ACCELERATING THE PATH TO DESIGN BUILDINGS THAT SATISFY PERFORMANCE AND COMFORT:

SOM CASE STUDY

Introduction

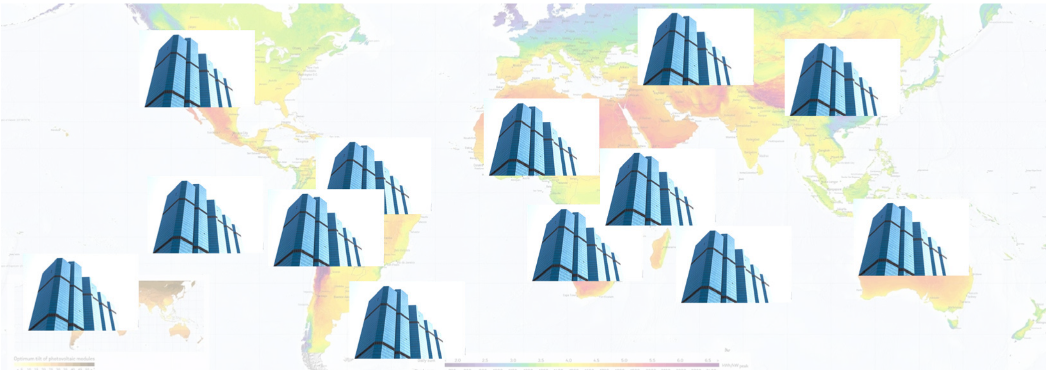
With its rich history of interdisciplinary architecture and engineering talent and strong advocacy for sustainable design, SOM has always been at the forefront of architecture and design. Using a combination of different scripts and tools, SOM is leading sustainable challenges in different levels. It comes as no surprise that an innovative approach involving psychrometrics and energy use would emerge from one of SOM's associate architects, Ruben Cabanillas. His approach takes into account human comfort in relation to a building's performance, which is factored into the overall design—and a perfect use case that naturally lends itself to working with cove.tool. In doing so, Cabanillas worked to simplify a complex workflow to identify the best choices for building performance metrics that he is working to achieve for a given project.

Historic Context

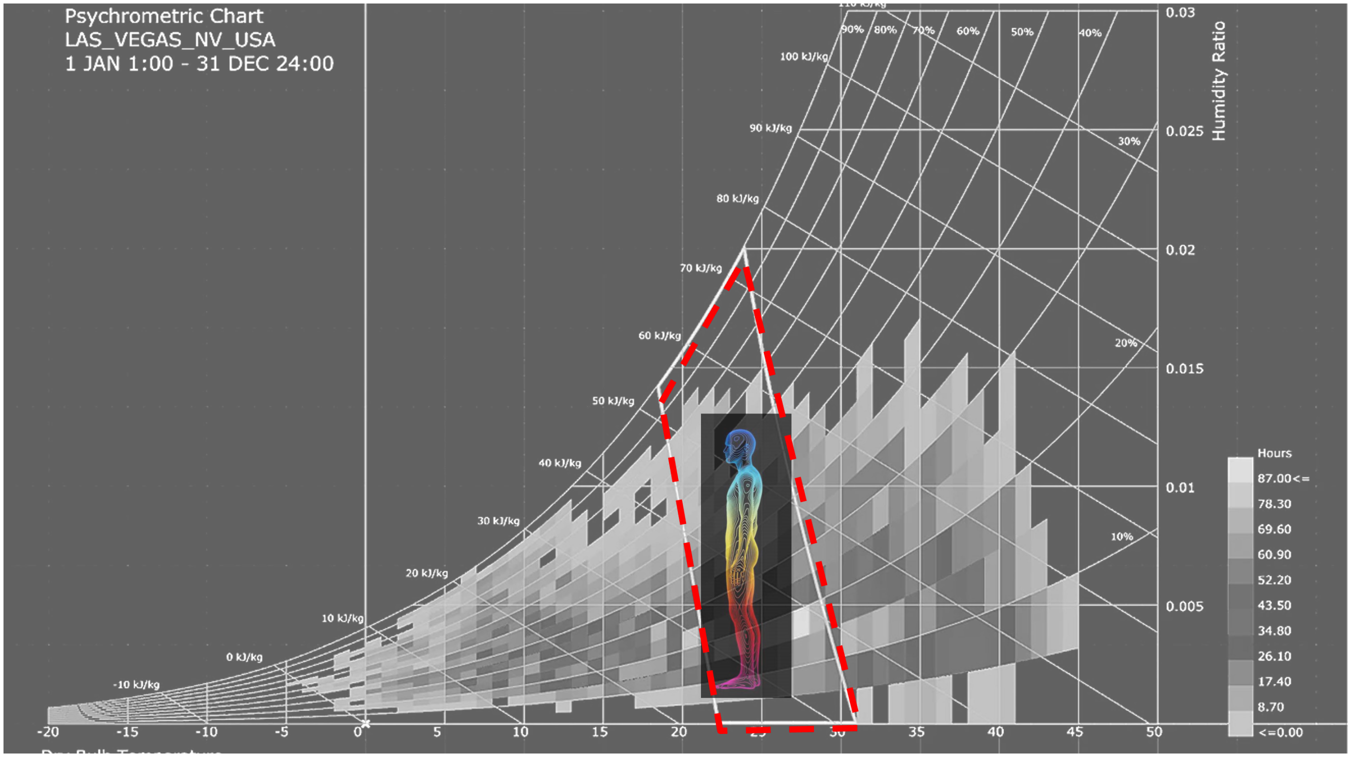
In the past (pre-industrial revolution era), environmental context like climate was always an important consideration for human habitats. Passive design strategies played a major role in the development of these habitats. But in the modern building era, the drive to create spaces that largely ignored the outside environment with features like climate control became more of the norm.

With modern HVAC systems and modern building technology, it was suddenly possible for humans to inhabit places where it would have once been unthinkable—think of the glittering condos built in the oppressive humidity of a Floridian summer, or the dazzling lights, bountiful water features, and carefully controlled environments of Las Vegas casinos built in the Nevadan desert. While these both represent examples of human progress and ingenuity in building technology and design, they are also potential examples where building design is inharmonious with nature, fighting the natural environment to exist.

Vernacular Architecture



20th Century Architecture



Orientation Shift & Overarching Design Philosophy

Now, in creating buildings for the future, forward-thinking firms like SOM are rethinking the paradigm by considering the holistic environment of the building, the surrounding space, its intended occupants, and its impact on climate change. This is a nod to vernacular architecture, drawing design inspiration that speaks to the local context and utilizes building materials local to the site location rather than glass boxes and steel construction that dominate International Style. With this subtle shift in orientation, many data points like climate patterns, human comfort and thermodynamics come into play along with other factors like energy use intensity (EUI) and operational energy. It becomes a question not of how can we make this building work in this space/environment, but one of *how can we design a space that's in harmony with the environment and everything else?*

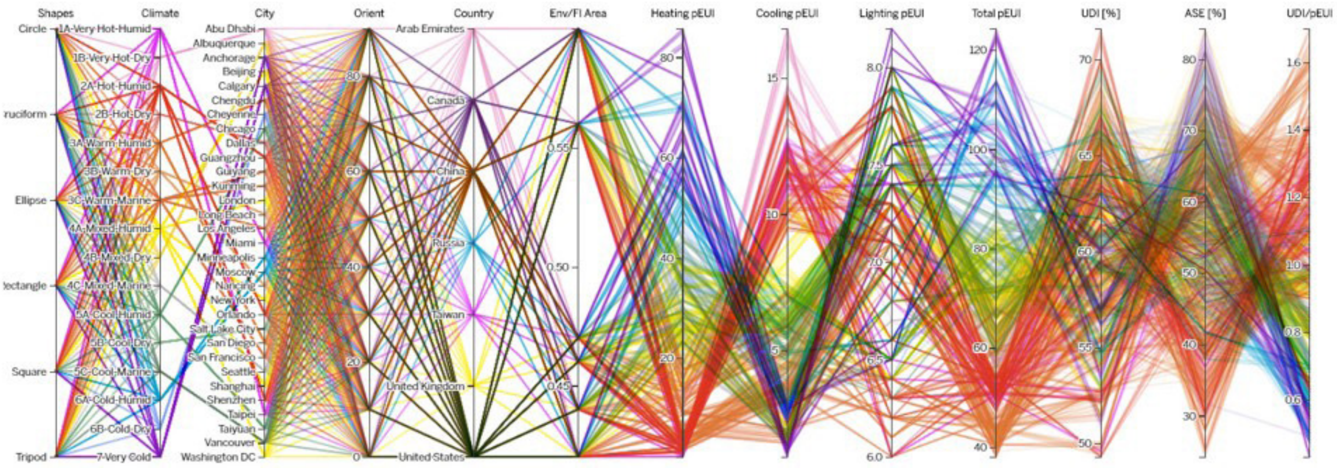
For Cabanillas and his colleagues, one of the central questions that guide their design philosophy serves as an initial point of inquiry and a way to calibrate their design decisions.

“How do we design the built environment to satisfy performance and comfort?”

To achieve this, they look at things like energy balance, which is defined by thermodynamic mechanisms. This involves peeling back the layers that define comfort, and finding the balance between heat generated and heat leaving the body. To break that down further, Cabanillas and his colleagues look at heat leaving the body, calculated by air temperature (factoring convective heat loss at 27%), mean radiant temperature (factoring radiant heat loss of 48%), humidity (factoring exhalation/perspiration at 27%) and wind speed (factoring in convective heat loss at 27%). This is combined with heat generated by the body, or the metabolic rate.

“As architects, we have been looking at the built environment to find different levels of protective skins to satisfy this balance toward high levels of comfort,” Cabanillas explains.

With the energy balance factors combined, Cabanillas and his colleagues created a psychrometric chart to better understand energy requirements, comfort and how the built environment would interact with those data points. This chart helps them identify the ideal occupant comfort zone. Cabanillas acknowledges that it’s not an exact science and that the chart is somewhat subjective, as different people have different comfort zones and tolerances. However, the approximate range does act as an important guidepost, and projects at SOM get mapped out based on comfort and performance, creating a path for design.



Challenges

The SOM process and methodology described above requires extensive climate data and various tools because each location requires different measures to bring moisture, temperature and air into the proper comfort zone. For example, a project in New York City will require more warmth and water absorbing materials to remove moisture. Fortunately, there are many tools and technology to address this.

The available data is extensive, but also poses its own challenges. Interpreting the data is not always easy to do and often requires many specialists. The data visualization side can also pose a challenge. Designers and architects need a way to easily present comprehensive data in a way that makes it easy to understand and collaborate with all the stakeholders of the project.

Initially, the way SOM's workflow was setup, it required several different tools to complete the simulation and to pull together the necessary data. Several layers and steps, as well as experts for specific tools were required to move from simulation to output. This was sometimes a tedious process for designers and could prove to be time consuming, especially because it required them to identify the right output or design direction.

Solution

Because SOM's existing method required so many tools and experts to drill into those metrics, they needed a solution to drastically simplify their workflow. Through the use of cove.tool's analysis.tool, they were able to simplify a complex process, and quickly zero in on the metrics that mattered to fuel discussions about daylight, comfort and energy use intensity.

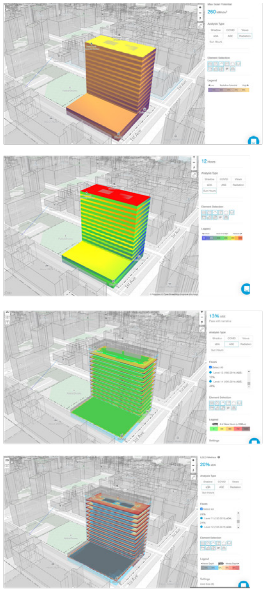
"cove.tool gives you an excellent summary and breakdown to fully understand important measures in your studies, along with some passive strategies to optimize them, such as decreasing equipment and heating or increasing WW-R to bring in more natural light, creating less reliance on artificial lighting. This can be especially useful in an office project, where internal load is significant." explains Cabanillas.

cove.tool can simplify a multi-step, complex process into three main steps:

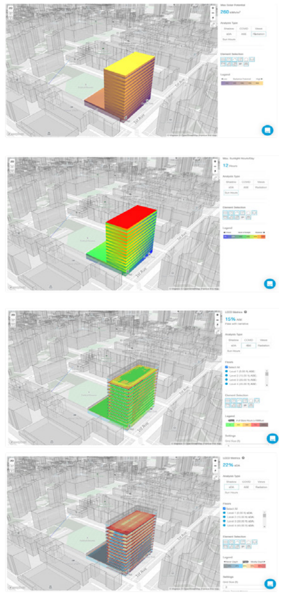
1. Importing the geometry (you can use the tools you're already accustomed to from your existing workflow).

2. Using the cove.tool simulation engine to run analysis, allowing the team to organize data in a way that greatly reduces time and effort.

3. Helping to create a useful output—analysis-graphics that make it easy to share and present to clients and other stakeholders.



OPT A



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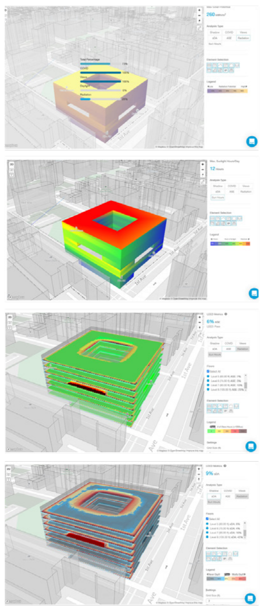

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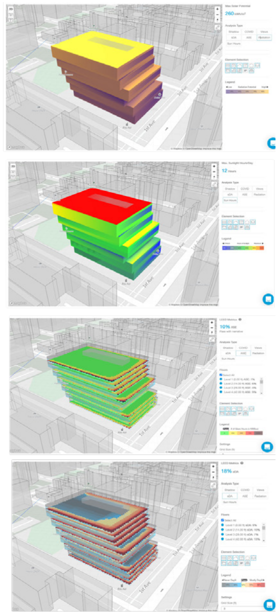


OPT D

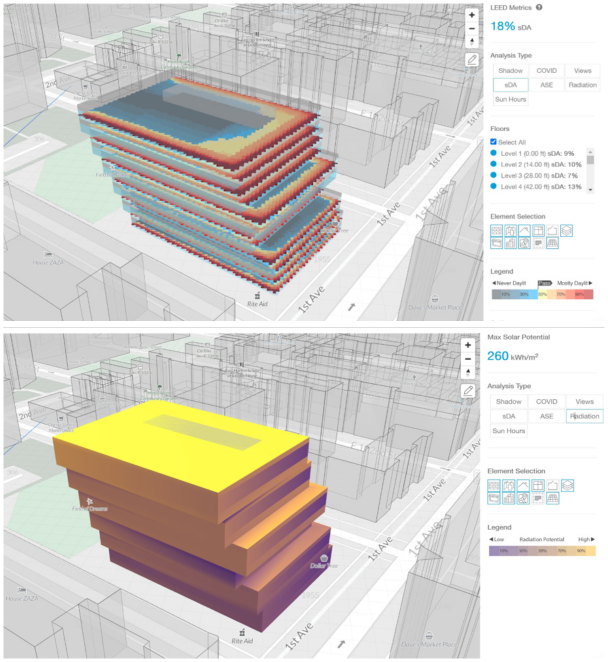
In Practice

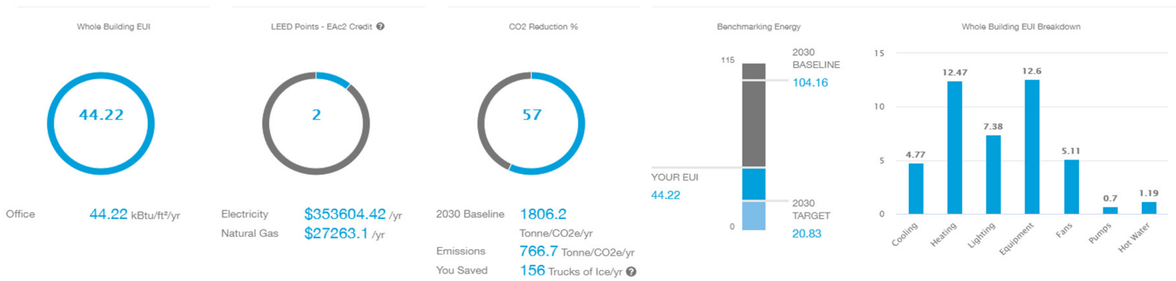
Cabanillas offered an example of a New York office project, whose site used the 2020 NYC Energy Conservation Code.

“A common scenario in the early design phase is getting an understanding of whether a building’s design will be performative, and to what degree. Too often, designers think they have to sacrifice design for good performance. With cove.tool’s analysis platform, we can quickly do a massing comparison, control for gross square feet (GSF), and understand from a high-level what the different massing options yield.”

By using cove.tool in the early design phase to quickly understand their options and getting performance data in minutes rather than hours or days, designers are able to iterate and move from hypothesis to analysis in quick fashion. The ability to compile quick metrics for daylight (sDA), annual sunlight exposure (ASE) and solar radiance alongside graphic renderings was another aspect of cove.tool that SOM designers found to be very useful in streamlining the decision process and sharing their key findings with internal stakeholders and clients.

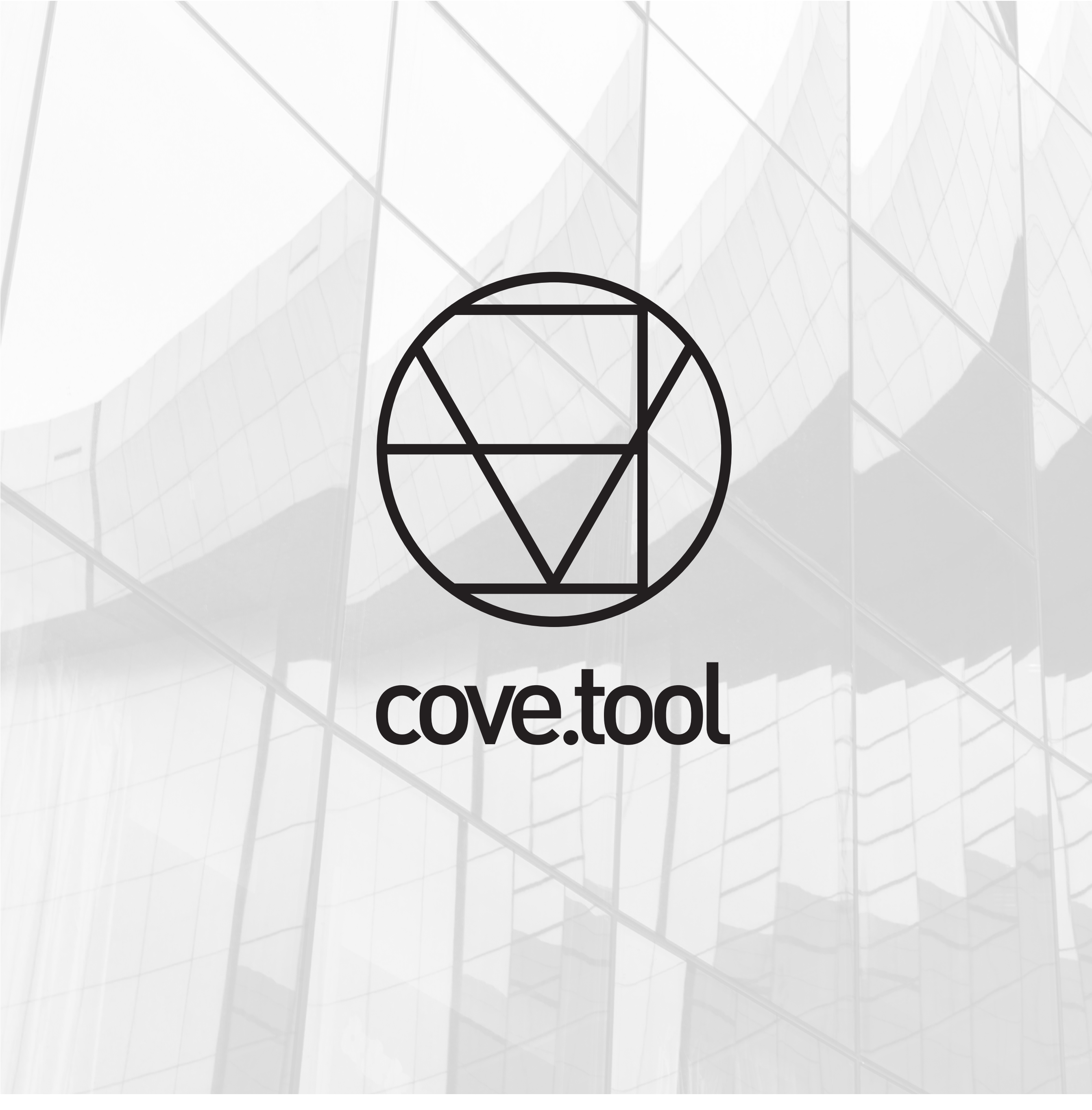
Through adding cove.tool to their existing workflow, the designers at SOM found a lot of value in the way cove.tool helped them organize their data and reduce the number of steps and approvals in their original workflow. It also helped teams save countless hours through a simplified workflow that increased collaboration.





Ruben Cabanillas Ramos is an Associate Architect at Skidmore, Owings & Merrill (SOM). Through his studies and experience from working in different studios, he has honed his architectural skills, mastered the art of collaboration, and has learned to handle rapidly changing schedules and shifting work priorities.

As a champion for sustainable design, he's worked to incorporate sustainable principles, performing a variation of energy analysis on different phases, which gives him better insight about smart passive strategies, like an envelope-massing approach.



cove.tool