

Title: **A LEED Platinum Global Model for Vertical Urbanism**

Author: Jeffrey Heller, President, Heller Manus Architects

Subjects: Building Case Study
Sustainability/Green/Energy

Keywords: Mixed-Use
Sustainability
Sustainability Certification
Transportation
Vertical Urbanism

Publication Date: 2014

Original Publication: CTBUH 2014 Shanghai Conference Proceedings

Paper Type:

1. Book chapter/Part chapter
2. Journal paper
3. **Conference proceeding**
4. Unpublished conference paper
5. Magazine article
6. Unpublished

© Council on Tall Buildings and Urban Habitat / Jeffrey Heller

A LEED Platinum Global Model for Vertical Urbanism

垂直城市化的LEED铂金级全球模板



Jeffrey Heller

Jeffrey Heller

Heller Manus Architects
600 Montgomery Street, Suite 100
San Francisco, California
94111 USA

tel (电话): +1 415.247.1100
fax (传真): +1 415.247.1111
email (电子邮箱): jeffreyh@hellermanus.com
www.hellermanus.com

Jeffrey Heller, FAIA, president of Heller Manus Architects. Directs green urban planning and major mixed use development in more than a dozen cities in China. He is Partner-in-charge of the first LEED CS Gold high-rise office buildings both in San Francisco and Shanghai.

Urban Advisor to several Government entities in China:

- State Administration of Foreign Expert Affairs
- CSUS of MOHURD
- National Mayors Association
- Senior Urban Planning Advisor, Shanghai Yangpu District and Zhuhai city and Conghua city
- Honorary citizen in Ulanhot

Serves on the boards of the Asia Society, the Bay Area Council, and the ChinaSF Advisory Board.

Jeffrey Heller, 美国建筑师高级协会会员, 赫勒·曼纳斯建筑事务所董事长, 绿色城市规划的倡导者, 在中国多个城市主持了混合用地功能的综合开发项目, 是美国旧金山市首个和中国上海市首个LEED CS黄金级认证高层办公建筑项目的设计负责人。

他在中国担任多个城市和政府机构的城市发展顾问:

- 外国专家事务管理局顾问
- 住房和城乡建设部下属的中国城市科学研究会顾问
- 中国市长协会顾问
- 上海杨浦区、广东省珠海市和从化市城市规划顾问
- 乌兰浩特市荣誉市民

他同时担任美国亚洲协会理事、湾区议会理事、旧金山驻华办公室的高级顾问。

Abstract

Every key aspect of sustainable urbanism is incorporated and integrated into the tallest mixed use, LEED Platinum tower on the west coast of North America, 181 Fremont. The exoskeleton structure is an advanced tuned design that is notched to create turbulence, reducing the aerodynamic pull of the wind while creating an opportunity for a terrace at the amenity level that saves steel in both seismic and wind response. The exterior diagonal structure results in column free interior space. The sawtooth curtain wall design is a combination of metal mullions and vision glass that angles away from the sun, reducing solar heat gain. These advanced building systems have led to a revolutionary LEED Platinum high-rise tower for San Francisco.

Keywords: Transit-Oriented, Active Sustainability, LEED Platinum, Transbay District, Mixed-Use, Pedestrian

摘要

伫立在北美西海岸的LEED铂金级认证塔楼弗里蒙特街181号, 作为世界最高的混合功能建筑之一, 融入了可持续城市化的每一个关键因素。建筑设计具有先进调谐的外骨骼结构, 建筑中部开放以产生湍流进而减少风的气动拉力, 从而从基础设施层面节省了抵御地震荷载和风力荷载的结构钢的用量。斜线结构与建筑外立面的结合还提供了无柱分割的内部空间。微锯齿状的幕墙设计结合了金属竖梃和通过角度调整避开阳光的视窗, 减少了太阳辐射量。这些先进设计手法, 结合可持续的建筑材料, 使得这幢建筑成为旧金山具有突破意义的LEED铂金级认证超高层塔楼。

关键词: 公交导向, 主动可持续性, LEED 铂金级认证, Transbay枢纽区, 混合使用, 行人

Introduction: San Francisco – Mixed-Use Development

San Francisco is in an elevated position in the U.S today because of its commitment to sustainability and quality life. It is considered the top green city in America. At 49 square miles and bound on three sides by water, San Francisco cannot expand outward like many similar metropolitan areas. With an influx of technology companies moving into the city, in great part due to its green policies, the population continues to grow. Instead of growing outward, the new center, the Transbay district, is growing upward. 181 Fremont is capitalizing on this circumstance through vertical mixed-use design. Conventional development where single-use parcels dominate blocks does not create the type of 24-hour activity that makes cities thrive, so the planning of the Transbay District helps create a compact mixed-use transit-oriented core.

A Mixed Use Building

One of the key buildings rising in the Transbay District is 181 Fremont, a 55-floor high-rise designed by Heller Manus Architects (see Figure 1). At 800 feet, 181 Fremont is a leader

简介: 旧金山 - 混合用途开发

旧金山由于其对可持续性和生活质量的承诺在美国享有较高的地位。它被认为是美国最绿色的城市。城市总面积49平方英里, 由于三面环水, 旧金山无法像其他类似的大都市区向外扩张。近年来, 城市的环保政策吸引了硅谷大量科技公司涌入, 人口得以持续增长。单一功能的传统街区发展模式无法激发城市24小时的全天活力, 而城市正是依赖这种全天活力才能蓬勃发展。新的城市中心—Transbay枢纽区没有采用向外扩张的发展模式, 而是向上寻求发展空间。整个枢纽区力图通过规划创造一个紧凑的公交导向型发展的城市混合功能中心。通过垂直方向的混合使用设计, 弗里蒙特街181号大楼很好地体现了这一规划思路并融入到周边城市环境之中。

混合功能大厦

Transbay枢纽区最重要的建筑之一便是由赫勒·曼纳斯建筑事务所设计的弗里蒙特街181大厦(见图1)。在800英尺的高度上, 弗里蒙特181号大厦作为美国西部最高的通过LEED铂金级认证的混合功能大楼, 是新一代可持续设计的引领者。

in next-generation sustainable design as the tallest mixed-use LEED Platinum tower in the western United States.

181 Fremont takes one further step in this philosophy by creating a vertical mixed-use development with residences, office space and retail. Within its 55 stories are 425,000 square feet of office space, 2,000 square feet of retail, and 155,000 square feet of residential. The top 17 floors of the tower will have 67 residential units with panoramic city and bay views. This kind of dense development creates a destination that contributes to promoting a jobs/housing balance that benefits downtown vitality and growth. This model of a dense urban core with vertical mixed-use development will contribute to the south of market community. Instead of building out, and perpetuating sprawl, the key to sustainable urban life is to increase downtown density and build up.

The Transbay District

The Transbay District is a newly created development zone in downtown San Francisco that is planned to leverage increased mixed-use development around a signature transportation hub highlighted by the new 1,040-foot tall Transbay Tower. When complete, the downtown transit hub will become a Grand Central Station for the West Coast of the United States, home to multiple bus systems, the city's light rail, and the new terminus for both the Caltrain rail system that connects San Francisco with Silicon Valley, as well as the planned high-speed rail line to Los Angeles. Surrounding this transit hub is high-density development: over six million square feet of new downtown office space, 4,400 units of housing that includes 1,200 affordable units, 100,000 square feet of new retail space, 1,000 hotel rooms and over 11 acres of new public parks and open space. It is anticipated that the Transbay development will add more than 35,000 permanent jobs, creating a vibrant pedestrian live-work district at the center of downtown.

181 achieved its LEED Platinum benchmark through careful design consideration involving a series of approaches:

- Its role as a transit-oriented development
- Vertical mixed-use design as a tool for increased density and jobs/housing balance
- Efficiency of structure
- Utilization of solar passive principles in the exterior design
- Innovative sustainability practices throughout the building systems
- Strong pedestrian connections

The building is taking a leadership role in innovative design and engineering that will establish it as a benchmark project for future builders to use as we expand our collective knowledge of environmentally responsible development including the growing field of sustainable technology.

181 Fremont is also an example of how close collaboration of all disciplines is essential for the design and construction of a project of this scale and complexity. Due to the demands of close interaction of interrelated building systems, bringing all designers into the project at an early phase was critical to establishing the building's design direction as a LEED Platinum tower. The result of using this integrated project delivery approach from the outset of the design process has been cost savings. Upgrading from LEED Gold to LEED Platinum is estimated to be less than 1% of the total construction costs, with a future savings of millions of dollars in lifecycle costs into the future.



Figure 1. 181 Fremont in the San Francisco skyline. (Source: Steelblue)

图1. 弗里蒙特181大厦在旧金山的天际线中的位置。(资料来源: Steelblue)

通过在垂直维度上混合开发住宅、写字楼及零售，弗里蒙特街181号大厦将可持续理念往前推进了一步。55层高楼中包含425,000平方英尺的办公面积，2,000平方米零售面积，以及155,000平方米住宅面积。建筑上部17层共包含有67个住宅单元，能够远眺城市全景和海湾美景。这种高度密集的开发模式有利于职住平衡，同时也能促进市中心的活力和发展。城市中心区的高强度垂直混合发展模式有助于旧金山市场街南部社区的发展。因为可持续现代城市生活的关键在于提高市中心的密度，向上垂直发展使用空间，而非传统的外展蔓延模式。

Transbay枢纽区

Transbay枢纽区是旧金山市中心新建的开发区，采用有效利用Transbay交通枢纽区和周边高密度的混合开发模式，例如正在建设的1,040英尺高的跨湾大厦（未来旧金山市最高建筑），强化了此区域不可忽视的地位。Transbay交通枢纽建设完成后，它将成为美国西海岸的中央车站，汇集多条巴士总线和城市轻轨。此外，还将成为连接旧金山与硅谷的城际轻轨系统的端点站，同时也是规划中旧金山到洛杉矶高速铁路的重要组成部分。围绕着这个公交枢纽站的都是高密度开发区，包括总面积超过六百万平方英尺的新办公空间，4,400户住房单位（其中1,200个单位为保障性住房），10万平方英尺的新零售空间，1,000间酒店客房及超过11英亩的公共绿地和开放空间。据推测，Transbay枢纽区的发展将带来超过35万个长期就业机会，并且在市中心创建一个充满活力的慢行生活工作区。

弗里蒙特街181大厦通过精心设计获得LEED铂金级认证，它充分考虑了以下内容：

- 在一个公交导向开发中承担的作用
- 垂直混合功能设计以达到提高密度、职住平衡的目的
- 结构的效率
- 外立面被动太阳能利用原则
- 整个建筑系统的可持续创新实践
- 高效的人行系统连接

随着知识的积累和可持续技术的发展，我们越来越认识到城市发展过程中建筑工程对环境的责任。该项目在Transbay枢纽区的创新设计和工程领域中发挥领导作用，并且力图成为未来建设者的参考。

弗里蒙特街181号大厦成为了在这种规模和复杂程度的项目设计和建设中，所有学科的密切合作的范例。由于建筑中各种相关的系统需要密切的合作，各个专业的设计师在项目的早期阶段即开始投入工作，这是建立LEED铂金设计方向的关键。协作式设计模式的结果是从设计之初便已开始节约成本。据估算，从LEED黄金级升级到LEED铂金级的费用不到总建筑成本的1%，在未来的建筑生命周期更能节省数百万美元。

Transit-Oriented & Adjacent Development

181 Fremont is designed to take advantage of San Francisco's existing pedestrian-oriented nature and the districts' new transit options. With the currently under-construction Transbay Terminal at the foot of the building (see Figure 2), workers and residents will be able to access the transportation hub seamlessly, moving throughout the Bay Area using a variety of public transit systems. Ultimately, California High Speed Rail will offer a direct connection to Southern California, and only 2 blocks away is the regions' commuter rail system, BART. For those who need personal vehicles, the project provides storage for 220 bicycles and parking which encourages low-emitting vehicles. This combination of options allows users of 181 Fremont to minimize their impact on the environment through the reduction of carbon emissions, traffic congestion and parking impact. By LEED standards, 181 Fremont has earned the maximum number of points available for access to transportation.

Pedestrian Connection

One of the key opportunities in designing an urban building in the core of a vibrant downtown is creating strong pedestrian connections that prioritize the pedestrian over other forms of transportation. Pedestrians enliven the urban environment and should be encouraged by well-designed streetscapes, visible road crossings, well-marked entrances and paths, and through connections that make going from place to place easier as a pedestrian. To that end, the plan includes a column-free, open lobby for office tenants, guests, and visitors that offers access to the existing green space behind a neighboring building and direct access via elevator to the elevated Transbay Park over a footbridge (see Figure 7), making it one of only two towers directly tied to the above-ground park. As with many buildings downtown, 181 Fremont has ground-level retail that brings activity to the street enlivening the entire district (see figure 8), but also has a significant amount of retail at the park level, creating an additional amenity adjacent to the public open space.

Active Sustainable Building

181 Fremont has been pre-approved for LEED Platinum Certification, including obtaining 6 points for innovation in design. The platinum strategy used on the site currently achieves 86 points in the LEED system. LEED certified buildings directly impact climate change by reducing the EUI (energy use intensity) in comparison with typical non-LEED certified buildings of the same building type and size in similar climate zones. The key to the environmental success of 181 Fremont has been the team's willingness to work collaboratively to achieve all possible points in the most cost effective way, keeping in mind value, performance and initial cost.

The sustainability begins in construction; 75% of all building materials are recycled. It also capitalizes on the regional building materials credit for sourcing of materials; wood on the project has been certified by the United States Forest Stewardship Council.

Energy, water, and heat efficiency measures have been integrated into the plans from the beginning. The building will house a 30kW bio-gas-fueled CHP turbine on the roof, which will achieve 1% renewable energy. The large windows provide ample sunlight to all offices and residential units, reducing the need for artificial lighting during the day, and improving user wellbeing. There will be a green roof, reducing the heat island effect by allowing heat and water to permeate the surface; all



Figure 2. The 181 Fremont tower with the Transbay Center in the foreground. (Source: Steelblue)

图2. 弗里蒙特181大厦的跨湾中心的显著位置。(资料来源: Steelblue)

公交导向与相邻开发

弗里蒙特街181号大厦的目的是充分利用旧金山现有的步行优先和地区新交通方式的特点,通过建筑底部正在建设的Transbay枢纽区终点站(见图2),职工和居民能够在枢纽中心无缝换乘,通过多样化公共交通系统从Transbay枢纽区去向四面八方。未来加州高速铁路将从此区域出发直达南加州;此外,仅2个街区之外便是地区的通勤城市轻轨系统——旧金山湾区捷运系统。对于那些使用私人交通工具的人来说,该项提供了容纳220辆自行车的停车场,通过这种方式鼓励公众使用低排放交通工具。公交导向策略使得弗里蒙特街181号大厦的用户用实际行动减少碳排放、交通拥堵和停车干扰,从而使其对环境的影响最小化。由于其良好的交通可达性,弗里蒙特181号大厦取得了LEED标准中有关交通方面的所有评分。

人行道连接

在充满活力的市中心设计城市建筑的关键之一便是创造高效的人行连接和优先考虑步行的需求。步行者能够激活城市环境,而步行行为可以通过精心设计的街景、可见道路交叉口、清晰的入口和路径来激发,另一个重要手段是通过增加步行道连接提高

parking is underground, meaning no paved parking lot to collect heat. Plumbing fixtures will use 30% less water than the building baseline.

The design also makes use of a gray water system using Living Machine® technology to filter and recycle wastewater. The Living Machine® cells will be located in the atrium or an outside green space, and pump water into storage containers located on the parking level—one for gray water, and one for reuse. The non-potable recycled water will be used for irrigation, allowing the native landscaping to stay green without waste.

The goal is to repurpose 90% of the storm water runoff. This system reduces the building's total water use by 40%. Because the Living Machine® system was integrated into the building plans from the beginning, the cost of implementing the system was reduced because it did not have to be added into the plan retroactively.

All LEED credits are weighted to prioritize climate change improvement. As an example, Bike Parking receives 6 credits whereas low VOC paint or recycling of construction and demolition waste might only count for 1 point. LEED Platinum is an important step in reducing the impact of the built environment, but this is still only a step towards the final goal of creating working and living spaces that are net-zero, handling their own power, waste and generation needs without the outside help of fossil fuels and other polluting infrastructure elements.

Efficient Structure

The structure of the building is designed to use materials as efficiently as possible, reducing the drain on raw materials. The exoskeletal design uses large steel members that counteract seismic and wind forces far more efficiently than traditional moment frame design (see Figure 3). In a traditional moment frame building, the rigid frame requires large steel columns and rigid connections that are materially inefficient. The diagonal bracing of 181 Fremont is flexible and structurally sound with thinner gravity columns that saves approximately 15% of steel tonnage compared to a traditional design. This reduces cost while also increasing the rentable space within the building.



Figure 3. The steel exoskeletal system. (Source: Heller Manus Architects)
图3. 钢结构外骨骼系统。(来源: 赫勒曼纳斯建筑事务所)

步行便捷性。因此,设计采用一个无柱开放式大堂,使写字楼租户,来宾\游客可直接进入建筑后邻近的绿地,或是通过电梯直接到达位于行人天桥上的高架跨湾公园(见图7)。本建筑成为这个区域直接连接Transbay枢纽屋顶公园的两个塔楼之一。正如许多市中心的建筑物一样,弗里蒙特街181号大厦的地面零售激活了整个区域的街道(见图8),同时在屋顶花园的高度也有许多的零售空间,从而为城市开放空间提供了便利的服务设施。

积极的可持续建筑

弗里蒙特街181号大厦已通过LEED铂金级预认证,其中包括6分的创新设计,总评分达到86分。与典型的同类型同尺度而未通过LEED认证的建筑相比,LEED认证建筑的能耗更少,从而可以减少对气候的影响。弗里蒙特街181号大厦在环境友好方面成功的关键在于积极的团队协作——通过最有效的方式获得可能的LEED评分、重视性价比和从初始就核算建设成本等因素。

可持续性考虑也贯彻到施工阶段。建筑材料75%是再生材料,注重采购地产的建材;项目所使用木材已通过美国森林管理委员会的认证。

项目之初,能源、水和热效率的措施便被纳入设计。该大楼将在屋顶上容纳一个30KW的沼气能热电联动汽轮机,提供1%的可再生能源。大面积窗户为所有的写字楼及住宅单位提供了充足的阳光,减少了白天对人工照明的需求,而且有益于用户身体健康。项目同时计划建造一个绿色的屋顶,通过吸热和



Figure 4. The distinctive notch reduces wind loading. (Source: SteelBlue)
图4. 独特的缺口减少风荷载。(资料来源: Steelblue)

The other key structural innovation of the tower is the notch at the center (see Figure 4): this notch creates turbulence that helps reduce the aerodynamic pull of the wind, allowing the design to require less steel to resist lateral wind forces. According to testing by RWDI, the notch reduces sway by 1 mg. By using material smartly, the 181 Fremont design has less weight, without sacrificing the integrity of the structure.

Passive-Solar Design

The exterior window-wall system employed on 181 Fremont allows the project to reduce solar gain through a solar-passive design approach. Walls of window glass with solid aluminum mullions are assembled in a saw tooth pattern (see Figure 5) where the glass slopes from the outside of one mullion to the inside of the next. The saw tooth pattern has different orientations on each side of the building that maximizes the reduction in heat gain on each face based on its solar orientation. This strategy gives the tower a unique geometry on each face that is visually enhanced as the sun moves across the sky (see Figure 6). As an example, the northeast face has glass that will be shaded sooner than a typical flat wall of similar orientation in the morning. The southwest and northwest façades geometry shades the glass at various hours during the afternoon. As a result, the metal mullions block the direct sun at certain times on each façade so that the design reduced the solar gain of the building by about 6%. This heat reduction technique helps keep the building cool while reducing the buildings overall active cooling load.

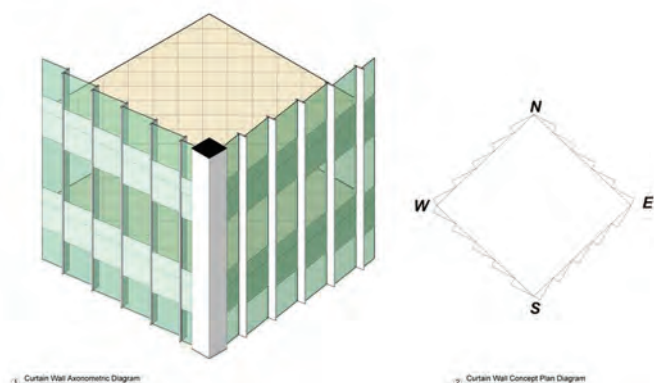


Figure 5. A sawtooth window pattern reduces solar heat gain. (Source: Heller Manus Architects)

图5. 锯齿形窗口减少太阳辐射的吸收。(来源: 赫勒曼纳斯建筑事务所)



Figure 6. The distinctive window orientation creates a very visually active façade. (Source: Heller Manus Architects)

图6. 独特的窗口方向创造了一个非常活跃的视觉外观。(来源: 赫勒曼纳斯建筑事务所)

渗水屋面减少热岛效应。停车场全部设置在地下, 由此减少硬铺地带来的热量反射。相比建筑能耗规范基本要求, 管道装置将节约30%的用水量。

该设计还采用了中水回收系统, 即采用“活机®”(某品牌名称)技术过滤和回收废水。设置在中庭或外部的绿色空间中的“活机®”模块将水抽入停车场层的储水箱中, 一个储存中水, 一个储存重复使用的水。这些回收的非饮用水将被用于灌溉, 使原生景观的生长不浪费干净水。

设计目标是回收利用90%的雨水。通过此系统可减少建筑总用水量的40%。由于“活机®”系统从一开始即被集成到建筑设计中, 不需要后期的改动, 实施成本更加降低。

所有LEED评分均通过其对气候变化的改善作用大小进行加权综合。比如, 自行车停车场获得6分, 而使用低VOC涂料或回收建筑垃圾的只能计为1分。LEED铂金级认证是降低建筑环境的影响的一个重要策略, 但对于创造零碳排放的工作和生活空间, 不依赖外界的化石燃料和其他产生污染的基础设施元素来处理自身的能源、废物和发电需求等终极目标来说, 还有很长的路要走。

高效的结构

项目通过建筑结构的优化最大限度提高材料使用效率, 从而减少对原材料的消耗。建筑的外骨骼设计采用了大型钢构件, 使其对地震和风荷载的承载力远远高于传统框架结构设计(见图3)。传统的抗弯钢框架结构需要大量的钢柱和刚性连接, 而这些方式对材料的利用率偏低。弗里蒙特街181号大厦的斜撑灵活且结构合理, 比传统设计节省了约15%的钢材, 减少了自重。外骨骼形式在降低了成本的同时增加了建筑物内的租用面积。

大楼的另一个关键结构创新是在中部留出一个缺口(见图4): 这个缺口产生湍流, 有助于减少风的气动拉, 使设计需要较少的钢以抵抗侧向风的荷载。根据RWDI机构的检测, 缺口减少了1mg摆动。通过智慧地使用材料, 弗里蒙特街181号大厦在不牺牲结构的完整性的条件下减少了结构重量。

被动式太阳能设计

弗里蒙特街181大厦采用的外墙-窗墙系统通过被动式设计减少了太阳辐射的获得。铝竖框玻璃幕墙组成锯齿图案(参见图5), 玻璃平面从前一个竖框的外侧向后一个竖框的内侧倾斜。通过调整建筑的每个立面上锯齿的不同角度使太阳辐射的获取降到最低。随着太阳在天空中移动, 这一策略使塔楼每个立面在视觉上都



Figure 7. The 181 Fremont tower connects directly to the elevated Transbay Park
图7. 弗里蒙特181大厦通过一个步行天桥与Transbay屋顶公园直接联系。(来源: 赫勒曼纳斯建筑事务所)

Conclusion

181 Fremont helps demonstrate that environmental stewardship and sustainable urbanism are not only achievable practices within the context of high-rise construction, but that these principles are becoming essential and needed concepts at a time that population growth and development are booming. Through high-density mixed-use development, the project conserves San Francisco's scarce land resources while providing complimentary uses that will keep the Transbay District active at all hours. That activity will come from the strong pedestrian connectivity that is the starting point for creating vibrant neighborhoods. By limiting vehicle usage through available public transit, bike parking and vehicle sharing, the project is placing pedestrians at the forefront.

Sustainable high-rises inspire users to take on sustainable practices. With recycling and conservation systems built into the plan, it is easy for office tenants and residents to add sustainable practices to their lifestyles. By highlighting sustainable elements such as the Living Machine®greywater system, 181 Fremont can extend the collective understanding and knowledge of sustainable design beyond the building, encouraging everyone to participate. Ultimately, in major cities, sustainable buildings and policies have become economic social and environmental cornerstones of making a greener future.

呈现独特的几何形状(见图6)。上午,东北面的玻璃比普通角度的玻璃更快的被遮蔽住;下午,西南、西北立面的玻璃在不同的时间段内被遮蔽住。其结果是,建筑每个立面在特定时间内其金属竖框都能挡住直射的阳光,从而减少了约6%太阳辐射量。这种被动式热降低技术使建筑保持凉爽,同时降低整体主动冷却负荷。

结论

弗里蒙特街181号大厦成功证明了在高层构建语境下环境管理和可持续城市化的可行性。特别是在当今人口的迅猛增长、城市蓬勃发展的时期,这些原则正在成为重要且必须的理念。通过高密度混合开发模式和提供免费试用的公共联系,该项目节约了旧金山珍贵的土地资源,保证了Transbay枢纽地区全天的活力。这些活力得益于高效的步行系统连接,它是创建充满活力社区的起点。通过提供多样化的公共交通选择、自行车与机动车停放空间共享,限制了机动车辆的使用,并将步行系统的考虑放在首位。

可持续高层建筑激发用户通过可持续的实践来使用大楼。通过内部回收利用和节能系统设计,写字楼租户和居民很容易将可持续行为引入到日常生活中。通过强调可持续发展的元素,如“活机”®中水系统,弗里蒙特街181号大厦拓展了我们对建筑可持续设计的共同理解和认识,并鼓励大家积极参与。最终,在全球各大城市,可持续建设方式和政策引导已成为未来通向更环保的社会经济和环境的基石。



Figure 8. The LEED Platinum tower will generate additional street activity near the Transbay Station. (Source: SteelB)

图8. LEED铂金级大厦将激发Transbay枢纽站额外的街道活力。(来源: Steelblue)