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Programming Buildings for Health: WELL, Fitwel, and Beyond

Move over, avocados and kale. Green buildings are the new science-backed frontier of healthy living.

by Paula Melton

Hospital lighting can cause stress. It can also reduce it. Home location can encourage inactivity and poor diet, or it can provide exercise opportunities and access to fresh veggies. A newly renovated office can contribute to asthma or supply better air than we breathe outdoors. From phthalates to fresh air to fitness rooms, we have plenty of hints about how our buildings can influence our well-being.

But very few people have the expertise and time to evaluate scads and scads of scientific evidence relating to buildings and health. And even if we could, it still wouldn't be easy to prioritize so much information to create wellness-promoting spaces. Let's say did, though. How could we be sure to get all the health stuff right without forgetting other green building priorities in the process? This is getting complicated. And probably expensive.

Enter certification programs.

Rating systems for health

From old standbys like LEED and the Living Building Challenge to newer and narrower programs like the WELL Building Standard and Fitwel, rating systems are designed to simplify and incentivize health-related priorities.

Whole-building rating systems tend to emphasize wellness features that are also related to energy, water, and waste: [done right, daylighting](#)

boosts well-being and saves energy. Other times, they provide checks and balances to health-promoting systems that threaten to compromise other sustainability goals: you don't want to kill your energy performance with [enhanced ventilation](#), so incentivizing both can lead to better outcomes for both health and environmental impact.

Health-only programs can mesh well with whole-building systems: active design ties closely with a location in a walkable neighborhood, for example. But they tend not to provide checks and balances, which is why WELL and

Fitwel are both designed to align with whole-building rating systems—and why you will hear their proponents suggesting dual certification with LEED or LBC.

WELL, Fitwel, and beyond

In this special series on green buildings and human health, we take an in-depth look at:

- [The WELL Building Standard](#)
- [Fitwel](#)
- [Health-related features of LEED and the Living Building Challenge](#)
- [The emerging field of neuro-architecture and how it's helping connect the science of well-being with the art of design](#)

Up next: [Why everybody's talking about WELL](#)

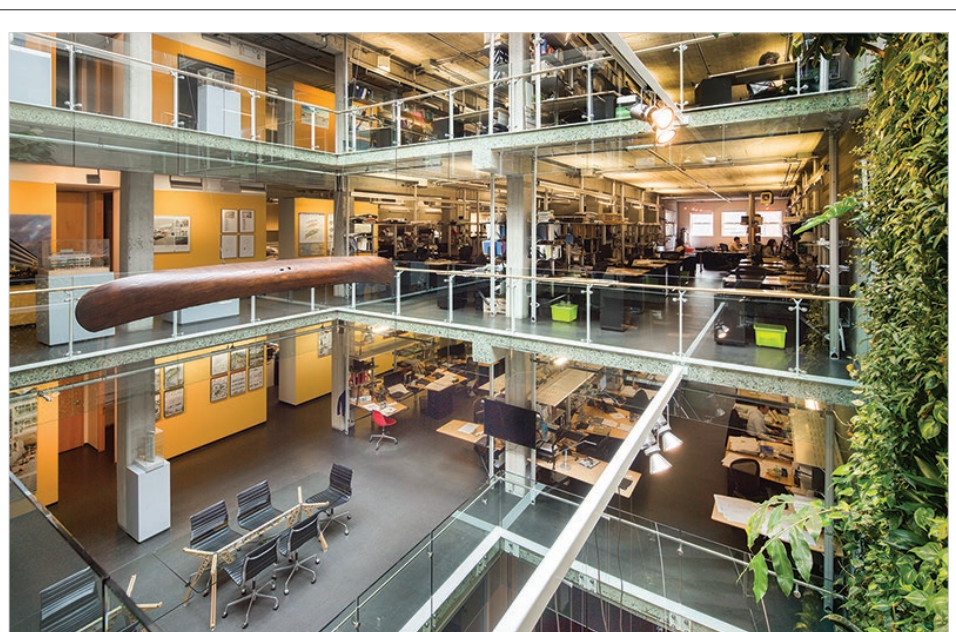


Photo courtesy Perkins+Will

Perkins+Will has become a Fitwel Champion and is certifying all its North American offices, including this one in Vancouver, British Columbia.



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How WELL Got Green Building's Groove Back

WELL is the hottest four-letter word in sustainable design. But will it work to the benefit or the detriment of green building?

by Paula Melton

Too niche, too difficult, too bureaucratic, too pricey: complaints about building certifications seem to get louder by the second. In this market, it would be crazy to introduce a new rating system that's less broadly applicable than LEED, harder to achieve, certified by the same third party, and more expensive.

But that's exactly what the WELL Building Standard is—and it's apparently having wild success. What's the attraction?

It's Here

"The absolute best aspect of WELL is that it exists," according to Mara Baum, AIA. Baum, who is Sustainable Design Leader, Health and Wellness, at HOK, says she's struggled throughout her career to bring health concerns into the sustainable design conversation.

"I got into healthcare design over a decade ago because it was almost the only realm in which I could have an intelligent conversation about health and well-being without getting laughed out of the room," Baum told BuildingGreen. This "has obviously changed quite a bit in the last few years," she added, with the emergence of health-related rating programs as well as the renewed prominence of human health, wellness, and safety in whole-building certifications. "I am thrilled that much of the rest of the world has started to catch up," she added.

Others we spoke with had similar views, suggesting that a program like WELL—which pulls everything health-related together into one place—was long overdue. Without it, we risk committing "random acts of sustainability," said John Mlade, Director at sustainability consulting firm YR&G.



Photo courtesy IWBI

TD Bank Group in Toronto was the first project in North America to achieve WELL Certification.

"Every architect, every designer, has good intentions but different perspectives," he said. "Very few teams are equipped to address all the areas" covered by a comprehensive health-focused system.

With all that said, WELL certainly has its share of skeptics and detractors, too. (See our [guest op-ed](#), which critiques the system in some detail.) In this article, we:

- run through the basics of the WELL Building Standard
- share feedback on WELL from users and outside observers
- offer our own "diagnosis" of the system's relevance, rigor, ease of use, and cost

Looking for other rating systems to get the same treatment? As part of this [special issue](#) on health-focused green building programs, we also examined [Fitwel](#), and [compared Fitwel and WELL with LEED v4 and the Living Building Challenge](#).

WELL 101

Real estate company Delos [announced the development of WELL in 2012](#), and the first certifications [began in 2014](#), after the creation of the International WELL Building Institute (IWBI) as a public benefit corporation that maintains and administers the standard.

Basic requirements

The standard covers seven major categories, called “concepts” in the rating system’s lingo, where pre-requisites are “preconditions,” and credits are “optimizations”:

- **Air**—This category requires a broad spectrum of air-quality measures, such as low-emitting materials, moisture management, and onsite testing of indoor air. Other features, like air-leakage testing, operable windows, and advanced air purification, are optional.
- **Water**—Onsite testing for a variety of contaminants is required. Allowable levels are tied to U.S. Environmental Protection Agency (EPA) limits, with the exception of chlorine, which has a low reference value set by the Australian government as an “aesthetic” standard. Optional actions include quarterly water testing, improved access to drinking water, and specialized water treatment.
- **Nourishment**—This section focuses heavily on onsite food service and vending machines. Requirements govern the proportions of fruits and veggies on offer, and include an emphasis on low-sugar drinks and whole grains. Options cover everything from food safety to plate sizes to the distance between people’s offices and the break room. (Projects without onsite food service don’t get penalized.)
- **Light**—This feature has relatively few hard requirements, but the language of the preconditions will likely be quite unfamiliar even to lighting designers (the circadian lighting metric is one of the more controversial aspects of WELL). Daylight access, automated shades, and improved lighting color quality are among the options.
- **Fitness**—Active design is a fairly low priority in WELL, with just a handful of requirements. These include promotion of stair use and monetary incentives for

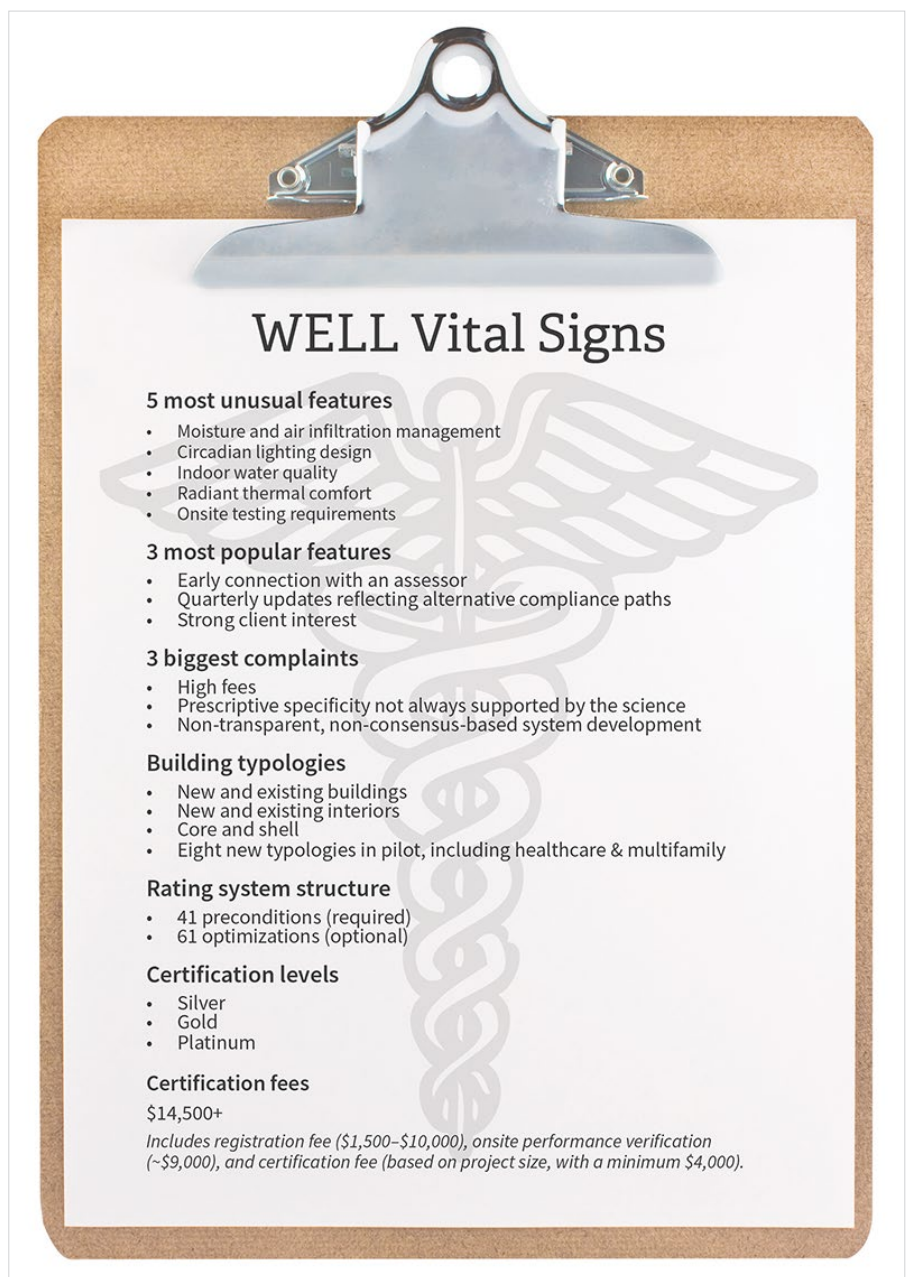
fitness-related activities. Optional optimizations include cycling infrastructure, onsite fitness equipment, and “active workstations” like treadmill desks and standing desks.

- **Comfort**—With a huge emphasis on acoustics, the Comfort feature also governs ergonomics and thermal comfort (both required). Options build on the basics with optimizations like sound masking and radiant thermal comfort.
- **Mind**—This is a miscellaneous category designed to promote aspects of wellness not covered in the other

features. Integrative design, wellness education, post-occupancy surveys, and biophilic design are all required. Items relating to sleep, workspace flexibility, and work–life balance round out the section.

Rating system mechanics

To achieve the lowest level of certification, Silver, a project must meet all preconditions. For whole buildings, there are 41 of these. After that, you can pick among 61 optimizations to go for Gold or Platinum.



WELL Vital Signs

- 5 most unusual features**
 - Moisture and air infiltration management
 - Circadian lighting design
 - Indoor water quality
 - Radiant thermal comfort
 - Onsite testing requirements
- 3 most popular features**
 - Early connection with an assessor
 - Quarterly updates reflecting alternative compliance paths
 - Strong client interest
- 3 biggest complaints**
 - High fees
 - Prescriptive specificity not always supported by the science
 - Non-transparent, non-consensus-based system development
- Building typologies**
 - New and existing buildings
 - New and existing interiors
 - Core and shell
 - Eight new typologies in pilot, including healthcare & multifamily
- Rating system structure**
 - 41 preconditions (required)
 - 61 optimizations (optional)
- Certification levels**
 - Silver
 - Gold
 - Platinum
- Certification fees**
\$14,500+
Includes registration fee (\$1,500–\$10,000), onsite performance verification (~\$9,000), and certification fee (based on project size, with a minimum \$4,000).

Image: BuildingGreen, Inc.

But you need to do more than design for the features and document your efforts: a WELL assessor must come to the site to ensure compliance. Even the design phase calls for coordination with human resources, building operators, and possibly upper levels of management. Third-party testing of air and water are also required, and spaces must be recertified every three years.

Green Business Certification Inc. (GBCI)—the same nonprofit that reviews LEED projects—is the third-party certifier for the system.

Comprehensive but Expensive: User Feedback

Though enjoying some success, WELL is really just getting started, and users offered feedback on a spectrum from high praise to hesitation.

Pros: LEED-compatible ice-breaker

There's a lot to love about WELL, based on our conversations with early adopters and the WELL-curious. Here are six of their favorite things about the rating system.

1. Does it all

"Health has been around for a while," noted YR&G's John Mlade. "Before WELL pulled it all in and created a platform for it, it just wasn't penetrating." Having a comprehensive system that covers one topic in depth really helps designers ensure they're making

inroads across a wide spectrum of health-related design decisions. It also gets a vital dialogue going, he said, adding that its mere existence is already "elevating the conversation around health."

"Health has been here all along," agreed Steven Burke, sustainability manager at Symmes Maini & McKee Associates. "It's really refreshing to have it be catalogued and provide an opportunity for discussions. People are beginning to discuss things they innately knew were already there but didn't have the framework to discuss."

2. Makes certification fun again

Although some people we interviewed reported long sighs about yet another rating system, that was not the norm. Instead, the emergence of WELL seems to be getting people excited about green building rating systems—much like BREEAM and LEED did in their early days. "WELL is breathing much-needed new life into what it means to have a sustainable design besides energy conservation," said Burke.

"We were starting to see certification numbness," reported Rachel Bannon-Godfrey, Assoc. AIA, Director of Sustainability at architecture firm RNL. "Now that we've got more options, I feel like there is renewed interest," with clients saying, "Let's think about this again; which one is the right one for me?"

But does this competition threaten to foreground individual human health at the expense of broader rating systems?

"LEED and the WELL program are meant to complement each other," argues Nathan Stodola, Vice President at IWBI. And that's been the official WELL position from day one, but how's it playing out in practice?

"LEED has definitely helped us on a couple projects to say, 'You are getting this far because of LEED,'" said Bannon-Godfrey, so achieving WELL on top of it is only a few more steps.

Mlade had a more nuanced story about the relationship between LEED and WELL. A project he's working on right now is pursuing both LEED v4 and WELL, and "they are fantastic together," Mlade told BuildingGreen. But "there is an argument that if you are only going to do one, do WELL instead of LEED."

Mightn't that lead to abandonment of basic green building principles, which WELL doesn't cover in depth? Just the opposite, in Mlade's view. "The industry has a grip on the LEED requirements," he said. "We already have that stuff." (Not everyone familiar with the mainstream building industry would agree, certainly.) So, if you have to pick one rating system for budget reasons, it might make sense to pick the one that provides detailed guidance on less-familiar achievements. Still, choosing between the two hasn't really been an issue for most projects so far, based on our conversations with green building professionals. And "pursuing LEED already made WELL not too significant of a burden," Mlade confirmed—suggesting that those clients who are able and willing to pay for certifications may wish to achieve both to get more bang for their buck.

3. Answers new questions

After years of being siloed in healthcare projects, conversations about health and well-being are "moving into everything we do," according to Paula McEvoy, FAIA, Co-director of the Sustainable Design Initiative at Perkins+Will. Rating systems like WELL and Fitwel, she said, "are increasing awareness of the people who are occupying, designing, and managing these spaces" about how the built environment can affect the health and well-being of occupants.

WELL addresses issues that don't get the same level of attention in LEED or even the Living Building Challenge (see the [infographic online](#) for a comparison), and designers say their clients are excited to hear how these novel concepts can help their employees or tenants.

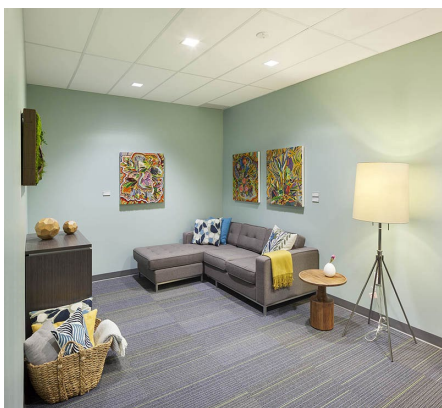


Photo courtesy IWBI

This tranquility lounge at the Toronto headquarters of TD Bank helped the project achieve WELL certification.

“One of the big ones right now is the tunable lighting,” said Amber Richane, Senior Associate Vice President, Performance-Driven Design at CallisonRTKL. “When we talk to clients about that, it seems like a no brainer to them.” (For more on this, see our coverage of [tunable lighting](#) and [circadian rhythms](#).)

Acoustics is another biggie. Though addressed in other programs, acoustics is much more heavily weighted in WELL. “Spaces tend to be more and more open,” explained Dave Madson, Principal at CBT Architects. “There are a lot of things in the WELL standard to deal with acoustics. It’s about dealing with stress.”

The beauty and biophilia sections also stir up excitement for both clients and designers, according to Madson. In a recent strategy session for a project, the 35 participants were asked to bring in an image of a place they’d like to recharge in. “Almost to a man and woman, they brought some sort of image of nature,” he recalled. Madson likes how WELL highlights our “affinity with the natural world, which is proven to affect our mood and our happiness.” This has led teams at his firm to ask how they are reflecting nature in their designs, he said. “We are not putting tree trunks and rivers through our space, but we can use a natural color palette, plants, green walls, and water features to help with that connection to nature.”

Finally, the focus on air quality is particularly popular internationally, according to Richane. “Additional air filtration: a lot of people are agreeable with that one, especially in our over-seas offices. It can be a good thing in areas where air quality is much poorer. How do I make the air better so people actually want to come to work and stay here and be productive? It makes a specific connection to productivity.”

That connection can seem tenuous to some observers (see below), but not all the evidence has to be in for things to be worth doing, Richane argues. “Even some [features] where it seems like anecdotal evidence, it makes so much sense,” she said. “Obviously,

people would feel more comfortable working in an environment where the air quality is better than the air quality outside.”

And the onsite testing of air quality is a huge benefit regardless of where you live, noted Bannon-Godfrey. “None of us can walk into a space and know intuitively the VOC level. We engaged a company to do an air quality test” to have preliminary results before the assessor arrived for the onsite commissioning. “One of the readings was not great,” she admitted, and the team “put in a much higher level of air filtration than we would have designed to under normal circumstances. It’s forcing us to have much more rigor in our design process.” (How seriously that new rigor penalizes projects on energy is an equation that the industry may be working out for some time.)

4. Brings new people to the table

If you thought inviting the mechanical engineer and operations manager to the design process was a stretch, what would it be like to have the HR director, the food service contractor, and the vending machine company there? If you do a WELL project, you might get to find out.

“The WELL program brings everyone together,” said Vickie Breemes, Director of Advanced Building Technologies at Little Diversified Architectural Consulting. “It’s not just a design and engineering firm sitting down and checking things off. You’re making sure everyone’s around the table.”

5. Busts value engineering

With rating system rigor and more team engagement comes a bigger commitment to the goals of the rating system, some experts suggest—a big plus when value engineering looms.

“It’s really helped give an extra layer of meaning,” attested Bannon-Godfrey. “If something’s on the chopping block, we can say, ‘Let’s look at the WELL Building Standard’” and discuss the evidence-based

reasoning behind the design feature. Even though “it doesn’t always work,” she added, the Standard helps make it clear that “We’re not just doing this design feature because we like it. There’s research to support it.”

For example, one project’s carpet choice came up for discussion: would something less expensive do? The team pulled out the sustainability narrative for the project and recalled that the finishes palette had intentional biophilic elements—not just to achieve points in the WELL Standard but also because the Standard explained how biophilia can increase well-being. “It was helpful for the client to remember this is why they chose that particular carpet pattern; biophilia was a part of the big story here,” Bannon-Godfrey explained.

6. Takes the brr out of bureaucracy

Perhaps one of the most popular aspects of WELL is the relationship between the team and its WELL assessor, who is appointed early in the process. “There is a relationship there of responsiveness,” according to Vickie Breemes, who said she has the same assessor for three different projects. “It’s still impartial and professional, but there are ways to communicate. That person is consistently responding to you,” so you never get two different answers to the same question, she added. “They’ve improved on that greatly from LEED to WELL.”

Also popular: WELL comes out with quarterly addenda based on changes made due to user feedback. “Every feature in the Standard is open to an AAP [alternative adherence path],” noted IWBI’s Nathan Stodola. “Users can make a case that it achieves the intent of the feature, and we will review all of those. If we deem that proposal to be sufficiently universal, then we will publish it in the addenda.” Although teams can choose to stick with the version that applied when they registered, many upgrade to the newer versions, he told BuildingGreen.



Image: CBT

Although not pursuing WELL certification, this project was inspired by the standard to incorporate biophilic areas of respite.

One big example of such changes so far? Initially, projects were required to include UV lighting on cooling coils. “That’s a pretty intense process,” according to Mara Baum. “It’s expensive and requires extra space in the system.” Teams came to IWBI with an alternative: regular mold inspections and, if needed, remediation. This more common-sense approach is now part of the Standard.

“Anytime a project feels like a specific thing is outside their scope, I’m encouraging them to contact us,” Stodola said. “We’ll be able to work out a solution.”

Not everyone reports consistent customer service, however. John Mlade says he requested an alternative to covered wastebaskets in offices since the project had no cafeteria. “You’re not going to get pests from a few Kleenexes and a broken pen,” he argued—and what’s more, he’s seen pictures of WELL-certified offices that have regular, open wastebaskets. He was told the pest-preventing trash cans are universally required.

Cons: Pricey plaque

The cost of WELL certification is probably the biggest complaint users

(and those who can’t use it) have had so far, but we also heard some other critiques.

1. Costs a LOT

“The program is a little bit more expensive than people are used to,” Stodola admitted. “But it is definitely a small cost overall, and there is potential payback from attracting employees and enhancing productivity. There is a return on the investment.”

Just how much does it cost? The registration and certification fees are based on project size, so they can start relatively small for tenant fit-outs but can skyrocket for larger buildings. IWBI estimates the assessor fee at around \$9,000. The minimum overall fee for all three is around \$14,500. What about the cost of implementing WELL features?

“In some cases, incremental hard costs are an additional 1%,” says Stodola.

Soft costs may range wildly, however, as they once did with LEED, while practitioners get up to speed on how to meet the requirements.

Some people downplayed the sticker shock. “For the most part, if you’re

pursuing LEED v4 at a decent level, getting a basic level of certification within WELL is not an overwhelming process,” argued Mlade. “It’s expensive in terms of registration and certification fees, but not capital costs. To add WELL is not going to break the bank.” Added soft costs may include documentation of biophilia and integrative design, he said, “but for the most part, it’s fairly straightforward, particularly if they don’t have food service.” With that said, he added, “My perception of this being pretty straightforward may be skewed” because the current project he is working on has no onsite cafeteria. (And his firm is used to working with complex rating systems whose nuances may not be so easily navigated by others.)

No matter how much it costs, users report that the sticker shock is much easier to manage when presented as a human resources expense in “cost per person” rather than a facilities expense in “cost per square foot.”

2. Is still dressing for prime time

The great customer service and responsiveness have a flip side: IWBI has to be this responsive while the rating system’s rubber starts hitting the road. Parts of WELL are effectively still in pilot, and as with any new program, some details are getting worked out on the fly.

“Some of the language in the very first edition was more open to interpretation than we are used to seeing,” said Rachel Bannon-Godfrey. “We pushed for more clarity. Does this feature apply to every floor, every space? Help us understand how these are going to be measured in the field. What equipment are you using?” With acoustics, for example, the team worried about how the onsite testing might be affected by ambient conditions out of their control. “If suddenly some delivery truck goes by the building randomly during your test, what impact will that have?”

According to Vickie Breemes, finding a lab to test the water to the proper

granularity has been a challenge. “We send out the requirements, and they say, ‘We never test for that. Where is that coming from?’” (Issues included testing for minute levels of turbidity and chlorine.) She joked, “That’s a good business idea for someone who wants to get into a startup!”

This is just par for the course with early adoption, though, according to some observers. “I think in creating the first rating system trying to focus exclusively on health and wellness, they have created parameters that had never really existed before,” argued Steven Burke. “As we put it into practice, we begin to see areas where things could be improved. But all in all, I think WELL is doing what it needs to do.”

3. Encourages cherry-picking

Many professionals we spoke with said clients are applying certain aspects of WELL—which they view as a good thing—but not going for certification.

“We are not currently working on a WELL space, but we are absolutely talking about it with our clients, and they are seeing the value” of designing to the Standard, noted Dave Madson of CBT. “What isn’t happening is the independent testing that happens in order to get something WELL certified.”

There are a couple reasons for this: the cost and the unknowns. Whether they want the project to be LEED certified “has become one of the first questions we ask,” Madson told BuildingGreen. “When we ask, ‘Will this be WELL certified?’ they don’t yet know what that is. They’re very interested in it,” but “many times, clients want it to be something that they know they can promote and use to attract talent”—as they do with LEED. Madson believes this is temporary and that WELL will gradually become better known and sought after by prospective employees.

“Whether or not we go through certification, the process is very educational for the client,” said Amber Richane. “Our job is not to get your project certified. Our job is to use [rating systems] as tools to make our work better. When you go through the preconditions and the optimizations, you can start to think, ‘Is that relevant to my project? Is there something I should bring up to my client? That’s the piece that I find super helpful.”

In the meantime, although it’s more affordable, picking and choosing from the system does increase the risk of the “random acts of sustainability” mentioned above by John Mlade of YR&G.

4. Plays fast and loose with science

Depending on whom you talk to, WELL might be praised for its thorough scientific backing or panned for its questionable application of the evidence. Which one is accurate?

They may not be mutually exclusive, as it turns out.

“This type of research is really hard,” according to Mara Baum, who’s spent a career trying to integrate scientific evidence into her work. “How much do you require before you make a sound determination?” Baum is one user who argues WELL is getting the science both right and wrong. She uses active workstations as an example.

“People should have some level of physical activity during the workday,” she acknowledges, “but it’s hard to try to pick a prescriptive or performance approach to achieve a specific goal, especially when there is a substantial human factor. Does having 30% of workstations be standing desks solve the problem?” Probably not, but it’s better than nothing, she suggests.

“I applaud them for trying and for putting something out there. Is it perfect? Probably not, but it’s a place to start. In general, the topics that WELL addresses are all on the money. The detailed aspects of execution are still evolving. Delos and IWBI know they are still evolving and have never pretended otherwise.”

BuildingGreen’s Diagnosis

Relevance & market demand: Mixed

WELL is in the limelight right now. Some clients are reportedly asking for it themselves, and many others are excited when it comes up. With that said, others are pretty skeptical of the value of having a health-only standard and think it’s outrageously expensive (see [“The WELL Building Standard: Not to Be Used Alone”](#)).

Healthy, Wealthy, and (fill in the blank)

Are clean air and water just for the privileged?

If WELL is the only tool you’re currently using to promote health in your practice, it might turn out that way.

According to Vickie Breemes, among owners who are interested in WELL, “Either the client wants to be an anchor in the community, or they are in an area where retaining employees is very competitive, and they feel this is a differentiator for them.” That’s tech companies and large corporations, for the most part, she said. “Not everyone can afford it.”

With a high price tag, a big focus on individual (rather than public) health, and a strong argument about recruitment and retention, WELL is certainly not the hot new thing in affordable housing or manufacturing facilities. That doesn’t mean it never will be, but observers are watching closely to see how long that takes.

In the meantime, many firms report that they are already looking to apply certain aspects of WELL as part of their standard practice. “What can we do on each one of our projects?” Breeme asks. “We feel it’s very important for [the] human sustainability portion to look at what we can do as a firm.” She compares it to when LEED first emerged, and many firms weren’t adopting the rating system as a whole but did change how they selected products for low emissions, recycled content, etc. “It’s kind of the same approach,” she told BuildingGreen.

Ease of use: Mixed

Many basic preconditions should be fairly streamlined, especially if you don't have to deal with onsite food service. However, the Lighting feature comes up frequently as an area of difficulty. Additionally, the onsite testing and three-year certification period, while raising the bar, do make it more difficult to achieve. And the kinks are still getting worked out in many areas. This is not a shake-and-bake rating system.

Rigor: High

The creators did their homework here, adding and removing preconditions and optimizations during the pilot phase based on sound science. However, once they get into the details, many users have quibbled with how the science gets applied. This is an area IWBI is actively working to improve.

Cost: Very high

This is probably the biggest complaint about the standard, but many users also argue that owners get great value for the dollars spent.

Up next: [Is Fitwel just "WELL Lite"?](#)



Fitwel: Science That Works

Users say it's like Energy Star for active design. CDC hopes its reach will be much, much bigger.

by Paula Melton

It looks modest enough: a handy app that facility managers download onto an iPad. Starting at the street, they perform a walkthrough of the building and report on how their building promotes wellness and productivity. The app spits out a score and an automated gap analysis suggesting what the project could do to score higher and have a larger impact on health.

Users never see the 3,000+ studies that the Centers for Disease Control and Prevention (CDC) reviewed in order to

create the system. They never see the meta-studies that led to the program's elaborate system of weightings. And they certainly don't see what may be the most surprising part of all: that CDC wants this new certification system to take over the world—and make us all healthier, happier, and more productive.

"CDC's ambition is that every [office] building has a Fitwel number," according to Joanna Frank, Executive Director at the Center for Active Design, which operates the certification program. "We want it to be accessible to everybody. Even if you're only scoring at 40, we still want you to be able to benchmark your project." (You need at least 90 points for certification.)

This vision is at the heart of Fitwel's reception in the market, which ranges from delight to disappointment. In this article, we:

- run through the basics of the Fitwel rating system
- share feedback on Fitwel from users and outside observers
- offer our own "diagnosis" of the system's relevance, rigor, ease of use, and cost

Looking for other rating systems to get the same treatment? As part of this [special issue](#) on health-focused green building programs, we also examined [WELL](#), and [compared WELL and Fitwel with LEED v4 and the Living Building Challenge](#).

Fitwel 101

CDC began developing Fitwel as a rating system in 2012, after years of working to systematize health-promoting design and operations across its own facilities. According to Liz York, Associate Director for Quality and Sustainability at CDC, the developers were asking, "How can we make a measuring stick that is easy for people to use, is supported by evidence, and helps design professionals and owners really take action instead of being confounded by studies?"

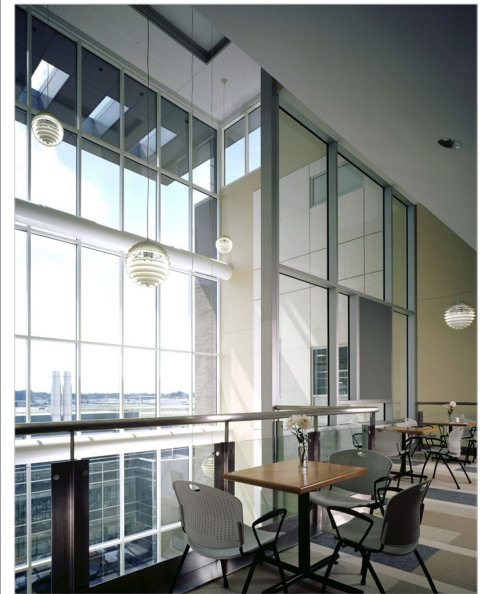


Photo © Hedrich Blessing

This naturally lit break room at the Perkins+Will-designed Centers for Disease Control headquarters is one of several features that helped the CDC eventually earn three-star certification through the program it helped create.

To further develop its system, CDC worked with the U.S. General Services Administration (GSA), which helped pilot the first version in 89 buildings. CDC and GSA will continue to be involved in updating the system, but they have passed operation and certification to a third party, the Center for Active Design.

For now, Fitwel is exclusively for commercial office buildings, but a residential standard is likely to emerge soon.

Basic requirements

Fitwel is broken into 12 sections, organized by how relevant building features are encountered as you approach and enter. Each section asks questions on a range of criteria, with a strong emphasis on active design and nutrition:

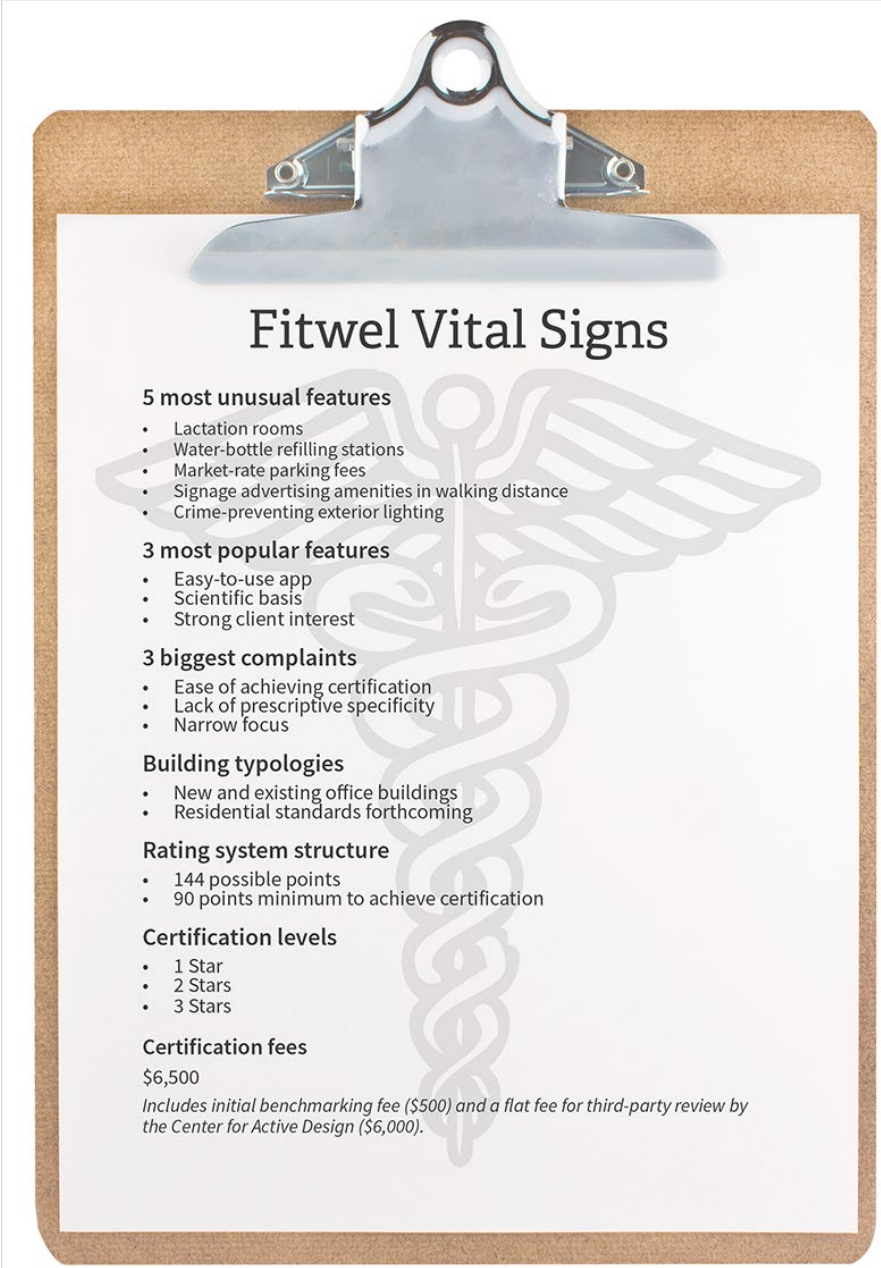
- Location—This section covers walkability and proximity to transit. Projects get a full eight points for having a Walk Score above 70 and thirteen if the Walk Score is above 90.
- Building access—Here, transportation is covered in greater detail, with points weighted

toward familiar features from LEED like bike storage and showers. Less familiar? Charging market rates for parking.

- Outdoor spaces—Onsite exterior amenities like eating areas and healing gardens encourage exercise and exposure to daylight, increasing productivity, according to the program. Also covered here are access to fresh produce, crime-preventing exterior lighting, and [integrated pest management](#).
- Entrances and ground floor—This section reinforces the emphasis on walkability by giving further points for specific design features that encourage walking and transit access. It also includes anti-smoking signage and permanently installed entryway systems for pollution control and improved indoor air quality (IAQ).
- Stairwells—This section covers stairs and nothing but stairs—their visibility, accessibility, and design—but it offers a full 16 points. That’s because designing stairwells to encourage frequent use is one of the best things you can do to get office building occupants to exercise during the work day.
- Indoor environment—This section discourages smoking, the use of toxic materials like asbestos, and high emissions from building materials and cleaning products.
- Workspaces—Daylight access, views, operable shading, and active workstations (e.g., treadmill desks) are the four areas covered here.
- Shared spaces—This far-reaching section incorporates everything from the bathroom cleaning schedule to onsite fitness centers. It also features the criterion with the single highest point total in the rating system—5.66 points for a dedicated onsite lactation room.
- Water supply—Here, projects get points for providing drinking fountains and water bottle refilling stations.

- Cafeterias and prepared food retail—This section references the [Health and Sustainability Guidelines for Federal Concessions and Vending Operations](#) developed by the U.S. Health and Human Services Administration (HHS) and GSA. Project owners can score five points by adopting these guidelines—which emphasize fruit and vegetable availability, require calorie reporting, and limit sodium, fat, and added sweeteners—or something more stringent. Projects without onsite food service are not penalized.

- Vending machines and snack bars—These criteria are similar to those for cafeterias, referencing federal guidelines and incentivizing access to free water near the point of sale. Together, the three nutrition-related sections (water, cafeterias, vending) add up to 30 points of the 90 needed for the lowest level of certification.
- Emergency procedures—The emergency criteria cover everything from survival kits to onsite defibrillators.



Fitwel Vital Signs

- 5 most unusual features**
 - Lactation rooms
 - Water-bottle refilling stations
 - Market-rate parking fees
 - Signage advertising amenities in walking distance
 - Crime-preventing exterior lighting
- 3 most popular features**
 - Easy-to-use app
 - Scientific basis
 - Strong client interest
- 3 biggest complaints**
 - Ease of achieving certification
 - Lack of prescriptive specificity
 - Narrow focus
- Building typologies**
 - New and existing office buildings
 - Residential standards forthcoming
- Rating system structure**
 - 144 possible points
 - 90 points minimum to achieve certification
- Certification levels**
 - 1 Star
 - 2 Stars
 - 3 Stars
- Certification fees**

\$6,500

Includes initial benchmarking fee (\$500) and a flat fee for third-party review by the Center for Active Design (\$6,000).

Image: BuildingGreen, Inc.

Rating system mechanics

Fitwel is unusual: it has no pre-requisites. To achieve the lowest level of certification (one star out of three), projects need to achieve 90 points out of 144 possible.

Although no specific criteria are required for certification, CDC and GSA organized the program with an elaborate weighting system that incentivizes the highest-impact criteria based on the peer-reviewed science. This is why Walk Scores, lactation rooms, and healthy cafeteria options all get you five points or more, while signage gets you only a partial point, explained CDC's Liz York. The weightings are based on the quality and size of the studies reviewed, the extent to which the design feature could impact public health, and whether the link between the design feature and the outcome has been convincingly established.

That's a huge help for building professionals, argues York, who is an architect herself. "I think architects and engineers get kind of flummoxed" by all the available science and aren't trained (or paid) to track down the quality of each one. "We all think we're doing research when we google stuff," she said, "but it's not research to the high standard of the CDC scientists."

Easy, but Maybe Too Easy: User Feedback

Fitwel is just coming out of pilot, but we spoke with a number of people who have either used or hope to use the standard. Although feedback was mostly positive, some were disappointed with the rating system's rigor and scope.

Pros: Accessible and evidence-based

The biggest advantage identified by users so far has been Fitwel's combination of scientific backing with simplicity for the end user.



Photo: Alexandria Real Estate Equities

The kitchen at Alexandria Real Estate's 499 Illinois Street building serves produce from an onsite organic garden.

1. Starts a dialogue

Even though she works as an architect at CDC and has been pivotal in the creation of Fitwel, Liz York told BuildingGreen the process of actually implementing the program was surprising and enlightening.

"It was an amazing process," York said. "We are the CDC. We talk about health every day—but this is the first time I ever saw a building manager, an occupant, an architect, an interior designer, and a LEED sustainability specialist sitting around the table talking about how we could make our building healthier for our own people." She added, "If we can get that kind of meeting happening around the world, that would be a great accomplishment."

The details of the conversation may not matter as much as simply having it, noted Steven Burke, Sustainability Manager at Symmes Maini & McKee Associates. "If people adopt something and they commit to something because of Fitwel, then there are all sorts of other conversations that begin to happen that wouldn't happen if it were just an aside or a peripheral conversation about how to build some kind of wellness into design," he argued. "By the act of committing to it,

the outcomes overall will be enhanced. And it can be a pathway to WELL."

Others are pursuing Fitwel to help ensure that initiatives they're already pursuing get scientific validation as well as recognition from building occupants and the public.

"We find that health and wellness are extremely important to our tenants, who are actually finding life-saving cures for disease," explained Vincent Ciruzzi, Chief Development Officer at Alexandria Real Estate Equities, a developer that specializes in life-science buildings. "Since piloting the Fitwel program, feedback from our tenants has been very positive." Popular amenities include organic kitchen gardens, fitness centers, and walking trails. "Fitwel validates what we're already doing," Ciruzzi told BuildingGreen.

2. Is affordable for most projects

The size of a project does not change the amount of time it takes the Center for Active Design to validate documentation and certify a Fitwel project, so the nonprofit charges a flat fee for third-party verification services, according to Joanna Frank. The fee per building actually goes down with multiple projects as well—and this



Photo: Alexandria Real Estate Equities

Gardens and walking trails are among the amenities occupants of Fitwel-certified buildings are likely to enjoy.

is mirrored in the software, which pre-loads things like your portfolio-wide policies. “We are aiming to keep this as accessible to everybody as possible,” Frank said. “It’s supposed to be an egalitarian approach to certification.” The maximum amount a single project will pay is \$6,500.

With that said, some observers felt the fee was steep for a small tenant fit-out project and could be a deterrent. “That’s the only thing I’m concerned about,” said Katherine Bubriski, AIA, Senior Associate at Arrowstreet. Bubriski recently participated in the Fitwel Ambassador training (Fitwel’s professional credentialing program). “A flat fee just doesn’t seem fair if you’re doing 3,000 square feet versus 100,000. Smaller spaces won’t necessarily be able to pay that.”

3. Could really change our behavior

What happens if you charge a dollar for a bag of chips and 75 cents for an apple? It’s simple economics: more people buy apples and fewer bags of chips.

“This is an easy thing to change,” said Amber Richane, Senior Associate Vice President, Performance-driven Design at CallisonRTKL. She told BuildingGreen that since finding

common-sense ideas like this in the Fitwel program, she’s been proposing them to clients during design charrettes. “One of the hardest things in sustainability in general is those behavioral changes,” she said. Why not use the scientific backing of Fitwel to put some of these into practice?

“Fitwel was developed with the idea of taking science and translating it into action,” affirmed York. “I’ve seen it happen myself here on my own campus. That makes me excited for the future.”

“We are really looking at changing behavior,” said Joanna Frank. “We are not just changing the air: we want to reduce the number of people who smoke, increase the number who quit, and reduce how much people smoke.” How does Fitwel do this? According to Frank, “Positive messaging about being smoke-free has a measurable impact on all those aspects.”

Perkins+Will is currently pursuing Fitwel at 12 of its own offices, with a goal of achieving it in all its North American offices, according to Paula McEvoy, FAIA, Co-director of the firm’s Sustainable Design Initiative. The attraction? “It’s evidence-based,” she told BuildingGreen. “It looks a little clumsily weighted,” she said, offering 1-½ points for some things

or ⅔ of a point for others, “but there is a lot of evidence on the back side” to support those weightings. The downside of that? “There is nothing like innovation credits,” she said. “Innovation doesn’t have the science behind it.”

York also emphasized that the program itself appears, in the early stages, to be on the right scientific track in terms of ease of achievement. During the GSA pilots, with 89 buildings that were not actually attempting to achieve the standard, “There was a bell curve of projects. Very few were reaching the very top three-star rating, and there were a few that were not making one star. The majority were in that one- to two-star area. That means it is probably a valid measuring tool.”

4. Is as easy to use as an iPad

“It’s a pretty seamless process,” claimed Ciruzzi. “We have had six buildings certified over the last three to four months.” He admits, though, that this could be in part because many of their buildings already operate to a three-star standard under Fitwel. “Because we’ve been doing this for ten years already, we’re just getting some validation for what we’ve done,” he said.

“Fitwel is one way to make it more universal” to integrate health-promoting strategies into design and operations, said Bubriski. “Maybe it doesn’t tackle every piece of the sustainable environment,” she continued, but she thinks that “universal adoption” is more likely with Fitwel than it is with more stringent standards.

“These are really quick, inexpensive, common-sense things you could be doing better,” concurred McEvoy.

In addition to the ease of use of the software—it’s designed specifically for facility managers to operate on a tablet computer during a building walkthrough—Joanna Frank notes that LEED documentation is accepted for some of the criteria, like indoor air quality, and location and transportation issues.

5. Works for existing buildings

"I would say this was very much designed with existing buildings in mind," said Frank. "What we hear from developers is they see it as a tool for their existing portfolio of buildings." This is in contrast to WELL, she noted, which "developers say they are using more for new construction. It's quite different."

This is why many experts we spoke with compared Fitwel to Energy Star and WELL to LEED for New Construction.

"It's more of an evaluation tool for existing spaces," affirmed Bubriski. "Clients are really interested in trying to figure out what to do with an existing space they're in—or they might be looking at new spaces" to rent. "It's a way for us to evaluate those spaces and buildings for them and figure out where it fits on the scale of Fitwel."

Cons: Might be too accessible?

For those who are used to the rigor of LEED or are exploring WELL as a health-promoting standard, using Fitwel may feel like putting a hot knife through butter.

1. Is too easy

"I could certify through Fitwel tomorrow without making any changes except signage," claims Mara Baum, AIA, about her office in San Francisco, where she works as HOK's Sustainable Design Leader, Health and Wellness. "We would need to make minor tweaks to our space, with no added cost or any type of construction, based on my initial analysis. To me, that suggests that Fitwel is not really getting you very far above standard practice in an urban environment." That's not necessarily a bad thing, she told BuildingGreen, but it's something to keep in mind. "Obviously, anything that elevates health and well-being in the built environment is great, and we'll take it!"

"It's probably going to get some push-back," said McEvoy, presciently. "It's not as rigorous as LEED or WELL by

any means." But, she added, "That's not the intent of it. A facility manager might not be able to do everything possible with LEED, especially for existing buildings. But carrying your iPad around and getting ideas for improving any aspect of it is a good thing."

"The rating system does offer a lot of latitude; it is kind of WELL Lite," said Burke. "But I think that at this point in time, it needs to exist because there's such an interest in starting to think about how these designs are directly impacting building occupants. You don't want to turn them away because of an overly cumbersome process or something prohibitively expensive."

And according to York, the system might not be as easy as it seems on the surface—at least not to achieve the highest level of certification, which requires 125 out of 144 points. Even her own CDC headquarters started as a two-star building, despite years of effort to make it a wellness-promoting space for CDC employees. People brought "excitement and knowledge" to the process, she said, and volunteered to work on policies and add signage and amenities. "After a two-month period of chasing down loose ends, we were able to make the changes and get up to a three-star building."

2. Lacks specificity

Finally, some users have criticized Fitwel for being too vague. Instead of prescribing a specific type of IAQ or green cleaning program, the standard simply incentivizes having one at all (LEED documentation is acceptable but not required). You should have a regular cleaning schedule for the bathroom and the fridge, but it doesn't tell you how often to clean. Daylight and views are encouraged, but no one is measuring lumens or vanishing points.

That's a drawback for some but is actually based on the evidence, claims Paula McEvoy. "We know that daylighting helps, but we don't know that 35 footcandles is exactly the proper amount," she told BuildingGreen.

On the bright side, if CDC achieves its vision of total market saturation, we will have a huge sample size to help public health scientists determine just how much daylight—or fresh air or other basics—we need in order to be happier and more productive.

BuildingGreen's Diagnosis

Relevance & market demand: Mixed

Design professionals report that clients are excited about Fitwel when they hear about it. However, it's very new, so many clients aren't going out of their way and asking for it yet. This may be in part because—if CDC has done what it intended—you don't need a design professional to help you achieve Fitwel.

Ease of use: Very high

This is probably the most popular feature of Fitwel, according to those we spoke with. It's designed to be very simple to implement, and based on initial feedback, CDC and GSA have succeeded at that.

Rigor: High

The CDC vetted more than 3,000 studies for rigor and evidence that certain features of the built environment can result in positive public health outcomes. Then GSA piloted the system in 90 buildings to help ensure the system provided a valid metric. It doesn't get more rigorous than that. However, that advantage is offset somewhat by the lack of prescriptive rigor within the rating system itself. This is an entry-level standard (and meant to be).

Cost: Low

You can benchmark your building for just \$500 and certify it for \$6,000. The only reason we didn't mark this as "Very Low" is that \$6,500 might be a bit steep for a smaller tenant fit-out.



The WELL Building Standard: Not to be Used Alone

Promoting health is important, but a standalone certification might not be the best way to do it.

by *Simona Fischer*

Many in the architecture and interior design community are excited about the WELL Building Standard, the first whole-building design guidance to focus solely on human health and wellness.

Background on WELL

Developed by New York-based real estate consultant Delos Living, LLC, and administered by the International Well Building Institute (IWBI), a public benefit corporation, WELL includes seven Concepts composed of 100 performance metrics or Features, many of which overlap with health-related credits in LEED v4 and Imperatives in the Living Building Challenge.

Before the debut of WELL, other major whole-building sustainable design guides like LEED, Living Building Challenge, Green Globes, and Enterprise Green Communities included human health as one priority among many, taking a triple-bottom-line approach to elevating building projects in the direction of more sustainable practice. WELL differentiates itself by diving into human health more deeply and incorporating the latest science-inspired design thinking in greater detail. For example, in addition to providing good daylight without glare, WELL requires electric lighting to support circadian rhythms and includes performance metrics on the color rendering index of lamps and reflectance values of materials.

Some concerns

WELL is intended to make designing for human health easy by pulling the latest research together into a clear

set of objectives, and I think design teams may find the specific guidance with regard to finer details in areas such as lighting, olfactory experience, acoustics, and sources of indoor air pollution enlightening. As a practitioner striving to eliminate toxic ingredients from materials in project work, I'm pleased by the groundswell of interest and support of this topic among designers and clients.

However, the first version of the WELL Building Standard is troubling on a couple of levels. I have a couple of concerns about specific guidance in the standard, and a question about the viability of this standard for a broader variety of project types than just upscale office environments.

More broadly, however, I have serious reservations about the concept of a human wellness standard intended for use separately from environmental building standards.

PFCs and antimicrobials

Perhaps to its credit, it doesn't take an extreme position on avoiding hazards: WELL Feature 25, Toxic Material Reduction, is actually less restrictive of perfluorinated compounds, halogenated flame retardants, and phthalate plasticizers than the Living Building Challenge Red List. But other items lack crucial clarity—for example, Feature 27, Antimicrobial Activity for Surfaces, which rewards selecting bathroom and kitchen countertops, fixtures, door handles, and light switches coated or made of a material that meets EPA testing requirements for antimicrobial activity.

The [EPA protocol referenced in the WELL Building Standard appendix](#) does not indicate what chemicals may or may not be used to create those antimicrobial surfaces. As a result, a non-chemist might read Feature 27 and specify antimicrobial surface treatments containing triclosan, thinking they are doing so in service of health, but in fact be doing the opposite.

Recent research questions the use of antimicrobial compounds at all in consumer products and building



Photo: Drew Carlson

Simona Fischer

products. The common antimicrobial compound triclosan has been found in the dust of homes and schools, and is linked to a number of worrying health and environmental effects including compounded antibiotic resistance, and contaminated wastewater that is difficult to treat in wastewater treatment facilities and is destructive to aquatic ecosystems. In fact, [triclosan was banned in consumer products in Minnesota starting in January 2017, and the rest of the nation will likely soon follow.](#)

Instead of recommending an antimicrobial coating, IWBI might consider awarding points for effective methods of signage conveying Centers for Disease Control-recommended handwashing practices ([20 seconds of lathering with a typical soap while the tap is turned off; turn on water to rinse](#)). In forthcoming versions of the Standard I hope IWBI will review this Feature and others to make sure they dovetail—not conflict—with other healthy design guidance and scientific evidence.

High-end health?

The WELL Building Standard raises other concerns.

WELL Building Certification is in the works for a number of project types, but some wellness concepts presented in the current public standard seem exclusive enough that only high-end, white-collar office real estate is likely to ever achieve higher levels of certification.

Features such as advanced air purification, added onsite water treatment, and subsidizing wearable sleep monitors for all employees are likely to be incompatible with the programmatic demands and funding for schools, libraries, affordable housing, and most service or retail environments, which means few of these typologies are ever going to be eligible for WELL.

And even if a highly marketable office environment is our client's goal on a particular project, as designers, it is our job to take those goals into account—and think bigger. Are expensive end-point interventions the best way to improve the well-being of all of the people who use and care for a building?

How to widen the impact

In the spirit of widening the potential positive impact of WELL, IWBI could consider scale-jumping options similar to those found in the Living Building Challenge. Instead of installing end-point water filters on taps and in showers and requiring testing at the tap, what if the design included an option to contribute funds toward water filtration at the neighborhood or city source, or help finance improved regular city-wide water testing at the water treatment plant?

If chemicals and heavy metals are an issue for residents of a tenant space, they are probably an issue for everyone in the building and maybe even the neighborhood. A system-wide solution would contribute more to health and wellness than providing perfectly purified water for a select group of occupants (who, if they are not poor, are statistically less likely to be experiencing a high body burden of toxicity than their lower-income counterparts anyway). It would also be doing something good for the community—a psychological benefit to building occupants, building owners, and the neighborhood all at once (see Feature 96, Altruism).

Are we compromising environmental goals?

The scope and rigor of the Standard are solvable issues. In practice, though, I question both the workability and the wisdom of separating human health from environmental sustainability without compromising one or both of these goals.

An indoor garden or water feature I designed to support biophilia won't by default contribute to improved air quality or reduced cooling loads; in fact, I might be setting myself up for a higher energy load to maintain indoor plants and dehumidify, and I might now require more equipment, air filtration, air changes, and possibly the use of fungicides to keep the HVAC system free of mold.

Points awarded for increased ventilation and air exchange rates could essentially amount to points awarded for increased energy usage—unless the indoor air quality requirement is inextricably linked to a requirement to achieve lower energy use intensity at the same time.

It's not an insurmountable conflict. As I design the upgraded filtration system, I just need to keep updating my energy models, constantly verifying that I'm still on target to meet the 2030 Challenge and reaching for net zero (and thinking about how I'm going to offset the carbon footprint of the extra concrete structure I'm needing to hold all that water or wet dirt).

I appreciate the note in the introduction suggesting that the WELL Building Standard is designed to align with a sustainability standard like LEED or the Living Building Challenge, but I have doubts about the usefulness of adding a new certification to the mix. The issue is that, in practice, clients tend to only pursue one certification at a time. Energy- and water-use targets will most likely fall by the wayside if wellness features are the only measured performance outcomes on a project.

Sustainability is a human right

But it's not just a logistical problem presented by pursuing human wellness apart from ecological design; it's the fundamental wisdom of considering them separately in the first place.

Designing for wellness in a vacuum is treading on dangerous ground. Globally, in all human industries, it is critical to:

- start sequestering more carbon annually than we release
- find innovative ways to conserve water and protect fresh water resources
- invent non-toxic, zero-waste manufacturing life cycles

I worry that by focusing narrowly on a carefully controlled human wellness experience—a satisfyingly achievable goal, where success is defined by fixing everything to perfection within the boundaries of a site—WELL may inadvertently distract followers from the vibrant, compelling narrative of survival that underlies the struggle to build holistically sustainable buildings, communities, and infrastructure.

We need paradigm-shifting inspiration and creativity not just in designed spaces but also in policy and economics as they relate to the entire building industry. "Sustainable" remains an ideal. The fight for a regenerative future is not yet won.

Are we taking climate change seriously?

To me, it would seem that challenges like climate change would be driving humanity to achieve their greatest feats ever in the face of slimming odds. Instead, many of us feel trapped. Data suggests [1 in 6 American adults have taken or are now taking medication for anxiety and depression](#).

Designing well-daylit and biophilic spaces along with healthy lifestyle measures (such as the yoga, organic snacks, and wearable fitness monitors that WELL encourages) can help with

those conditions. For those of us losing sleep about our future in a warming world with dwindling biodiversity, however, they're not enough.

Maybe it's because we're not really taking the fight seriously yet.

There is a disconnect that happens when you tell yourself you built a "green" building merely because it caters to human wellness. The creators of WELL should consider that feeling connected to one's environment and to reality, even if it's a frightening reality, is an essential component of feeling grounded, present, and empowered—concepts that are touched upon but not yet fully evolved in the Mind Concept of the Standard.

Don't try this alone

We feel connected when we know we are making meaningful choices in alignment with the decrease in consumption and the circular economy we know we must create, for ourselves and for our neighbors, for those upstream and downstream in the cycle of resources, for healthy biodiversity and ecosystems, and for the health of the world we leave our descendants. I would submit that true biophilia is more than a view of the sky or a water feature. It is about feeling genuinely connected, to others and to the struggle and purpose of building it better, through making good choices that address real problems. It's pretty hard to fool people in the long run.

My hope for the next iteration is that IWBI will review and broaden the WELL Building Standard based on updated research on toxic chemistry, consideration of scale-jumping options, and a more holistic view of the interconnection between meaningful performance-based regenerative design and human well-being.

To preserve the integrity of the environmental building movement on whose coattails it rides, and to support designers who are trying to balance human wellness with other objectives, I encourage the writers of WELL to be mindful and transparent about

optimization for humans that may be at odds with energy, water, and material resource sustainability goals, and strongly encourage, if not require, compliance with those other goals.

It's great to have a standard that specializes in tying the latest and best details of health research into design. Design teams and clients will find interesting food for thought in the details of each of WELL's Concepts. But before the next version comes out, a note of caution for designers: WELL is not to be attempted alone. Humans have a history of optimizing their surroundings at the expense of natural ecosystems, and it would be a shame for this new design guide with good intentions to end up leading down that familiar path.

Simona Fischer is a designer at MSR in the Twin Cities. She works on sustainable design issues in practice with a special focus on the carbon footprint and health impacts of building materials.



NEWS ANALYSIS

EPA to Regulate Hazardous Chemicals in Building Materials

Asbestos, HBCD, and other chemicals face restrictions under the new Toxic Substances Control Act.

by James Wilson

A toxic flame retardant used in polystyrene insulation may finally be banned in the U.S.

Hexabromocyclododecane, or HBCD—a [persistent, bioaccumulative toxic chemical](#) already [banned by the E.U.](#)—is one of ten chemicals currently being reviewed by the U.S. Environmental Protection Agency (EPA) under the amended [Toxic Substances Control Act \(TSCA\)](#).

Not even asbestos has been banned

Originally passed in 1976, the law grants EPA the ability to investigate



Photo: Cjp24. License: [CC BY-SA 4.0](#).

This detail of a building retrofit shows expanded polystyrene (EPS) being added to the exterior. Most EPS contains a toxic flame retardant that is banned in Europe and could be banned under new U.S. regulations.

and place restrictions on hazardous chemicals, but for decades that power was rarely exercised. The amended law includes a new risk-based safety standard for chemical evaluation and requires clear and enforceable assessment deadlines. In November 2016, EPA released a list of the first ten chemicals it will seek to regulate, which includes substances commonly found in building materials.

Not surprisingly, the list also includes asbestos, a known human carcinogen that EPA has been attempting to ban for decades without success due to significant flaws in the original TSCA. Though the use of asbestos has largely been phased out, it can still be found in a range of building products, including pipe insulation, floor tiles, and cement board.

Other hidden hazards

The list also includes chemicals that may be less familiar to designers and builders, such as N-methylpyrrolidone, a reproductive toxicant that can be found in interior paint, floor coatings, resilient flooring products, and other building materials. HBCD appears on the list

as “cyclic aliphatic bromide flame retardant cluster.”

The complete list of the first ten chemicals selected for risk evaluation is included in EPA’s [press release](#). EPA drew these ten chemicals from a list of 90 included in the 2014 TSCA Work Plan, which uses the following criteria to prioritize substances for review:

- Potential concern for children’s health
- Neurotoxic effects
- Persistence and bioaccumulation combined with toxicity
- Probable or known carcinogenicity
- Use in products to which children may be highly exposed

EPA opened the list to [public input](#) in February 2017 and will accept written comments until March 15, 2017. Comments and information can be submitted to EPA via the [Federal eRulemaking Portal](#) or by mail.

Still to come: Polyurethane foam and formaldehyde?

VelocityEHS, Environmental Health and Safety specialists, [predict](#) the EPA, mandated to review chemicals more aggressively under the new law, will move to regulate additional chemicals used in building materials in the near future, including formaldehyde and diisocyanates.

Formaldehyde, another known human carcinogen that has never been fully assessed by EPA, is often used in the manufacture of composite/engineered wood products. Diisocyanates, including methylene diphenyl diisocyanate (MDI) and toluene diisocyanate (TDI), cause skin and respiratory irritation and are potential carcinogens. Diisocyanates are used in the manufacture of flexible and rigid foams and can be found in polyurethane foam building insulation, composite and engineered woods, adhesives, and coatings.

Organizations like Safer Chemicals, Healthy Families have made

recommendations to EPA about which chemicals to prioritize for evaluation, based on the urgency with which a chemical poses a threat to public health and the environment. An [open letter to EPA](#) co-signed by a range of advocacy groups recommended ten chemicals for initial review, including lead, cadmium, and styrene, all of which can be found in a range of building products.

Possible alternatives to HBCD

There are currently two viable alternatives for HBCD available: butadiene styrene brominated copolymer and a TBBPA-bis brominated ether derivative. Butadiene styrene brominated copolymer, marketed as [Emerald 3000](#), has been found to have low potential for toxicity and carcinogenicity due to its low bioavailability. It is also unlikely to have toxic effects on ecology. Though [Dow claims that this chemical is not persistent](#), [EPA reports](#) it has very high potential for persistence. The TBBPA-bis brominated ether derivative is the more hazardous alternative with moderate potential for carcinogenicity, genotoxicity, and reproductive and developmental effects. It also has the potential to be highly persistent and bioaccumulative.

Limits to innovation?

Section 5 of the updated TSCA requires greater transparency of EPA’s reviews of pre-manufacturing notices (PMNs) for new chemicals. This change has dramatically slowed the rate at which PMNs are reviewed.

The American Chemistry Council (ACC) has already [called attention](#) to the delays and has voiced concern that innovation in the chemical industry may stall due to EPA’s slow adjustment to the change. [Karyn Schmidt](#), Senior Director, Chemical Regulation, Regulatory & Technical Affairs at ACC, writes that, “Right now, innovation is stuck, because completion of new chemical reviews has ground to a halt.”

Limits to state power?

The new law gives EPA the authority to preempt state legislation. This means that while EPA is conducting a risk evaluation of a chemical, states will not be able to regulate that chemical for the same use. Once EPA issues a final ruling on the chemical, it is permanent, meaning that progressive states will be unable to impose stricter regulations on it. This will not affect any state restrictions enacted before April 22, 2016, but states now have to apply for special waivers to pursue legislation tougher than federal laws.

Minnesota, the first state to pass a law banning HBCD, in 2015, has been one of the most progressive states on chemical regulation. Advocates in the state are [concerned](#) that TSCA may now obstruct ongoing state-level action to study and restrict other hazardous chemicals. Fortunately, the law allows for states to pursue regulation independently if EPA exceeds the maximum 3-½-year period to evaluate a chemical.

TSCA under Trump?

The Trump administration has made clear its intention to [reduce regulations](#), leading to speculation about whether laws like TSCA will be affected. An inquiry to the Toxic Substance Control Act Assistance Information Service (TAIS) prompted the following reply: “The TAIS has not received any information indicating that the recent amendments to the TSCA will be affected in any way by the new Executive Branch Administration.”

During his Senate confirmation hearings, Scott Pruitt, the new Administrator of EPA, [stated](#) that, “Implementing the amended Toxic Substances Control Act is absolutely a priority.” However, some advocacy groups, including Environmental Working Group (EWG) have [voiced concern](#), noting that Pruitt, responding to written questions from the Environment and Public Works Committee, “refused to affirm that

he would push through a full ban of asbestos.”

For more information

EPA Office of Pollution Prevention and Toxics

epa.gov/oppt/



PRODUCT NEWS & REVIEWS

Façade as Ventilation: Moving beyond Open Windows

AirFlow Panels supply air and recover energy on commercial building façades, improving air quality while reducing energy and space requirements.

by Brent Ehrlich

An open window is arguably the best way to bring fresh air into a building—when the weather is right.

But those conditions are rare in many parts of the world, so commercial buildings use centralized air handling units (AHUs) to bring in air. These systems modify the air temperature and humidity, and distribute it via ductwork to the building using large, energy-intensive fans.

AirFlow Panels, from [Architectural Applications](#), approach fresh-air delivery from a new angle. These façade panels double as a ventilation source, bringing in fresh air—similar to an open window—while using a unique energy recovery ventilator (ERV) system. The panels provide fresh, humidity-controlled air directly into a space while using very little energy.

A more efficient ERV

“If you just use an operable window [for fresh air], most of the time it will be too warm or cold to open windows,” says John Breshears, President of Architectural Applications. An ERV can expand the usefulness of fresh exterior air



Image: architecturalapplications.com

AirFlow Panels' façade and energy recovery ventilation system was rolled out at Greenbuild 2016 and is now being manufactured by façade manufacturer Pohl, which should expand availability and future design options.

by tempering it through energy and water vapor transfer. In cooling season, an ERV can expel cool, dry outgoing air while cooling and dehumidifying warm, humid incoming air. In heating season, incoming cold air is tempered by outgoing warm air. AirFlow Panels expand the range during which fresh air can be brought in without using auxiliary heating or cooling, while saving energy. “The idea behind the AirFlow Panel is to make the [ERV] process much more efficient,” Breshears says.

ERV technologies, such as enthalpy wheels or plate-type heat exchangers, are typically contained in bulky boxes with ducts coming in and out. Architectural Applications basically flattens the ERV and gives it a large surface area. This makes it thin enough to place on the building façade instead of in a mechanical room. With direct access to the exterior, the panels can provide 200 cubic feet per minute (cfm) of fresh air directly to the building perimeter. For example, an office building with a 20'-deep perimeter and 100 ft² per person engineered to California Title 24 standards would require one panel every 65 linear feet along the façade.

The panels provide tempered fresh air without cooling coils, ducts, or other equipment used in centralized ERV/air handler systems. This can result in 30%–40% overall HVAC energy savings, according to the company.

The core of the AirFlow Panel is a proprietary sheet material made by an affiliate of Passive House ERV manufacturer Zehnder (see “[Choosing between an ERV and an HRV](#)”). The material exchanges water vapor and heat across its membrane using one low-voltage, electronically commutated motor (ECM)-driven fan to move outgoing air over one side of the material and another to move incoming air across the other side. The airstreams do not mix, so outgoing air and contaminants are vented during heat and moisture exchange, and the moisture remains in vapor form, so there is no condensation or freezing concerns. (The units have been field-tested for freezing in Toronto, and for humidity and high temperatures in Singapore.)

MERV 13 and MERV 8 filters clean the supply and return air, respectively, and a backflow damper helps maintain pressure. They are insulated to approximately R-14 using XPS board insulation (more on this later) and, they are designed so that weather-driven rain cannot penetrate the system, and instead drains to the exterior.

The panel's minimum size is 62"–38", to fit the ERV technology, but they can be ordered in sizes of up to 66"–144", and larger sizes could be custom fabricated. They can fit into anything from a spandrel application to full floor-to-floor panels, according to the company.

Aesthetics to suit landmark high-rises

The first generation of AirFlow panels were yellow with steel vents at the top and bottom—not a look that designers were likely to embrace.

But the second-generation panels are being made by the German façade manufacturer POHL, which supplied façades for One World Trade Center and many other landmark buildings. The stainless steel vents have been replaced by smaller openings that blend into the panels, and the skin can now be made to match just about any façade color or material.

Most effective in perimeter applications

AirFlow Panels are most effective when delivering air to the perimeter of a building, but air from the panels can be moved deeper into the space, according to Breshears. The company is trying to avoid using ducts, but the system can be designed to provide air through ceiling or floor plenums. The AirFlow Panel is not replacing the entire HVAC system, but its use can lead to smaller chillers, air handlers, and ducts.

Breshears said there are a number of applications that make sense for the technology, and the company is in talks with ductless variable-refrigerant-flow (VRF) HVAC system manufacturers because, though VRFs are efficient at heating and cooling, they don't bring in fresh air. VRFs would be "perfect for putting near our panels and running them in parallel," said Breshears.

But the renovation market may be where AirFlow Panels find their strongest niche. "Part of the problem with deep renovations is there isn't space in the shafts or cores to put in the kinds of systems you want to," Breshears says. Offsetting some of the loads with these panels could allow for more creative, less expensive ways to comply with fresh-air requirements while meeting or exceeding current energy codes.

Theory, costs, and current projects

Though AirFlow Panels have not been installed on any real-world projects so far, they have been tested on installations through Lawrence Berkeley National Laboratory and ETH Zürich, and various simulations show first cost and operational savings. One energy simulation for a 29,000 ft² school, for example, found that a system using AirFlow Panels and electric resistance heating outperformed one using VRF, ERV, and a dedicated outdoor air system (DOAS), with Energy Star-level energy use intensities (EUI) for the two HVAC systems of 17 and 27 kBtu/ft² · yr, respectively (lower EUI is better).

According to Jennifer Young, Associate at Lake | Flato Architects, "I think there is a huge opportunity for these to be used in retrofit solutions." Her firm is planning on using the system for a retrofit of its three-story San Antonio office. The concrete structure is a converted car dealership, and getting fresh air to the first and second floors has been a challenge for the firm. "I can't even tell you how many [HVAC] schemes we ran through," she says. Some options required structural changes, but they are now planning on using four AirFlow Panels to serve the second floor ventilation needs of a large conference room, and will be incorporating circulation fans to move air further into the space.

"We are right on the line between hot-and-dry and hot-and-humid, and we get a lot of humidity," but Young claims that analysis from the Integral Group shows the system can handle the humidity and temperatures. They have an additional hurdle before the project begins. "Our building is a historic structure, and we needed to find a way on an open façade to make the alteration less visible." Using AirFlow Panels, the project will not have visible exterior vents, and the color options should allow the system to pass the pending historic design review.

Panels must be integrated into HVAC

Breshears acknowledges that, although there has been an overwhelmingly positive response to the launch of AirFlow Panels, there are many factors that engineers and architects need to take into consideration before installing them.

BuildingGreen reached out to experts to get their take on the technology. Erin McConahey, P.E., Principal at ARUP, worked with Architectural Applications during development. "All of the ventilation is coming directly into the room," she said, "but you still need to supply some level of pressurization from the AHU to make this work." While not an insurmountable problem, it underscores the importance of integrating the panels into an HVAC system.

Alejandra Menchaca, Senior Building Scientist at Payette, told BuildingGreen that she had concerns about the panel's thermal performance, which varies from R-10 to R-15, depending on conditions and airflow. That's not bad compared to some basic curtainwall systems, but is far from high-performance. Breshears counters that the panels make up a small portion of the total façade, and that the fresh air, energy savings, and other benefits make up for thermal losses (though not an apples-to-apples comparison, glazing takes up more façade real estate and has worse thermal performance). The system does have thermally broken frames, he says, and the company could make much thicker, high-performance panels, but most walls are not that thick, so the market is currently not there for them.

Menchaca also expressed concerns about installation and maintenance. Breshears claims the panels install quickly, but each panel does require low-voltage wiring for the ECM fans. There are no built-in controls or sensors for the units either. The company includes basic wiring connection instead to keep the system simple and broadly compatible, leaving the controls—building

management systems, CO₂ and occupancy sensors, and the like—up to the end user; but he says the next generation will incorporate software and sensor technology.

Maintenance will have to be done on individual panels rather than a central unit, however, and the filters must be changed about every six months, depending on pollution levels, via an easy-to-access interior panel. Though the membrane and fans can be replaced from the inside, the company claims the panel should last 25 years, and the German fans are “the best in the business.” The system has a three-year warranty.

Is this the future of HVAC?

Using AirFlow Panels will require first adopters to bring architecture teams and HVAC engineers together to make sure the system works as intended. In a conservative, risk-averse industry with conventional workflows, they might be a tough sell for some projects. But Architectural Applications appears to have done its homework and created a product that continues to evolve and could eventually change how we supply ventilation to our buildings.



PRIMER

Neuroarchitecture: Thinking with Our Buildings

Can the fields of cognitive science and neuroscience improve the built environment? Those studying neuroarchitecture think so.

by *Tristan Roberts*

Admirers of the human brain have taken to calling it “the most complex structure in the universe,” and they have a good point: it holds 100 billion neurons, and each neuron is connected to 10,000 other neurons. There are major discoveries still being made about some of the brain’s basic functions.

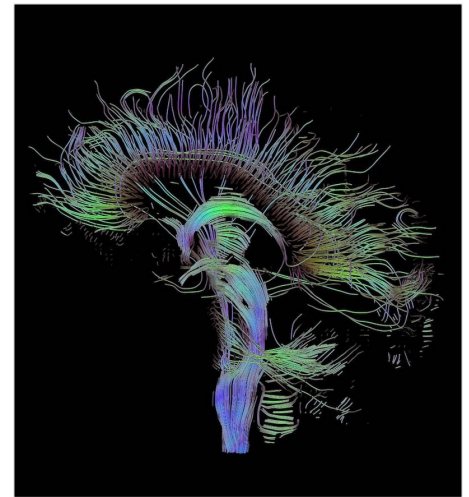
Perhaps the most intriguing trend for creative types such as architects and designers is the demolition of the limited association between the brain and the mind. [Decades of research and work](#) on our understanding of *embodied cognition* tells us that the entire body shapes and contributes to human cognition and mental states.

And our bodies don’t just exist in space: they are deeply affected by the building interiors where [we spend 90% of our time](#). You only need to recall spaces that have evoked [home](#), or contemplation, or celebration, to see that our physical experience of architecture strongly affects our emotions and our thoughts.

This ground is so fertile that it has birthed a new field: neuroarchitecture, which, as the name implies, seeks to apply neuroscience to architecture. This exploration takes at least three major forms:

- using neuroscience to understand how humans (and other animals) experience the built environment, and in particular, exploit the potential to design spaces for more positive experiences of health, well-being, and productivity
- using neuroscience to study the design process via the brain of the architect
- asking, via the exploratory field of [neuromorphic architecture](#), “What happens if architecture incorporates in itself some of the lessons of the brain—if, in a sense, you give a brain to a building?” in the words of Michael Arbib, Ph.D.

[The Academy of Neuroscience for Architecture](#) (ANFA) is the hub of research and conferences for neuroarchitecture. (See also the [Environmental Design Research Association](#), or EDRA.) ANFA was formed in 2003 by the San Diego Chapter of the American Institute of Architects (AIA), and the College of Fellows of the AIA was a key early supporter of ANFA via the Latrobe Fellowship. A sampling of the variety of topics at a recent ANFA conference



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A visualization of the human brain's neural connections. As neuroscientists learn more about how the brain works, they are able to offer designers insights into why we experience our environment the way we do.

illustrates the potential of neuroarchitecture to benefit our experience of our buildings:

- the types of physical cues that make a space memorable: depth, complexity, landmark, symmetry, and repetition (strains of this research are similar to and overlap with [biophilia](#) and [biophilic design patterns](#))
- emotional design in architecture: the effect of the environment on emotions, and, conversely, the ability to design for specific emotions such as wellness (think of healing and contemplative spaces in healthcare settings) using architecture
- cultural preferences for elements in our environment (such as curvilinear vs. angular), and the impacts of spaces aligning with our preferences on mood, problem-solving, community connections, and health
- the cognitive effects of open office spaces
- the development of metrics for arousal of curiosity in the brain and the application to the design of built environments

- the design of environments to nurture youth affected by chronic stress and anxiety
- how windowless environments and underground spaces—spaces where occupants are more and more likely to find themselves for extended periods, particularly with the growth in mega-cities—affect human behavior and well-being

Neuroarchitecture looks at color, light, physical layout, and acoustics, among many other things. Its concerns overlap with considerations around wellness that are appearing in mainstream green building standards:

- LEED for Healthcare includes a credit for [places of respite](#).
- The WELL Building Standard devotes a category to “Mind” and recognizes the impact of spatial design on mood and productivity.
- The Fitwel rating system encourages increased fitness through aesthetic cues like well-lit stairwells.
- The Living Building Challenge requires attention to beauty and inspiration.

Over time, we might see neuroscience and neuroarchitecture explain and support preferences for specific building materials and policies that overlap with green building priorities.

Certain brain regions and even specific neurons (“mirror neurons”) are activated both when a person takes a specific action and when a person observes the action performed by another. According to some scientists, these brain functions are connected to our experience of empathy. Seeing a person carve a piece of wood can fire off the same parts of the brain that would be activated when one is carving wood oneself. In turn, seeing or touching a piece of carved wood could evoke memories or sensations that connect you to actions that made that material, and to its maker.

More broadly, environmentalists have long relied on empathy to support

policy agendas such as habitat protection. A deeper understanding and focus on neuroscience could help advocates bring more support to such policies, at the same time as bringing materials and designs into buildings that occupants can derive joy from.

If as a designer you have ever wondered why people respond to spaces in certain ways, or wondered what’s going on in your brain as you design, chances are that the field of neuroarchitecture is working on similar questions.

