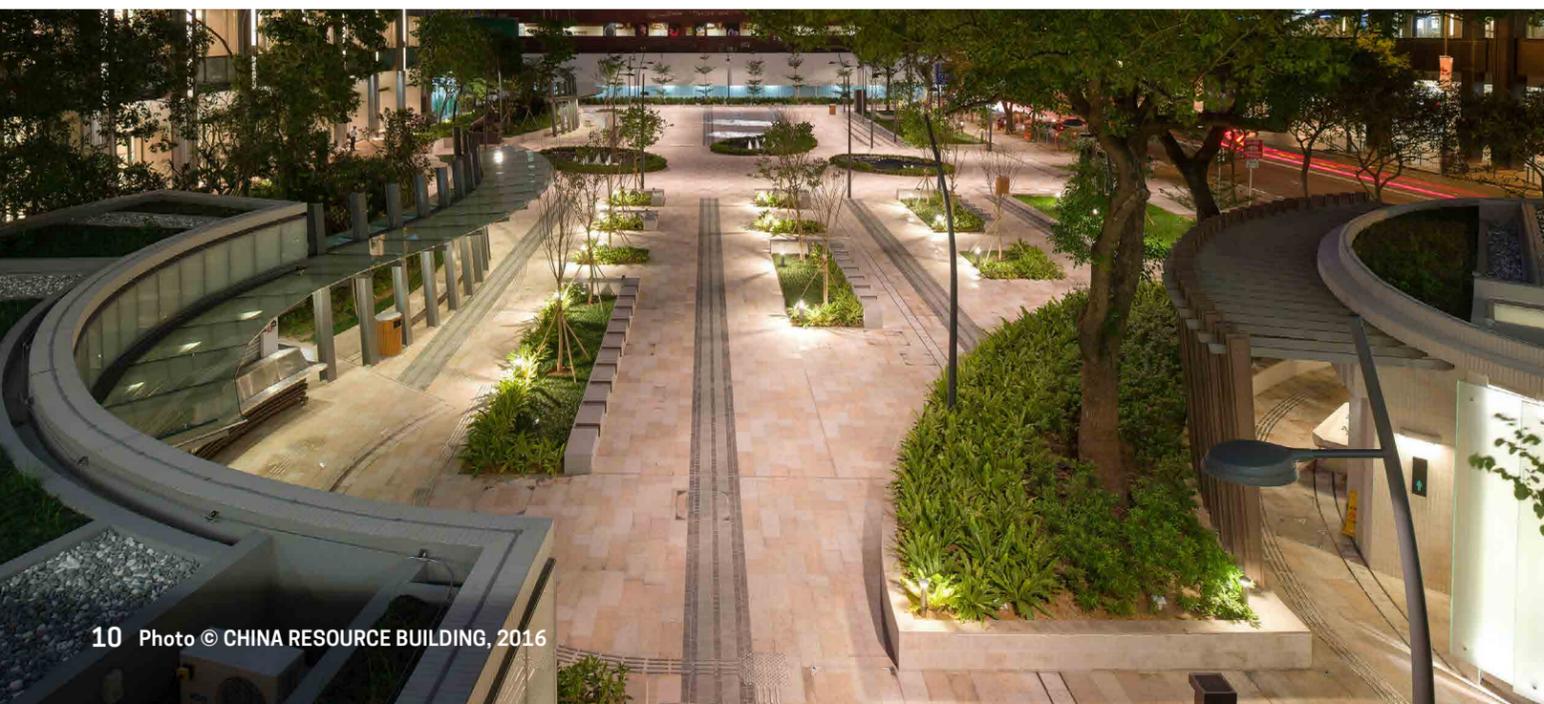
CASE STUDIES of organisations taking action to create healthy, green offices

SPOTLIGHTS on markets and companies leading the way on health and wellbeing in green offices

We hope this report can be a helpful next step in the real estate sector's journey towards productive, healthy and green buildings and *Better Places for People*.



Photo © CHINA RESOURCE BUILDING, 2016



10 Photo © CHINA RESOURCE BUILDING, 2016

We've used nine icons in this report to identify different elements of a healthy office, eight corresponding to physical attributes and one, employee engagement, corresponding to measuring the experience of office occupants. Some of these features also correlate well with the green attributes of a building: for example, indoor air quality is improved when low volatile organic compound (VOC) materials are used in an office, and the life cycle environmental impact of low VOC materials are lower than traditional materials, and increased daylighting reduces electrical loads, which in most markets, reduces greenhouse gas emissions. These icons are used throughout the spotlights and case studies to identify the various health and wellbeing actions taken.



INDOOR AIR QUALITY & VENTILATION



THERMAL COMFORT



DAYLIGHTING & LIGHTING



NOISE & ACOUSTICS



INTERIOR LAYOUT & ACTIVE DESIGN



BIOPHILIA & VIEWS



LOOK & FEEL



LOCATION & ACCESS TO AMENITIES



EMPLOYEE ENGAGEMENT

WORLDGBC'S FRAMEWORK FOR HEALTHY, GREEN OFFICES

Our work on offices and retail has focused on the development of metrics for measuring health, wellbeing and productivity, and on the frameworks for putting them into action.

In this report, we set out an Offices Metrics Framework that builds on our previous work and reflects our latest thinking and terminology¹.

ENVIRONMENT	EXPERIENCE	ECONOMICS
<ol style="list-style-type: none"> 1. Indoor Air Quality 2. Thermal Comfort 3. Daylighting & Lighting 4. Noise & Acoustics 5. Interior Layout & Active Design 6. Biophilia & Views 7. Look & Feel 8. Location & Access to Amenities 	<p>Perception of the occupants' experience in the building, as measured by a survey.</p>	<ol style="list-style-type: none"> 1. Absenteeism 2. Staff turnover / Retention 3. Medical Costs 4. Revenue 5. Medical Complaints 6. Physical Complaints

HOW COMPANIES CAN USE THE FRAMEWORK

The Framework is deliberately concise – eight elements of the environment to consider, one perception survey to conduct and six economic metrics to review. WorldGBC realises that many organisations are considering health and wellbeing systematically for the first time and there is a strong need for a simple process that facilitates effective action.

You do not need to consider the Framework in its entirety. Indeed, many different kinds of stakeholders can and have drawn important insights simply by engaging with the Framework.

Even if you are new to this agenda you do not need to begin from scratch: chances are you can apply the metrics retrospectively against data that has already been collected. Companies that are further along in their understanding of these issues will benefit from the explanatory power of a simple framework and set of variables (as, for example, when there are many properties to assess).



¹Our three categories in the 2014 offices report were Physical, Perceptual, and Financial. In this report they are labelled as Environment, Experience, and Economics, respectively, which is consistent with our latest terminology. Only the three category labels have changed -- the metrics remain the same as those found in our original 2014 study.

We believe the Framework is attractive and powerful and is quickly gaining traction, as evidenced by the case studies presented later in this report.

EACH OF THE PILLARS EXPLAINED

ENVIRONMENT

It is critical to not only measure the environmental features of the green building, but to measure the different physical features of the green building environment in order to determine how a green building affects its occupants. Some of these physical features may be assessed directly, like light, acoustics, and pollutants, but some may require more subjective measures, like views or quality of amenities.

EXPERIENCE

While directly or subjectively measuring the physical aspects of the building environment is important, perhaps even more important is how the occupants feel and experience their workplace. Two people may experience 24° C and 65% relative humidity differently.

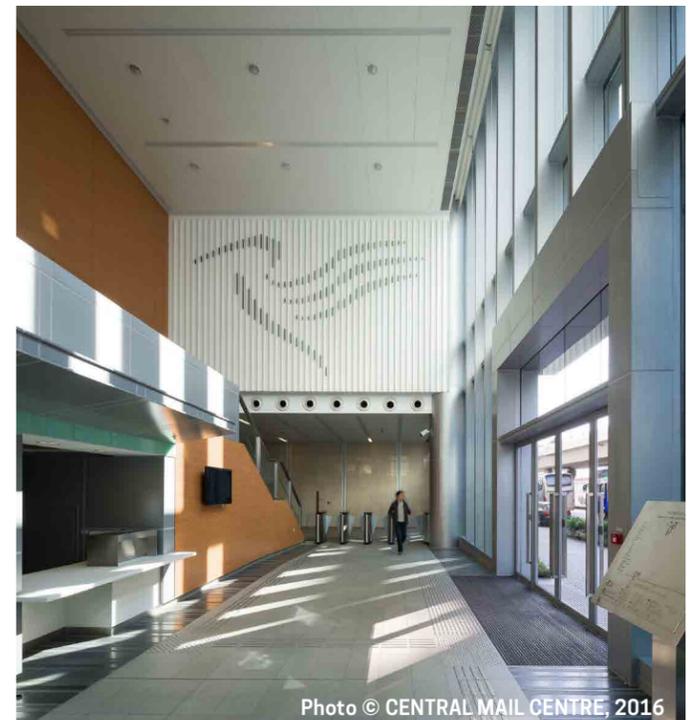
A perception survey is used to determine the experiential factors that are very important to the health, wellbeing and productivity of occupants of an office. There are many aspects of the occupant's experience that are considered using a wide variety of questions, including thermal comfort, workplace satisfaction, and self-reported illness.

More specific questions that are used to conduct occupant surveys are available at www.betterplacesforpeople.org/index.php/toolkits.



ECONOMICS

The first two pillars, environment and experience, affect how people work and how healthy they are in their work environment. Staff costs can typically account for 90% of the operating costs of a business, so anything affecting their productivity has a direct impact on the bottom line. We use economic metrics, including absenteeism and medical costs to quantify that impact. These factors are all described fully in our [2014 report](#).



EIGHT FEATURES THAT MAKE HEALTHIER AND GREENER OFFICES

1. INDOOR AIR QUALITY & VENTILATION

Healthy offices have low concentrations of CO₂, VOCs and other pollutants, as well as high ventilation rates.



101%

WHY? increase in cognitive scores for workers in a green, well-ventilated office.¹

2. THERMAL COMFORT

Healthy offices have a comfortable temperature range which staff can control.



6%

WHY? fall in staff performance when offices are too hot and 4% if too cold.²

3. DAYLIGHTING & LIGHTING

Healthy offices have generous access to daylight and self-controlled electrical lighting.



WHY?

46 minutes

more sleep for workers in offices near windows.³

4. NOISE & ACOUSTICS

Healthy offices use materials that reduce noise and provide quiet spaces to work.



66%

WHY? fall in staff performance as a result of distracting noise.⁴

5. INTERIOR LAYOUT & ACTIVE DESIGN

Healthy offices have a diverse array of workspaces, with ample meeting rooms, quiet zones, and stand-sit desks, promoting active movement within offices.



WHY?

Flexible workspaces help staff feel more in control of their workload and engenders loyalty.⁵

6. BIOPHILIA & VIEWS

Healthy offices have a wide variety of plant species inside and out as well as views of nature from workspaces.



7-12%

WHY? improvement in processing time at one call centre when staff had a view of nature.⁶

7. LOOK & FEEL

Healthy offices have colours, textures, and materials that are welcoming, calming and evoke nature.



WHY?

Visual appeal is a major factor in workplace satisfaction.⁷

8. LOCATION & ACCESS TO AMENITIES

Healthy offices have access to public transport, safe bike routes, parking, and showers, and a range of health food choices.



€27m

WHY?

savings through cutting absenteeism as a result of Dutch cycle-to-work scheme.⁸

EMPLOYEE ENGAGEMENT



Healthy offices have employees that are regularly consulted and that feedback is used to drive continuous improvement.⁹



CASE STUDIES & SPOTLIGHTS

The aim of this section is to showcase action on health, wellbeing and productivity in green offices and to demonstrate that there is growing market momentum for healthy, green offices throughout the globe.

In the following pages, we give you examples of initiatives from around the world from a small San Francisco environmental consulting office looking for solutions to help its employees who feel lethargic in a meeting room to one of the best performing banks in the world looking to improve the general health and fitness of its employees: six of the seven offices featured are green certified and the other incorporates a host of green features.

In between the case studies, you'll find seven spotlights: on global healthy, green building markets, research, and a corporate strategy on biophilia.

No case study or spotlight is quite the same. Some show timelines of the processes to incorporate health and wellbeing into their office designs. Some feature the particular health and wellbeing elements that are key to healthy high-performing green offices.

You'll find employee engagement survey results, employee stories, and results of the Leesman Survey, a rigorous systematic test of employee engagement. Some detail productivity measurements, even when very difficult to do so, and tie them to the payback periods of green building project renovations. Regardless, all demonstrate a clear business case for their actions.

This is only the beginning, but the next pages show we are truly building *Better Places for People*.

Explanation on Methodology:

The case studies and spotlights contained herein were solicited through a call for content made in May 2016 to participating Green Building Councils, sponsors, and companies who reached out to WorldGBC or to a participating GBC. A case study specification document was provided to GBCs and companies expressing interest, whereby a data-driven approach was prioritised, geographical diversity was sought and differing stakeholder perspectives (developer, tenant, etc.) were sought. Upon submission, each case study was reviewed by WorldGBC staff and the report chair and changes were requested to ensure compliance with specifications. Neither WorldGBC nor the contributors listed have verified the methodology and data of each contributor's case study.

CASE STUDY: SAINT-GOBAIN



Saint-Gobain call centre staff in their new North American headquarters have achieved a 97% increase in sales-generated leads and 101% increase in leads per call since moving into the building.



ABOUT THE OFFICE

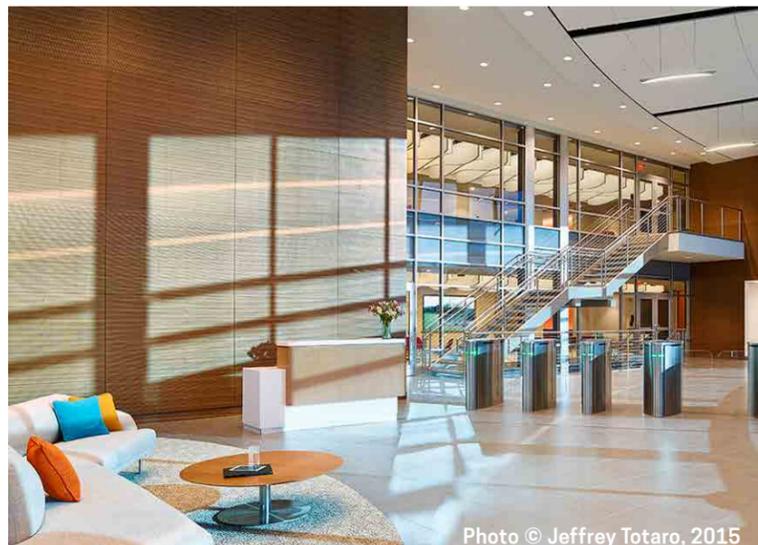
Saint-Gobain and CertainTeed's North American headquarters, in Malvern, Pennsylvania, USA, is over 277,000 ft² and houses over 800 employees. It is certified LEED Platinum (Core & Shell and Commercial Interior) and was designed as a living laboratory to test the company's building performance products.

The new office space offers 116 collaborative spaces with 68 that seat six people or more. There was a:

150% increase in collaborative meeting space hours booked

HEALTH AND WELLBEING ACTIONS

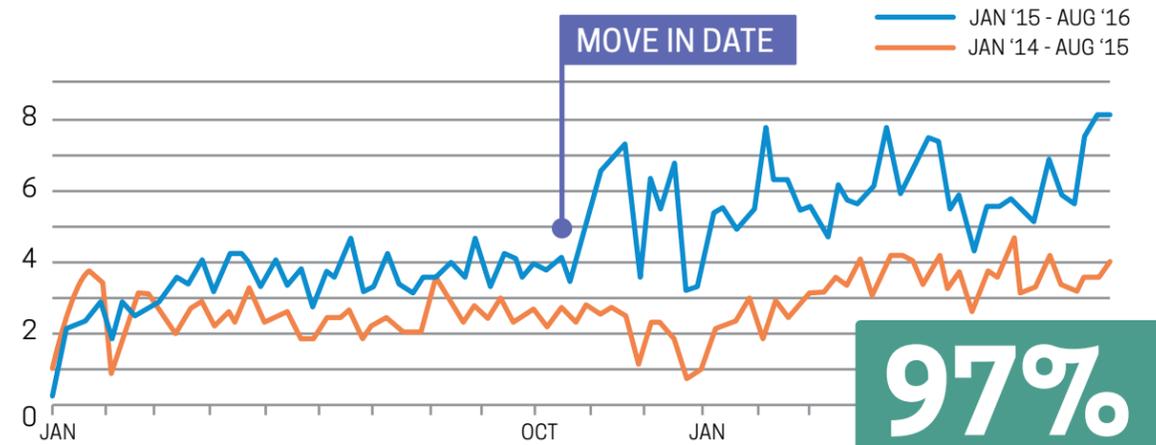
- 25% increase in daylighting
- 92% of the offices have views to the outdoors
- Fitness centre, pond, outdoor work spaces, and 1.3 miles of walking trails
- Stairwells have views of the outdoors making these spaces more attractive compared to elevators, and encouraging physical activity throughout the day



ECONOMIC IMPACT

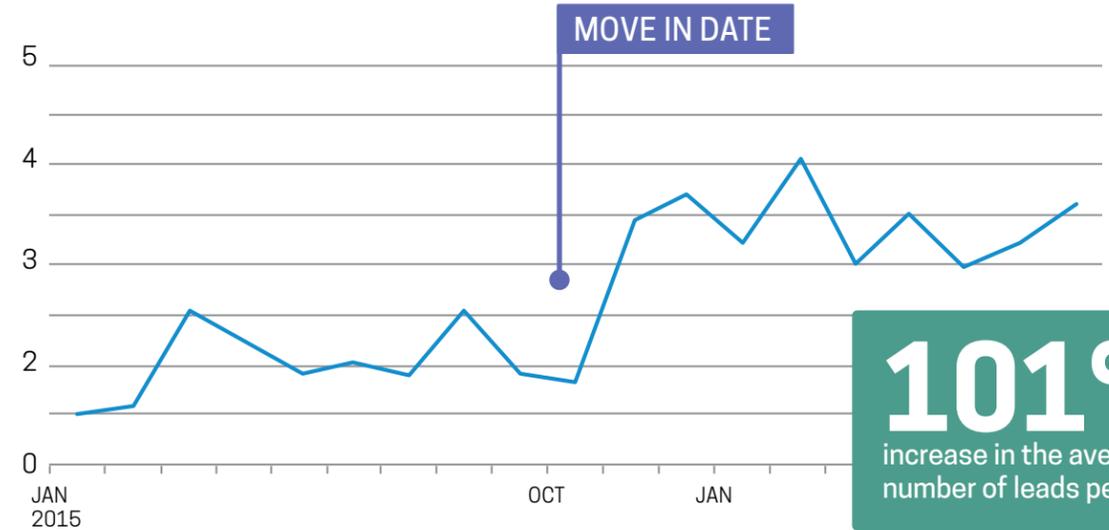
Saint-Gobain measured the productivity of their sales support call centre in the old and new building and found dramatically increased performance after the move.

Number of Sales-Generated Leads per Week Relative to Jan 2014



97%
increase in the average weekly number of sales-generated leads

Number of Leads per Call Made Relative to Jan 2015



101%
increase in the average weekly number of leads per call

WHAT'S NEXT?

Led by its team of building scientists, Saint-Gobain is partnering with Dr. Ihab Elzeyadi of the University of Oregon to assess the impact of the building's design on the occupant experience. A pre-occupancy survey has been conducted in the former office and a post-occupancy survey will end in December 2016. This survey covers all aspects of occupant perception as outlined in the Framework from our 2014 report, including measuring factors such as indoor air quality and thermal, acoustic, and visual comfort.

CASE STUDY: SKANSKA



Skanska UK saved £28,000 (\$36,000) in 2015 in staff costs, and reduced the green payback period of an office move from 11 to 8 years by achieving 3.5 times fewer building-related sick days alongside increased employee comfort and satisfaction.



Photo © Skanska, 2016

ABOUT THE OFFICE

Bentley Works is Skanska UK's Northern England hub situated in Doncaster. Skanska rebuilt the facility, which included constructing a modern 1,800m² two-story office building, and achieved BREEAM 'Outstanding'. To measure the effectiveness of the new office, employees were surveyed before and after the move to the new building and economic metrics related to sick days were collected.

HEALTH AND WELLBEING ACTIONS

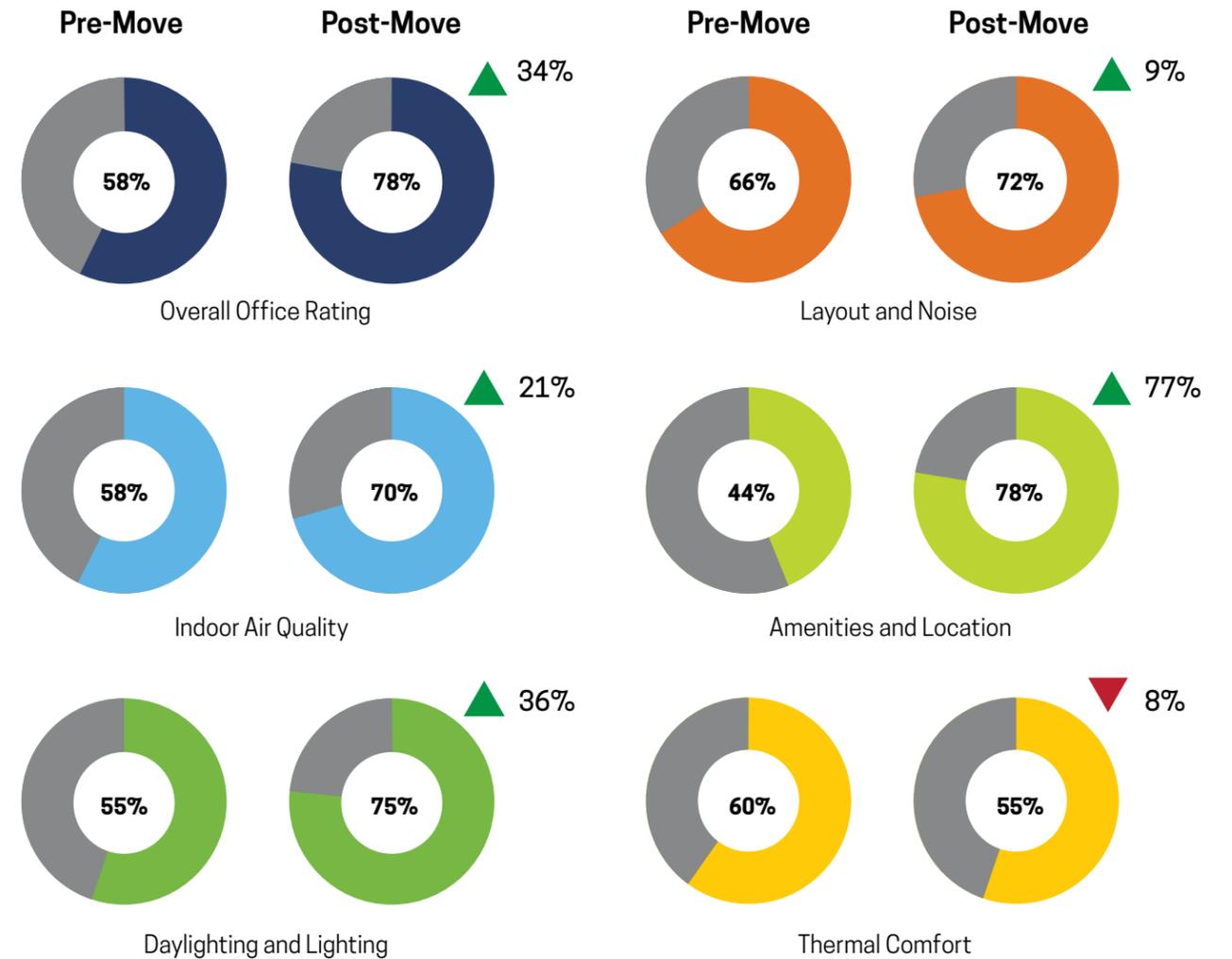
- A central light well was used to supplement natural daylight, reducing the lighting load and resulting in higher satisfaction with lighting levels
- No hazardous substances were used in construction which improves background IAQ and resulted in higher employee perception of IAQ
- Computer modeling was used to optimise employee thermal comfort
- Was designed to Deep Green on Skanska's environmental colour palette

"Our experience at Bentley Works has enhanced our approach to health and wellbeing in our office buildings. This will benefit future green projects through our greater understanding of the factors that influence occupant health, wellbeing and satisfaction, as well as improving the measurement of green building performance in use."

- Chris Pottage, Sustainable and Healthy Buildings Officer, Skanska UK

EMPLOYEE PERCEPTION SURVEY RESULTS

Skanska surveyed the 110 occupants of the office on their perceptions of the indoor environmental quality before and after the move: 43 responded before the move and 59 responded after. It is clear that the new building improved the perception for most of the factors, except thermal comfort where the element of personal control had been removed in the new facility.



ECONOMIC IMPACT

3.5x fewer sick days taken compared to other UK offices in 2015

28% faster green payback period

£28,000 savings in staff costs in 2015

SPOTLIGHT: COGNITIVE FX STUDY 2

A research team from Harvard University and State University of New York (SUNY) Syracuse, supported by United Technologies Corporation (UTC), launched the COGfx study in 2015, which showed that a low-VOC, high ventilation office space produced up to a 101% increase in cognitive function¹. The team recently released research that is another game-changer for the green, healthy buildings business case and showed that green certified buildings produce even better cognitive scores than non-certified green buildings. This research strongly supports the hypothesis that green buildings are healthier for occupants. We profile the results from the research team at Harvard University and SUNY Syracuse, which includes researchers Joseph Allen, Piers MacNaughton, John Spengler, Akira Yamaguchi, Jose Vallarino, Suresh Santanam.



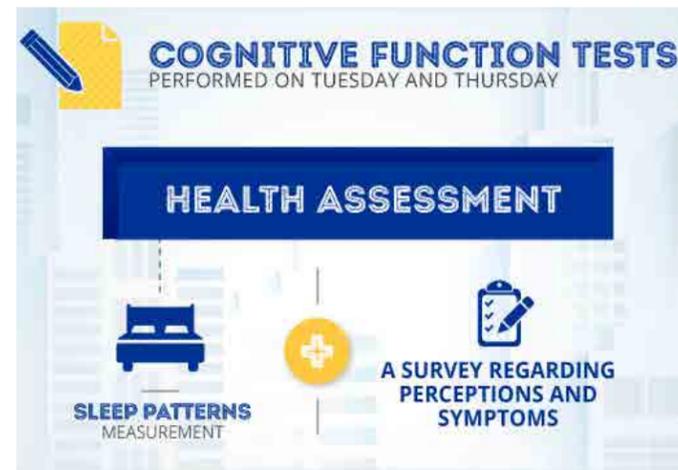
MAIN FINDINGS

OCCUPANTS OF GREEN-CERTIFIED, HIGH-PERFORMING BUILDINGS SAW



SLEPT BETTER AND REPORTED FEWER HEALTH SYMPTOMS

METHODOLOGY



BUILDING TYPES:



HIGH-PERFORMING NON-CERTIFIED
Low Total Volatile Organic Compounds and High Ventilation



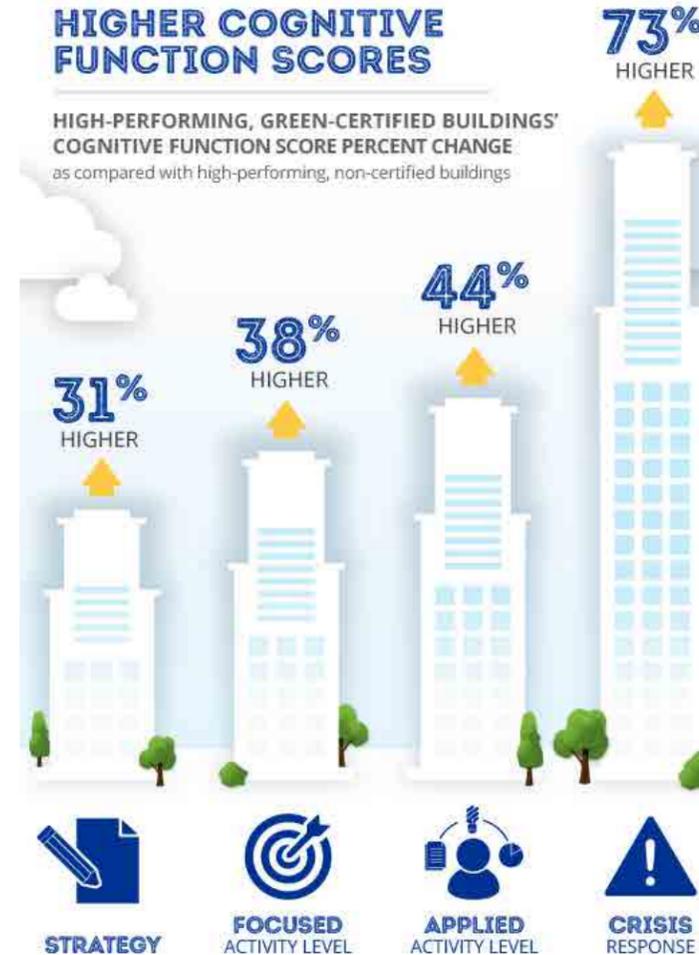
HIGH-PERFORMING GREEN-CERTIFIED
Low Total Volatile Organic Compounds and High Ventilation and Green Certification



RESULTS

HIGHER COGNITIVE FUNCTION SCORES

HIGH-PERFORMING, GREEN-CERTIFIED BUILDINGS' COGNITIVE FUNCTION SCORE PERCENT CHANGE as compared with high-performing, non-certified buildings



SICK BUILDING SYMPTOMS



SLEEP QUALITY SCORES



GREEN-CERTIFIED BUILDINGS HAVE BETTER THERMAL CONDITIONS



BEST PRACTICES

INDOOR ENVIRONMENTAL QUALITY

There are a variety of IEQ credits available through green building certification organizations that can help achieve improved indoor environments. Examples include:

VOC REDUCING Volatile Organic Compound-emitting materials

Providing **DAYLIGHT / VIEWS** and **CONTROLLABILITY** of lighting systems

Achieving **THERMAL COMFORT** through design and verification

To learn more about this study, visit www.thecogfxstudy.com.

CASE STUDY: DELTA DEVELOPMENT GROUP



Heerema, the occupant, could see a €42 million net present value over 20 years due to increased productivity, staff retention, and reduced absenteeism, according to KPMG.

ABOUT THE OFFICE

Voldellaan 47 is the global headquarters for Heerema Marine Contractors B.V. (HMC), housing 1,100 full time employees within 23,336 m² over 12 storeys, and is certified to BREEAM-NL 'Excellent'.

The project was Delta Development Group's first foray into jointly measuring workplace effectiveness using the Leesman Index and KPMG's holistic True Value methodology for the measurement of social, environmental, and economic impacts of a commercial building; the first such attempt world-wide.



HEALTH AND WELLBEING ACTIONS

- Orientation of façades – optimise views and natural daylight while blocking solar heat gain
- LED lighting for artificial lighting needs
- Solar boilers combined with groundwater heating and cooling for further improvements to thermal comfort
- The use of low VOC and where possible Cradle to Cradle Certified™ materials.
- Considerably more biophilia than the previous building



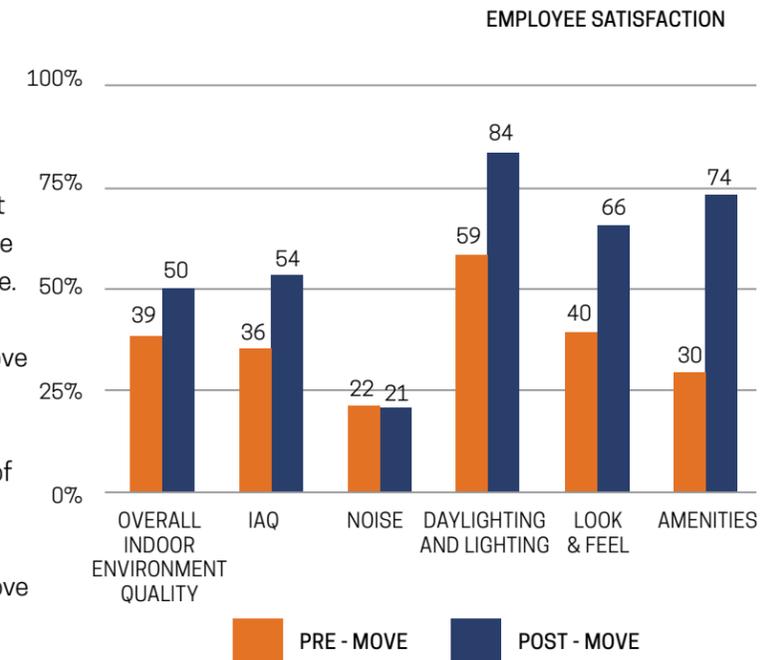
Photo © DELTA DEVELOPMENT GROUP, 2016

LEESMAN OCCUPANT SURVEY RESULTS

At Vondellaan 47, Delta and HMC worked together with Leesman to measure workplace effectiveness. Pre and post move Leesman surveys were conducted with a response rate of 405 employees (35%) pre-move and 433 (38%) post-move.

The Leesman Index (LMI) increased from a 57.7 LMI pre-move to a 70.1 LMI post-move, making this building the highest scoring building housing over 500 employees within the Benelux countries. With this score, it is within the top 5% of all Leesman projects world-wide.

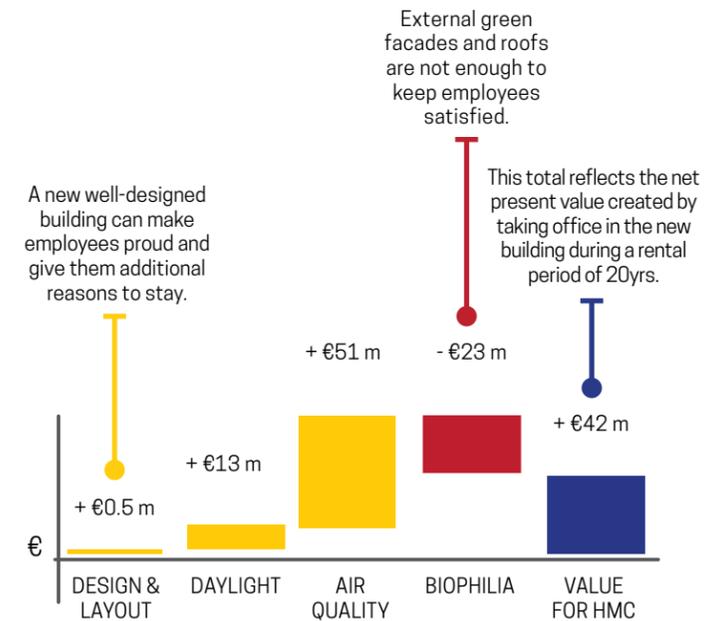
The Leesman study gives actionable results to further improve the working environment for those who are using it.



ECONOMIC IMPACT



KPMG supported the Delta Development Group with the application of its True Value assessment tool to quantify the impact of the building on productivity, absenteeism, and retention, using the results of the Leesman surveys and multipliers from literature on variation in those factors and the influence on costs and revenues. The results are shown below:



The office design increased retention rate

Improved daylighting and air quality reduced absenteeism

A further increase in greenery could increase user satisfaction

+€42 million

net present value benefit over the 20 year rental

For more information on the KPMG True Value Methodology visit <https://www.kpmg.com/Global/en/topics/climate-change-sustainability-services/Documents/introduction-kpmg-values.pdf>

SPOTLIGHT: CANADA



This research update was written by Canada Green Building Council (CaGBC). The views expressed are those of CaGBC only.

Not only is Canada home to one of the first WELL Certified™ Gold buildings in the world, the TD Bank Group’s TD23 project, but there is growing interest from builders and owners on the value of health and wellbeing of their occupants. In this spotlight on Canada, we see the results of a recent survey of Canadian building owners on the topic of health and wellbeing. We also visit the Canada Green Building Council’s (CaGBC) Vancouver office, situated in a building aiming for LEED Gold, that made health and wellbeing a major focus.

DODGE DATA REPORT

The CaGBC commissioned *Healthier Buildings in Canada 2016: Transforming Building Design and Construction*, to provide insight on the Canada-specific findings, based on a study conducted by Dodge Data & Analytics. This report surveyed 200 Canadian building owners and examined the factors influencing building owners, design firms, contractors, and public health professionals on their decisions for adopting healthier building practices and features.

BUSINESS BENEFITS OF HEALTHY BUILDINGS

The top three benefits cited by 30% of healthy building owners include: increasing building value, cited by 38%; the ability to lease space more quickly (46%); and the ability to charge premium rent (28%).

OWNER CHALLENGES AND OPPORTUNITIES

The survey asked building owners to identify challenges and opportunities with health and wellbeing. Notably, most saw a business opportunity in quantifying the financial and health impacts of buildings.

We thank the CaGBC for letting us use their data in this report to gain insight on the inclusion of health and wellbeing features in offices.

Challenges

Occupant health and wellbeing is a lower priority than cost savings and energy performance

Budget concerns and limitations

Need for more data

Opportunities

Emerging codes and regulations

Assessment of financial impacts

Measuring impacts to occupant health

38% of owners who report an increased building value see an increase of 7% or more

46% lease space more quickly

28% are able to charge premium rents

CaGBC VANCOUVER OFFICE

The Canada Green Building Council® is Canada’s leading national organisation dedicated to advancing green building and sustainable community development practices. When a growing team required the Vancouver office to relocate, CaGBC led the industry by becoming one of the first in the country to pursue LEED v4 Interior Design + Construction (ID+C) Gold® certification. With a stretch goal of Platinum, this new office aims to provide a healthy, sustainable space for staff and visitors – and one that reflects the innovation and growth in green building that CaGBC has fostered over the past decade.

In pursuing LEED v4 within a building also targeting LEED® Canada CS Gold, CaGBC applied many features throughout the design of its new office that were aimed at enhancing staff comfort and satisfaction. This is currently being quantified in a post-occupancy survey.



Photo © CaGBC, 2016

HEALTH AND WELLBEING ACTIONS TAKEN

- New office features large windows providing abundant natural light and superior views of the Vancouver cityscape.
- The office is aiming to achieve three new LEED v4 credits for Environmental Product Declarations (EPDs), Sourcing of Raw Materials, and Material Ingredients. The carpeting, flooring, shades, and fabric covers are Cradle-to-Cradle™ certified.
- HVAC (heating, ventilation and cooling) system was designed to provide at least 30% more outdoor air than ASHRAE 62.1-2010 requirements, passing it through a filter before it is distributed throughout the office.
- The open-office design, with a variety of workspace options including sit-stand desks, gives staff the opportunity to work within different areas of the office throughout the day.
- The office is centrally located in downtown Vancouver and benefits from an extensive separated bike lane network, public transit, restaurants, and coffee shops.



Photo © CaGBC, 2016

To provide public education on green building strategies and solutions, the Vancouver CaGBC team offers a guided tour of the new office, using the project to highlight sustainability.

This research update was written by Lauren Riggs, Operations [e]Team at Google, based in the United States. The views expressed are those of the company only.

Google's workplace vision is to create a sense of space and place that feels wonderful for people to be in, places that are vibrant and multisensory and touch the soul. These places have the ability to inspire on a daily basis, and support not just doing work, but life. Google office design of the past often leveraged the Google brand, including colour, to establish a Googley sense of place. As Google has grown, so has its design and operational philosophies.

INDOOR ENVIRONMENTAL QUALITY & GOOGLE

Indoor air quality, acoustics, biophilia, thermal comfort, and visual comfort are the key aspects of a productive and comfortable indoor environment. Google leverages each of these five factors in design and operational strategies to create the healthiest environment for Google employees.

Here, I want to focus on biophilia: what it is, why it matters, and how we've started to find ways to incorporate new natural forms into offices like in Tokyo. Biophilia is not just for the designers!

BIOPHILIA & WHY IT'S IMPORTANT

In a nutshell (get it?), biophilia is humanity's deep-seated affinity for nature. It explains why we feel restored after being in a park, invigorated by the seashore, captivated by crackling fires and crashing waves; why our capacity to be creative can be influenced by viewing scenes of nature; why shadows and heights instill fear; and why animal companionship and gardening have healing effects.

Our company regards biophilia as important for three primary reasons:

Biophilic elements have benefits for worker productivity, emotional wellbeing, stress reduction, learning, and healing.

Biophilic design is often economically sensible as it can reduce costs from absenteeism, health care and insurance.

Biophilic attributes can encourage an appreciation of nature which encourages protection of nature.

And this is why: Google has derived some initial findings on the effects of biophilia in the workplace. While much more research is needed before we can draw a causal link on biophilia, Googlers who can see design elements in the building that mimic nature from their desk report:

13% higher satisfaction with the colours and textures in their workspace

11% higher overall satisfaction with their workspace

15% more people say their building sparks creativity



HOW WE OPERATIONALISE BIOPHILIA

We start with a survey of occupants:

Do they feel connected to nature?

Do they have their desired level of access to outdoors?

An example survey examines the three primary strategies we use when it comes to biophilia:

Using natural elements such as light or water

Leveraging natural patterns or natural analogies

Offering elements of space and place and considering the experience of prospect and refuge points, where the individual has broad and distant views, but at the same time feels safe from behind and above.

Based on the responses, we can take action to identify ways that we can alter the operating facility to bring in elements and hints of the natural environment.

A recent example comes from our office in Tokyo, where the facilities team completed the assessment process and successfully implemented a biophilia intervention in several locations around the office. One specific intervention came after the local team utilised space usage rates and recorded activity data to determine where they could have the most impact on user experience: in the red conference room. The colour red was determined to be distracting and stressful to Googlers and, at that time, only 6% of survey respondents were satisfied with their access to nature in that office.

For the intervention, the Tokyo team considered the values of their location and culture as they selected their project materials. They chose to recreate the experience of sitting in an old Japanese house - existing in balance with the outdoor environment. The walls of the conference room are Japanese mud walls, which are culturally known to have air filtering properties, the floors are made of natural hemp, and there is a view through a Japanese style window to the autumn forest. We are waiting on the results of the next survey for quantitative feedback on the success of the intervention. However, interviews and qualitative results are positive.

Using biophilic design principles in an operating facility is feasible! We all have the capability to leverage our innate connection to nature as a resource to transforming space and experience for ourselves and our office companions.



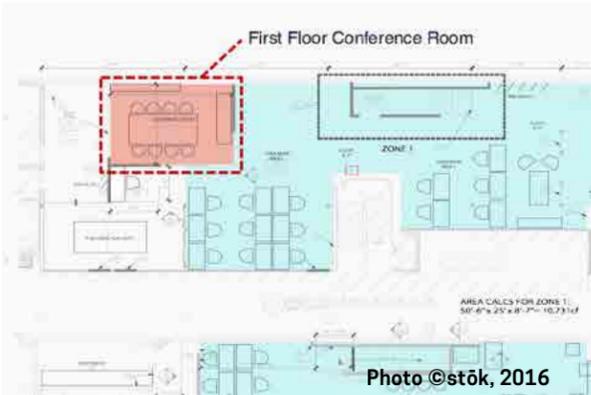
CASE STUDY: stök + biome



A 39% decrease in hours of problematic CO₂ levels by installing a portable green wall in stök's main conference room resulted in better employee satisfaction and focus.

ABOUT THE OFFICE

stök's headquarters in San Francisco is 400 m², houses 25 employees and has many green features. The conference room in question is the biggest in the office and used very regularly for meetings with up to 15 people. The room has **no windows to the outdoors** and users have **no ability to control** temperature or HVAC. Employees regularly complained about the office being stuffy and "stagnant" making people feel lethargic and unable to focus. stök set out to find an inexpensive solution to this problem but also to learn about offering more comprehensive IAQ services to its clients.



HEALTH AND WELLBEING ACTIONS



stök installed an air quality sensor to examine CO₂, VOC, and Particulate Matter (PM) concentrations and see if pollutant levels were above recommended ranges.

15% of work hours had problematic CO₂ concentrations above 1,000 ppm¹



Without the ability to increase ventilation, stök installed a modular, portable BIOME green wall as a pilot to see if it could reduce the problem by converting CO₂ to O₂.



¹1000 ppm was recognised by COGfx study as the concentration at which people begin to experience reduced cognitive ability and thus chosen as the "problematic" threshold for this analysis.¹

SURVEY RESULTS



AFTER THE BIOME WAS INSTALLED...

100% felt the conference room looked "nicer"

90% felt more comfortable

70% felt they could concentrate better

81% would "highly recommend" more green walls throughout the office



AIR QUALITY IMPACT

BEFORE THE BIOME

727 ppm CO₂
average during workhours

14.7%
hours above 1,000 ppm CO₂

AFTER THE BIOME

688 ppm CO₂
average during workhours

8.9%
hours above 1,000 ppm CO₂

39% DECREASE IN HOURS OF PROBLEM CO₂ LEVELS

WHAT'S NEXT?

stök had attempted to find the CO₂ concentration per person in the room before and after the Biome installation, but their room booking system wasn't robust enough to determine the number of people in the room for each meeting. An alternative solution is being found as the analysis continues and will be implemented in other rooms where a Biome is placed.

SPOTLIGHT: AUSTRALIA



This research update was written by Green Building Council Australia (GBCA). The views expressed are those of GBCA only.

GREEN STAR: HARD-WIRED FOR HEALTH

Occupants are increasingly demanding healthy, green buildings in Australia as they look to reduce greenhouse gas emissions and energy use and improve productivity, enhance their brands and demonstrate their long-term commitment to their greatest asset – their people. What they find is a built environment ready to meet their needs, thanks to Australia’s secret weapon: Green Star.

Since its inception in 2003, Australia’s Green Star rating system has driven design solutions that look out for the environment as well as the health and wellbeing of building occupants – with Green Star points available for projects that focus on the low-carbon built environment but also good air quality, lighting, and thermal comfort, and that avoid the use of harmful chemicals and off-gassing materials. Australia is a global market leader in the healthy, green building movement because of this pioneering start and these are just a few examples of buildings showing the way forward.



Photo © LENDLEASE, 2016

Clockwise from Top Left: Lendlease’s International Tower Three and Macquarie Bank.

LENDLEASE’S INTERNATIONAL TOWER 3

SIX STAR GREEN STAR

At Lendlease’s International Tower Three at Barangaroo South in Sydney, a focus on wellness for occupants and employees:

- Nutritious food served in the café
- 1,000 bike racks
- 40% of work stations are stand-up desks
- 6m high green wall with more than 5,000 plants

MACQUARIE BANK

SIX STAR GREEN STAR

Down the road at Sydney’s Macquarie Bank’s light-filled headquarters, health and wellbeing features are the order of the day:

- New transparent dome on the roof created a light-filled atrium
- Flexible spaces for informal meetings, training, and events
- Low sugar food served in the café
- Yoga classes, music rooms, fitness facilities, mindfulness training programmes, a choir
- A roof top garden with chickens, beehives, and vegetables

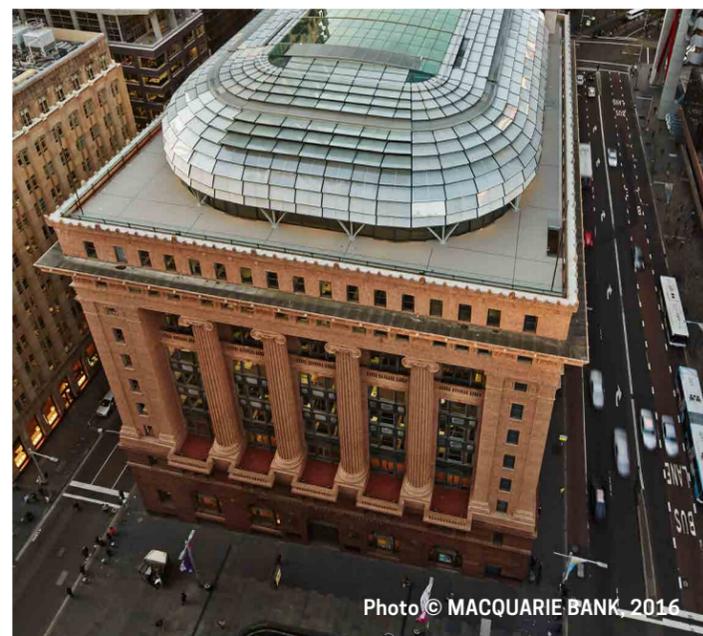


Photo © MACQUARIE BANK, 2016



Photo © MEDIBANK, 2016

Clockwise from Top Left: Medibank, WWF-Australia office, and Sydney Opera House.

MEDIBANK

SIX STAR GREEN STAR

Medibank’s new office in Melbourne is the centrepiece of a culture change programme for Australia’s largest health insurer.

- Edible gardens, fireplaces on every floor, and sports facilities
- 26 types of workspaces that can be booked through smart phones, including tranquil indoor spaces, collaborative hubs, wifi-enabled balconies, and standing desks
- Lighting mimics natural daylight
- 2,300 plants in the whole office and 10% of the façade is covered in native plants

These measures have already improved staff wellbeing and productivity.

80% working more collaboratively **2 in 3** felt healthier in office **5%** lower absenteeism

WWF AUSTRALIA

FIVE STAR GREEN STAR

WWF-Australia’s office, located in a former wool store in Sydney’s inner city suburb of Ultimo, also sets a high bar when it comes to health and wellbeing:

- The office mimics the natural world through its lighting, furnishings and layout
- Open-plan space features plants, wood, bark, and natural colours and materials
- Meeting rooms and breakout areas encourage collaboration
- High ventilation rates increase the flow of outdoor air to improve IAQ



Photo © WWF AUSTRALIA, 2016

MANY MORE...

Of course, health and wellbeing isn’t limited to offices. At the iconic Sydney Opera House, natural cleaning products – such as olive oil and bicarbonate of soda – have replaced toxic alternatives.

At Stockland’s retail centre in Townsville, state-of-the-art cycling facilities, including showers and lockers, have been installed to encourage staff to stay active.

Meanwhile supermarket giant Coles has developed a prototype of a ‘supermarket of the future’ – one that is more efficient to run, and also a more comfortable place for people to work and shop.

GBCA will continue to improve Green Star to ensure that Green Star-rated buildings are hard-wired for the environment and health.



Photo © GBCA, 2016

SPOTLIGHT: IWBI



This research update was written by Dr. Whitney Austin Gray, of the International Well Building Institute, based in the United States. The views expressed are those of IWBI only.

THE ROLE OF RESEARCH IN THE WELL BUILDING STANDARD

The International WELL Building Institute™ (IWBI™) is a public benefit corporation whose mission is to improve health and well-being through the built environment. IWBI administers the WELL Building Standard™, a performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and wellbeing, and develops resources towards a better understanding of the impacts of the built environment on human health and wellbeing. WELL was developed by integrating scientific and medical research and literature on environmental health, behavioral factors, health outcomes and demographic risk factors that affect health with leading practices in building design and management.

We know that 90% of a company's operating costs are staff salaries, so any improvement in human productivity can have a big impact on the return of that investment. These results were borne out from the recent Dodge Data & Analytics SmartMarket Report, entitled "The Drive Toward Healthier Buildings 2016".

Owners responded that improving employee satisfaction was the best way to improve their return on investment¹. The survey also found that 69% of those who have implemented healthy building features have seen improvements in employee satisfaction and engagement, with 29% reporting a "high level of improvement". Increasing employee satisfaction represents even better value for money than reducing healthcare costs and increasing occupant productivity, the survey revealed. The workplace environment has a significant impact on all three. It is critical to demonstrate the value of investing to ensure buildings have a positive impact on their occupants. However, significant challenges still remain in defining what is a healthy building and the metrics to evaluate the effectiveness of building investments on human health and wellbeing. In other words, how do we measure and align building performance with human performance? We believe there are three ways we can accomplish this:

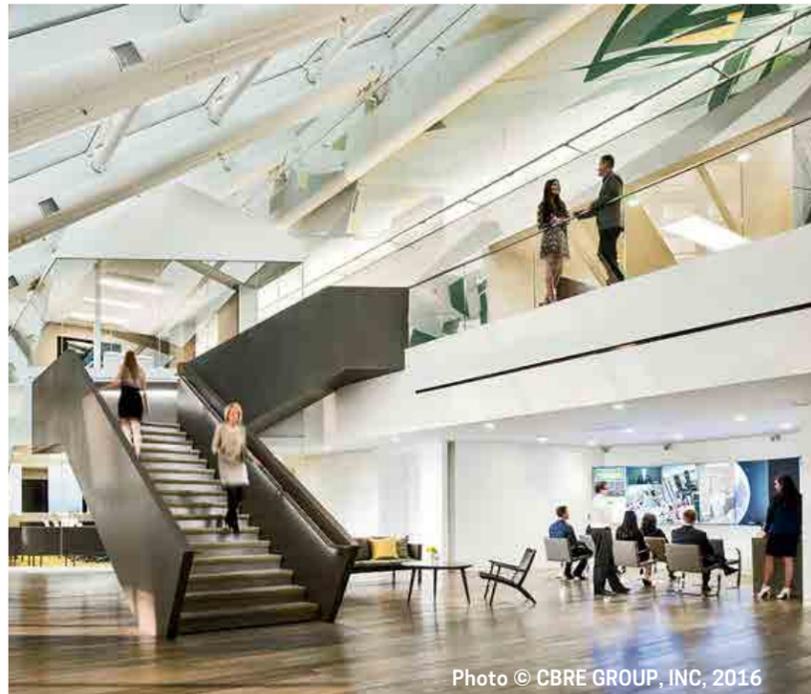


Photo © CBRE GROUP, INC, 2016

RESEARCH

ACTION

CERTIFICATION

¹Dodge Data & Analytics, "SmartMarket Report," 2016. P. 33. ²Delos Living LLC, "The WELL Building Standard," International WELL Building Institute pbc with permission from Delos Living LLC, NY, 2016.



Photo © CBRE GROUP, INC 2016

APPLIED RESEARCH PROGRAMME

The applied research programme aims to study the impacts of WELL Certification by working directly with registered projects. In 2016, as part of a partnership with the American Society of Interior Designers (ASID), a research collaboration was announced with Cornell University to study ASID's new corporate headquarters in Washington, D.C. The project is registered to pursue WELL and targeting Platinum level certification. ASID has committed to the headquarters serving as a living laboratory aimed to advance research and education around health and wellbeing to its members using environmental testing and occupant feedback. The building is targeting for LEED Platinum as well as WELL platinum level certification by incorporating the following health and well-being features:

- Circadian lighting
- Indoor herb garden
- Dedicated Wellness Room
- Sit/stand desks
- Pre- and post-occupancy surveys
- Environmental testing

ASID has committed to the headquarters serving as a living laboratory aimed to advance research and education around health and well-being to its members using environmental testing and occupant feedback.

The WELL Standard™

The WELL Building Standard (WELL), administered by IWBI, combines best practices in design and construction with evidence-based medical and scientific research.

Key points:

Performance-based system for measuring, certifying and monitoring the impact of the built environment on human health and wellbeing

280 projects in 24 countries

Nearly 6 million m² registered or certified

Silver, Gold, or Platinum level certification

We're seeing a dramatic uptake of this certification which only reinforces early research efforts and what building owners already know: that improving the health and wellbeing of employees has the potential to improve return on investment.

WELL sets performance requirements to support healthy office environments, and through research efforts the goal is to provide many more examples of the return on investment in staff through improvements to the indoor environment over the coming years.

CASE STUDY: TORONTO & REGION CONSERVATION AUTHORITY



A 170% increase in overall employee workplace satisfaction was seen when TRCA moved into an interim office with new health and wellbeing features. Their new office, to be finished in 2021, will be designed from direct consultation with employees.



Photo © DTAH ARCHITECTS, 2016

TRCA Proposed Headquarters, DTAH Architects Limited

ABOUT THE OFFICE

TRCA had outgrown its 1970s office and needed new premises. It wanted its new headquarters to be highly sustainable, in keeping with its mandate as a conservation organisation, but knew that this would take some time to achieve, so it moved into an interim office. TRCA conducted extensive employee surveys to ensure that their health, wellbeing, and productivity was considered in the design of the interim office and that lessons were learned to influence the design of its future headquarters. Here, we showcase the process that is taking TRCA to a new sustainable head office, that will aim for LEED Platinum and WELL Certification.



Photo © TRCA, 2016



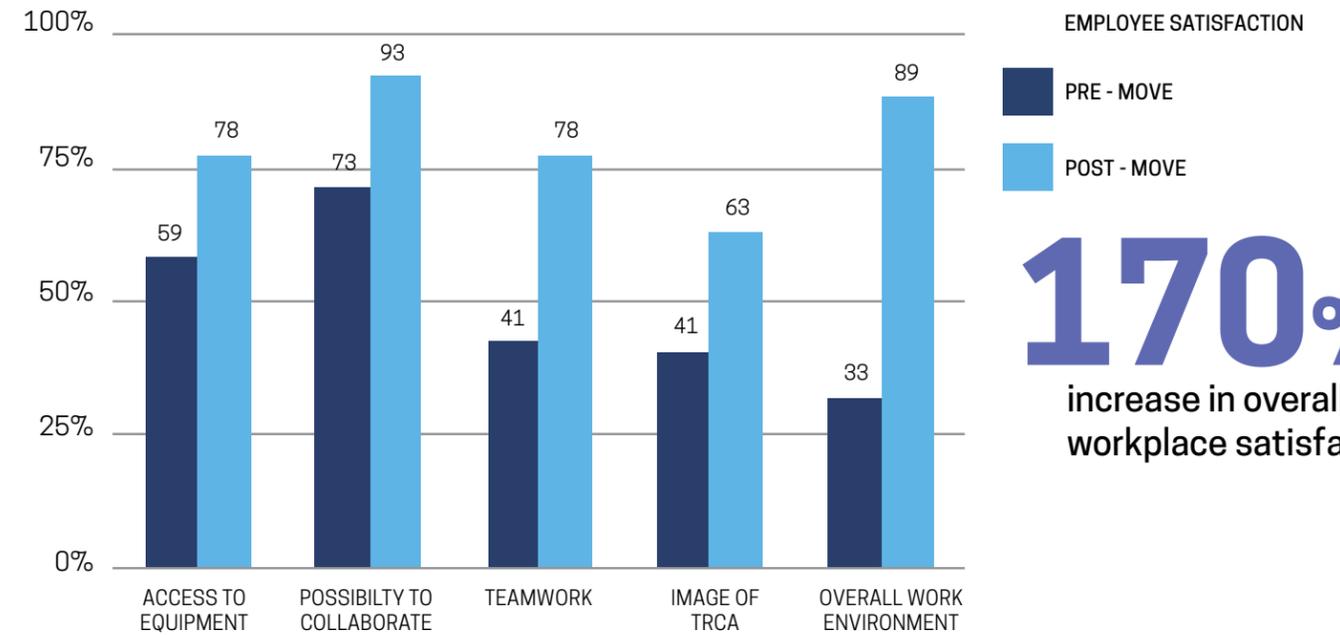
Photo © TRCA, 2016

TRCA Former Office

HEALTH AND WELLBEING ACTIONS

- Low-wall desks to increase daylighting
- A mix of informal and formal meeting spaces, combined with comfortable lounges encourage staff collaboration
- Hotelling sit/stand stations, quiet rooms for concentrated work, and large-layout tables for reviewing drawings vary the workplace
- Colours and aesthetics inspired by nature

CONDUCTED A THOROUGH PRE AND POST-OCCUPANCY SURVEY



170%
increase in overall workplace satisfaction

USED PRE & POST-OCCUPANCY SURVEY TO INFLUENCE DESIGN OF NEW HEAD OFFICE

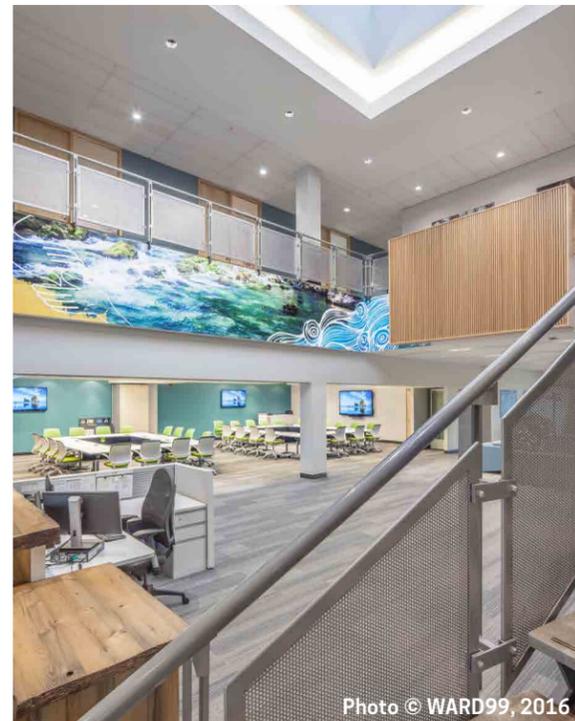


Photo © WARD99, 2016

TRCA Interim Office, ward99 architects



Photo © DTAH ARCHITECTS, 2016

TRCA Future Office Concept, DTAH Architects Limited

SPOTLIGHT: MIDDLE EAST REGION

This research update was written by Middle East Council of Offices (MECO). The views expressed are those of MECO only.

The Middle East has seen a significant influx of multi-national companies over recent years, and there is a wide variety of occupation styles across commercial office space which does not match the desires of a young, quickly modernising population.

The region also has many distinct characteristics that make it different from other parts of the world, including an extreme climate, a workforce comprised of many nationalities and a strong local culture which influences work practices and protocols.

The Middle East is overdue for a fresh look at how to promote health, wellbeing, and productivity in offices.

In May 2016 the Royal Institution of Chartered Surveyors (RICS) in partnership with the Middle East Council of Offices (MECO) conducted a study to examine the impact of office design and configuration on business productivity.

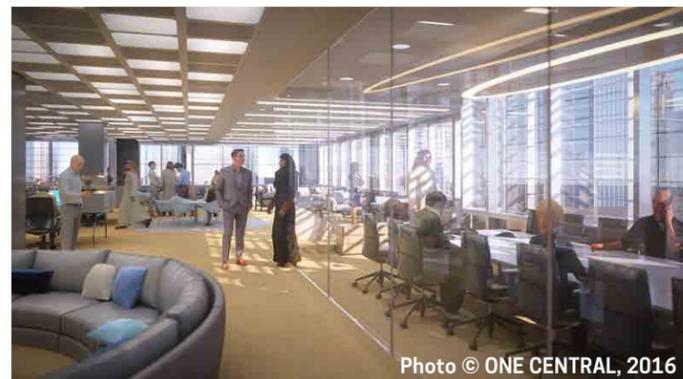
It surveyed 655 office workers in United Arab Emirates (53%), Qatar (15%), Saudi Arabia (15%), Oman (5%), Egypt (4%), and other countries to explore productivity in office environments, challenge preconceptions and build understanding of why “one size does not fit all” for office design.

The findings provide a unique insight into the impact the physical environment has on the productivity of workers, and how to improve the return on investment in corporate real estate.

37% said lack of comfort in their office had a negative impact on their productivity

Over **75%** of respondents felt they needed more flexibility in their working environment.

#1 feature occupants would change to improve productivity:
INDOOR ENVIRONMENTAL QUALITY



40%



of workers suffer from noise disturbances; 51% felt they were seriously impacted by interruptions; 39% were negatively affected by noise from other employees in open-plan offices.

38%

complain about waiting for an elevator.

The survey revealed a diverse Middle East workforce with **highly variable preferences, concerns and perceptions about what factors affect productivity**. This provides conclusive evidence that **generic, frequently open-plan, one-size fits all office layouts will fail to improve employee productivity**.

Three quarters of employees wanted more flexibility in their work environment, including where they worked, their hours of work and the office layout, revealing a gap between current office practices and those perceived to promote optimum productivity.

However, the survey showed there is a greater willingness to experiment with activity-based innovative workplaces in the Middle East than observed in other studies in Europe.

The Middle East presents some unique problems: a significant proportion of building stock is below the standard found



42%

felt that their office did not help them be more creative.

in other parts of the world and there is a **severe lack of sustainable buildings**. Indoor environmental quality is a major issue and the number one thing staff would address to improve productivity.

The physical aspects of buildings also came under scrutiny and 38% of respondents said slow elevators hindered their productivity. This is the first time this issue has been flagged as a negative impact on productivity.

There is a clear need to promote higher specifications, encourage better design and embed sustainability into the building stock to address significant concerns with the quality, controllability, and general health and wellbeing of the Middle East office environment.

CASE STUDY: TD BANK GROUP

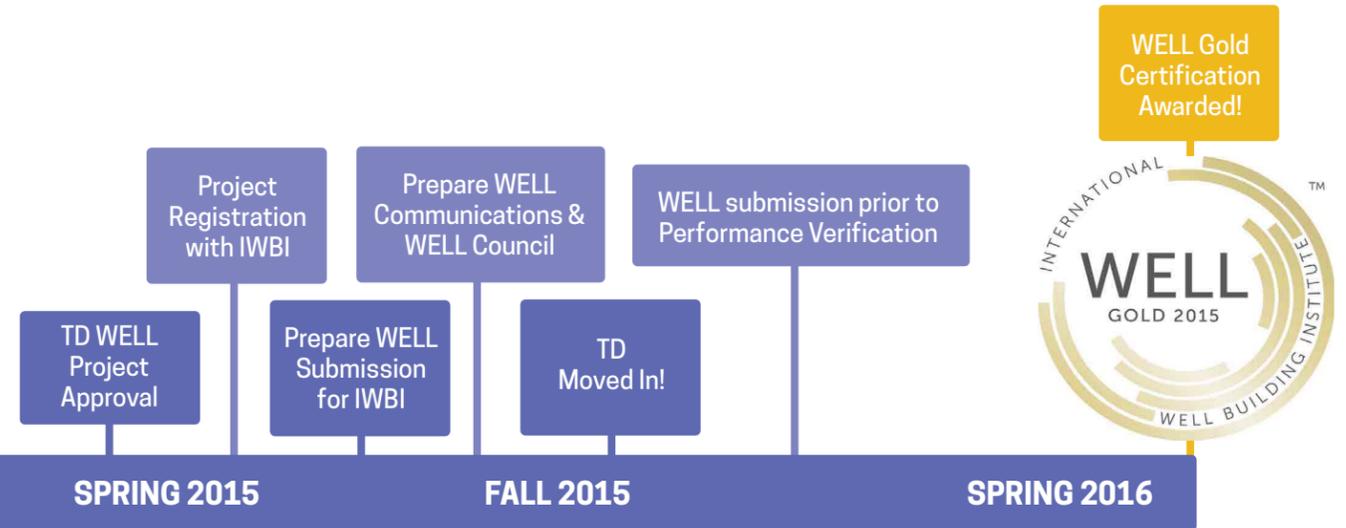


The first WELL Certified™ Gold office under WELL v1 in the world was built in Toronto by TD Bank Group and highlights features like varied and collaborative workspace, an emphasis on employee fitness and wellness, and fantastic views of Toronto city and waterfront.



ABOUT THE OFFICE

This office, over 2,400 m², is called TD23 because the WELL Certification is for the 23rd floor of a 56-storey building in downtown Toronto that was completely renovated over the past several years to LEED Platinum. The renovation of TD23 was an ideal opportunity for the implementation of WELL due to its prototypical floorplan – it was a project that could be replicated on many more floors in the building if proved successful. The process from kick-off to WELL Certification took over 18 months and is outlined below.



DURATION OF 18 MONTHS FROM PROJECT INITIATION TO WELL CERTIFICATION

HEALTH AND WELLBEING ACTIONS

- A new space includes a tranquility lounge with maximum ambient lighting of 200 lux with a dimmer, various types of seating and the calming patterns and colours of nature
- Gym and fitness studio discounts, public transportation benefits, and bike share discounts
- At any time, 30% of the occupants may be using a standing desk, which feature direct Lake Ontario and downtown Toronto views
- Pre-occupancy IAQ testing showed TVOC levels higher than the WELL standard; this was remediated through the use of carbon filters

WHAT'S NEXT?

The TD23 office space pilot in conjunction with TD's retail WELL pilot in Bethesda, MD, have prompted the Bank to look into measurable metrics that had not previously been investigated. TD has begun investigating metrics that can currently be measured as well as those that cannot currently be measured but could potentially provide a noteworthy statistic in the future. This includes data such as absenteeism due to illness, employee productivity, employee overall happiness, customer engagement around wellness, health insurance claims, etc. These metrics are not always easily quantifiable, but TD is committed to exploring ways to track the data and use it to provide insight for future designs.

SPOTLIGHT: HONG KONG



This research update was written by Hong Kong Green Building Council Australia (HKGBC). The views expressed are those of HKGBC only.

Hong Kong is one of the major financial centres in the world and a gateway to mainland China. Currently, it has over 11 million m² of office space, 20% of which is currently certified green by the Hong Kong Green Building Council's (HKGBC) BEAM Plus system. The BEAM Plus scheme gives credits for actions to promote health and wellbeing and builders are increasingly applying for these as they start to see the benefits to their bottom line and to their occupants.

The Hong Kong Environmental Protection Department (EPD) also provides certification for indoor air quality in buildings, either 'Excellent' or 'Good' – this is a significant concern in an area where outdoor air pollution is often above recommended thresholds. This ensures buildings meet certain levels of indoor air quality over the year and improves the health and wellbeing of the occupants.

STANDARD CHARTERED BANK BUILDING

Originally built in 1990, this building was recently renovated to achieve BEAM Plus Platinum for Existing Buildings. Even within the constraints of an existing building envelope, a host of health and wellbeing features were included:

- IAQ 'Good' in 2015 and 'Excellent' in 2016
- New HVAC system to maintain indoor temperature and air flow rate at an optimal level. This upgrade also reduces energy use and greenhouse gas emissions



ZERO CARBON BUILDING (ZCB)

The ZCB, constructed in 2012, achieved BEAM Plus Platinum in 2015 and was the first building in Hong Kong with net zero carbon emissions.

- Cross-ventilation, low VOC materials, and wind-catchers helped the building achieve IAQ 'Good'
- Daylighting and natural ventilation improves thermal comfort and also reduces energy use by 20% compared to normal buildings
- All offices have an outdoor view, with some looking out on the first urban native woodland in Hong Kong



SHATIN COMMUNICATIONS AND TECHNOLOGY CENTRE (SCTC)

SCTC is the latest addition to the Hong Kong Jockey Club's extensive property portfolio, BEAM Plus Gold.

- By using demand control CO₂ sensors, 30% more fresh air is ventilated inside the building
- Core placement on the NNW façade reduced solar gain by 32%, improving thermal comfort
- 64% of the rooftop is covered in accessible green roofs
- Employees reported 97% satisfaction with the new office



ELECTRICAL AND MECHANICAL SERVICES DEPARTMENT HQ (EMSD)

This former air cargo terminal has been transformed into an office and workshop for EMSD and achieved BEAM Plus Platinum. This re-use limited the amount of waste and, along with the massive solar array, helped reduce greenhouse gas emissions associated with construction and operation. Employee's productivity has been improved significantly since the original fit-out in 2005:

- IAQ 'Good' in 2016
- Internal 30 m² green wall and two green roofs
- Increased daylighting led to 25-36% lower lighting power density
- Health and wellbeing changes led to 80% occupant satisfaction in the new building



INTERNATIONAL COMMERCE CENTRE (ICC)

The ICC is the tallest building in Hong Kong and seventh tallest in the world. With over 250 000 m² of office space, it uses its health and wellbeing features as a selling point to potential occupants, including:

- Central core design to maximise daylight IAQ Excellent Class Certificate
- Pedestrian access to retail, hotels, and services in the West Kowloon Cultural District as well as public transportation
- A shingled curtain wall façade was designed to maximise views and daylight while reducing solar gain and maintaining comfort

Tallest building in HK, 7th in world!



CASE STUDY: DLR GROUP



Measuring air quality in DLR Group's LEED Gold offices dramatically increased employee engagement and gave their employees the opportunity to understand the services they give to their own clients.

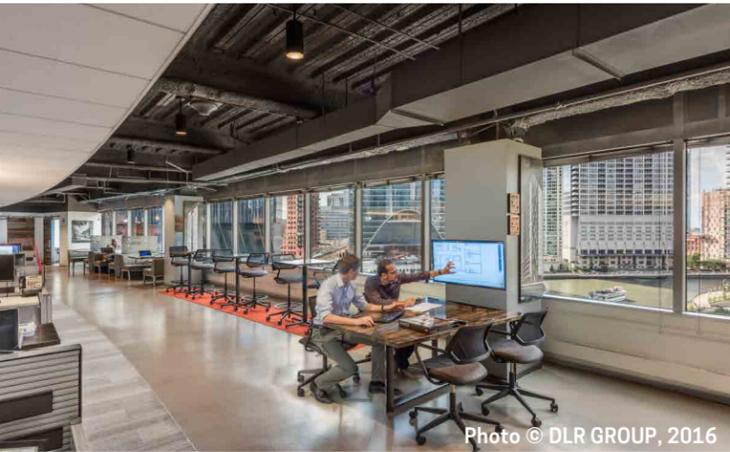


Photo © DLR GROUP, 2016

ABOUT THE OFFICE

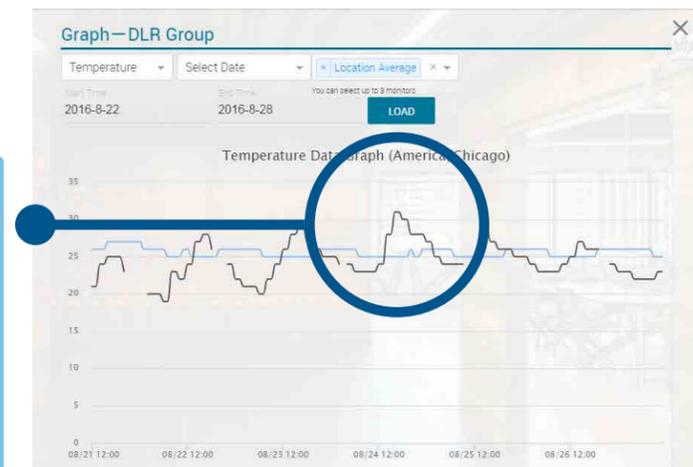
DLR Group, an integrated architecture and design firm, moved into a new Chicago office space rated LEED Gold in 2014. It wanted to create a “living lab” using the QLEAR IAQ monitoring system to help employees see why it uses a holistic approach to designing buildings – quantifying the thermal comfort, indoor air quality (IAQ), and acoustic and visual comfort of a building.

Here, three of the five air quality metrics they examined are discussed. Temperature, which affects thermal comfort, is an important factor in employee productivity and variations from the building set point can cause problems: 4% drops in productivity when too cold and 6% drops in productivity when too warm. Also, they examined CO₂ which has been shown, most recently, to have a dramatic effect on cognitive ability when too high. They also examined particulate matter, which has short and long term impacts on people's immune systems and is heavily influenced by outdoor air quality.

TEMPERATURE

When the office temperature moved outside the building's set parameters, employees could easily identify why their comfort was being compromised.

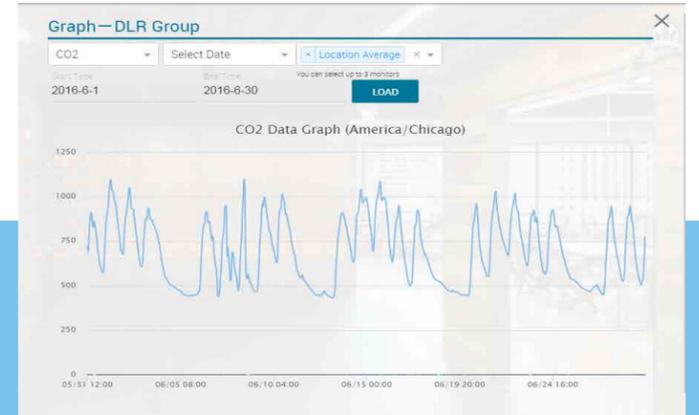
"On one occasion numerous people in the office had stopped work to take a break, and were complaining about the temperature in the office being too high. When we consulted our dashboard, the temperature in the office was at 78.8°F (Setpoint = 75°F). Temperatures have always been steady in our space, but this 3.8F variation in temperature was enough to cause a disruption in the workday for many."



CO₂

One of the biggest indicators of the connection between air quality and employee satisfaction was when the employees felt a considerable change in comfort when the CO₂ concentration was above 800 ppm.

"At the start of the summer, we hired five new interns. There was a marked increase in CO₂ levels in the spaces we measure and this was clearly attributed to a higher employee density. This also made us more aware of the fact that increasing the density too high could lead to CO₂ levels higher than what is supportive of productive work, as identified in the study by Allen et al. (2016)."



PARTICULATE MATTER

PM levels inside the office correlate well with those outside, but are slightly lower due to the air filtration system. **On days with the worst outdoor air quality**, however, the system can only remove so much PM. This shows that no matter how good a building's systems are, the outdoor air quality will always impact the indoor environment.

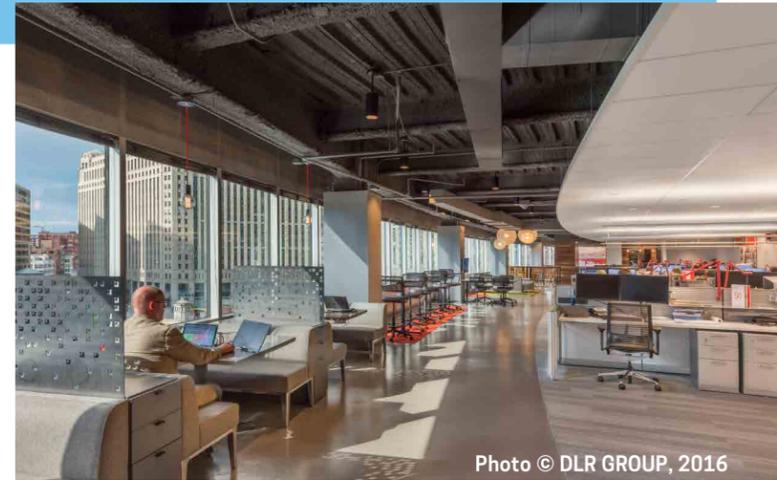


Photo © DLR GROUP, 2016

WHY DATA TRANSPARENCY IS IMPORTANT

Reliable data helps drive good design and construction, but is also becoming integral to supporting building operation. Making this data public ensures that:

Employees can see an accurate picture of the indoor environment

Helps them feel supported as employees of a company

DLR Group publicly discloses air quality data to its employees and empowers them to evaluate and evolve their workplace. This level of “control” and transparency over their built environment gives occupants satisfaction which has been proven to lead to better productivity.

In a society where end-users are becoming more accustomed to having real-time data at their fingertips, it is increasingly important for designers, contractors, and operations staff to be able to respond to the challenges this poses throughout the life cycle of a building.

WHAT'S NEXT?

In this concluding piece, John Alker, Campaign and Policy Director at the UK-GBC, shares how he sees industry engagement from the WorldGBC's first report on health & wellbeing in 2014 through today and for the years to come.



WHAT TOOK EVERYONE SO LONG?

In Spring 2014, when I began editing WorldGBC's first major report on health, wellbeing and productivity in offices, I had a feeling that we were "onto something". I could not, however, have imagined just how quickly interest in this topic would grow in a relatively short space of time.

For many green building advocates, there is probably a slight sense of "what took everyone so long?!" Perhaps this is because many of the principles of sustainable, healthy design are not new. It is about good quality design and putting people at the heart of the building.

However, despite clear evidence of the relationship between an office building and the health, wellbeing and productivity of its occupants – some of which goes back years – we recognised in the 2014 report that too little of this was influencing mainstream design, investment and leasing decisions in most markets. By presenting robust evidence in a user-friendly way, and proposing a simple Framework, we wanted to raise awareness and increase demand from builders, occupiers and end-users.

WHAT HAS CHANGED SINCE THEN?

For those of us with radical ambitions, the honest answer is probably not enough. There is still a long way to go in most markets before a healthy office is considered the norm. Change takes time to feed through - developments can take years, and refurbishing existing building stock is a challenge.

However, there is much from which to take encouragement. Many national GBCs have been tackling market barriers to healthy buildings head on. Some through rating tools, others through occupier engagement or research. All are linking in to WorldGBC's Better Places for People campaign and disseminating the tools and guidance collectively produced. This report has shone a spotlight on just some of those efforts – stories of success from Australia to Canada, Hong Kong to the Middle East – and many places in between.

We – as GBCs - cannot take too much credit, because effectively we are barometers of the market. Yes, we exist to challenge the industry, but we are also reflecting back its interests and priorities. And there is no doubt that health, wellbeing and productivity is a growing priority, not just amongst the usual suspects, but in the mainstream.



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THE DRIVERS FOR HEALTH AND WELLBEING ARE VARIED, COMPLEX AND SUBJECTIVE

We can point to our understanding of the human body, which is growing all the time, and the way in which the WELL Building Standard has bridged the two worlds of biology and buildings. We can also confidently say that individuals are increasingly engaged in their own health and wellbeing, and taking personal responsibility for it, which is feeding a growing industry worldwide.

Perhaps most intriguingly, technology is putting power in the hands of building users, providing real performance data in real time, at lower prices and in a format that everyone can understand. If healthy is the new wealthy, then data is the new currency. This is highly democratising, and will ultimately render obsolete the already outdated question from investors, developers or agents of "Why should I bother?"

I'M EXCITED ABOUT THE NEXT CHAPTER OF THIS STORY

I strongly believe companies that reliably demonstrate leadership on health and wellbeing, as a key component of wider sustainability, will derive significant commercial benefit – tenants will attract and retain their best employees; investors and developers will realise higher property values; owners and managers will see an increase in rental rates and the engineers and consultants who can design and deliver green, healthy buildings will be in high demand amongst clients. For our part, national GBCs, WorldGBC, our sponsors and research partners will continue to provide a global platform for those pushing the market forward.

In short, we are on the verge of something big. Now is the time to get on board.



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EIGHT FEATURES THAT MAKE A HEALTHY, GREEN OFFICE PAGE 14

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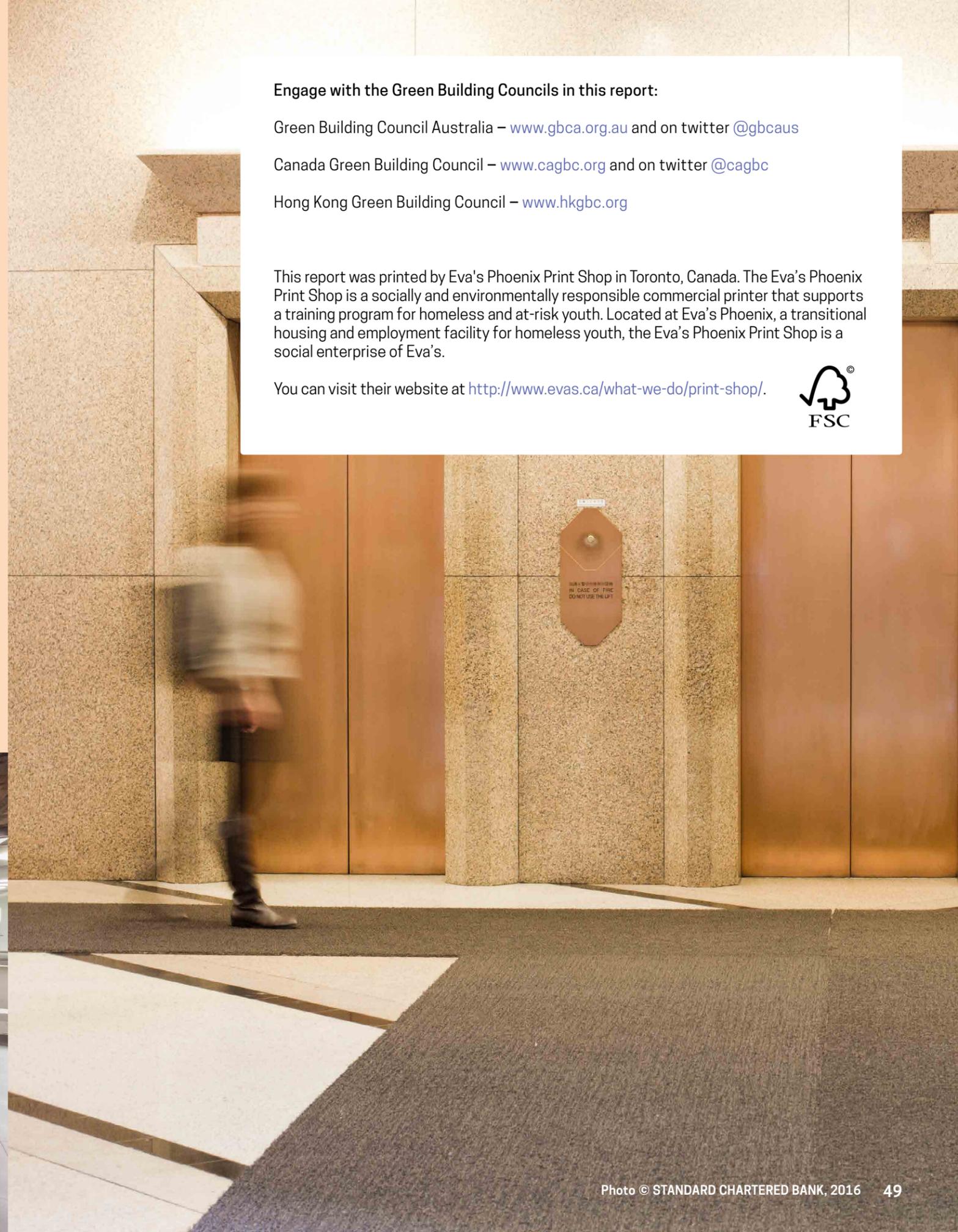
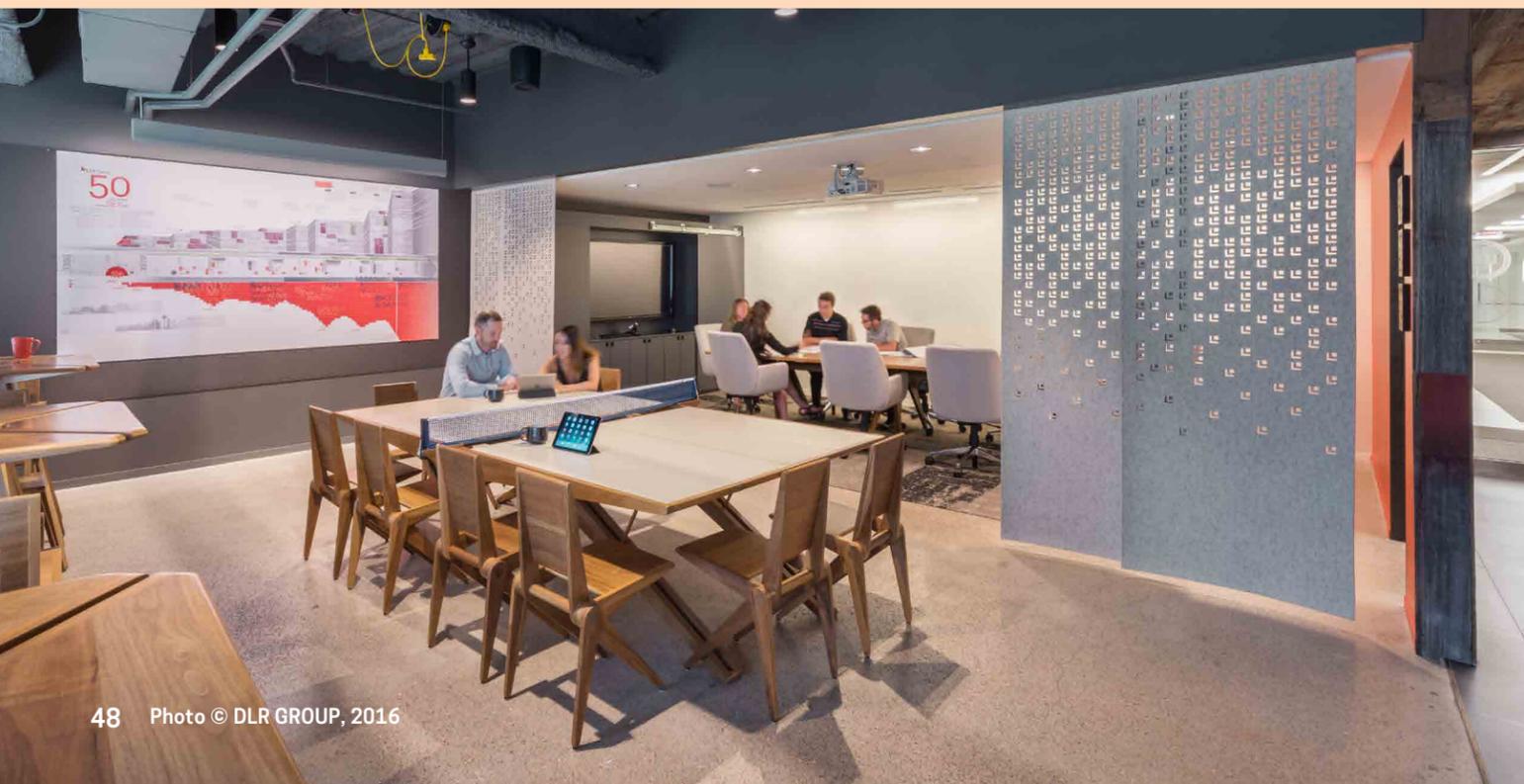
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