Arch 384 VELUX AWARD 2010 COMPETITION

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The Velux Award aims to challenge the existing concept of daylighting in architecture with an open-minded and experimental approach. In seeking the new definition of the “Light of Tomorrow”, the award encourages and widens the boundaries of daylighting, including aesthetics, functionality, sustainability, and the interaction between buildings and environment.[1] In a more macroscopic level, daylighting cannot be separated from the rhythms and balances of sunlight and nature, which are also revitalizing urban tissues. This project tries to bring sunlight into the most nature unfriendly place in the urban living context, the subway station. And it emphasizes the importance of environmental design and use of advanced technology. In order to transform the existing inanimate environment of the subway station into a vivid garden, ways of merging darkness and light, connecting above and underground, and integrating nature and technology are essential.

[1] Competition brief

Canary Wharf Underground Station
London, UK, 1991-1999

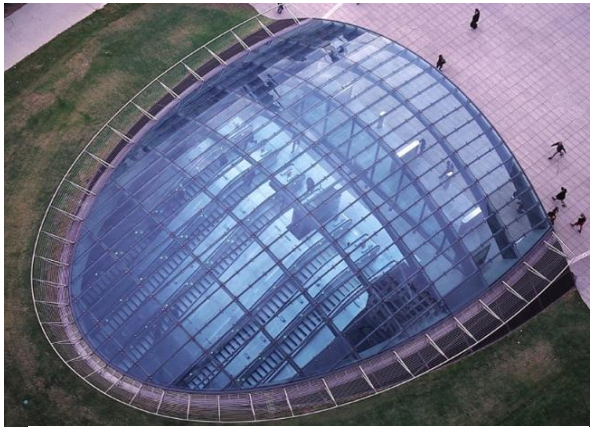

Figure 1: canopy of subway entrance

Figure 2: subway entrance

Designed by Norman Foster, the entire subway entrance is laid out as a landscaped park at ground level, creating a public recreation space with grass, trees, seating, fountains and paths. It incorporates green roof into the subway entrance which used to be a place where people waited with great saturation. The only visible station elements are the swelling glass canopies that cover its three entrances and draw daylight deep into the station concourse. By stretching the glass canopy into an elliptical shape, maximum amount of sunlight is able to enter the canopy and providing natural light for underground station. And as natural light is concentrating dramatically at these points, orientation is enhanced, minimizing the need for directional signage.

The design creates a robust aesthetic which is achieved by a simple palette of hard-wearing materials: fine concrete, stainless steel and glass. These materials have great clarity, simplicity, and are light

transmission; they are effective materials for subway canopy because their clear quality improves the spatial and lighting condition, create a reassuring passenger experience within the space. This dramatic atmosphere is most apparent at the platform level where the concrete diaphragm tunnel walls are left exposed.[2] The contrast between concrete and glass, as well as the light weight design of the canopy, all creates a flow of natural light, thus a gradual transition from light to darkness, and blurs the boundaries between above and underground.


Figure 3: subway entrance

To allow enormous amount of natural lighting entering the entrance, the canopy must be large enough to cover the entire entrance and the pathway (staircase or elevator) need to be straight and wide enough so that sunlight can reach the very bottom of the entrance. This premise is not a common situation, as most of the subway entrance is squeezed in a two-meter winded pedestrian sidewalk. Therefore the glass canopy itself alone is not enough to provide sunlight for the underground. Extra means of transporting sunlight is necessary.

[2] Foster + Partners: Catalogue, p.254

California Academy of Sciences
San Francisco, USA, 2008

Figure 4: bird's eye view

Figure 5: skylight embraced into the roof

In designing the Academy, Renzo Piano sought to distance it from traditional museums, which he saw as "kingdoms of darkness".[3] This is evident immediately when people enter the space, an immense inner courtyard that suffuses the entire structure with light. A complex undulating skylight ceiling gives three huge domes and hangs panels that distribute daylight. This concept is relevant to the design of the subway station, where it has been a place without the touch of sunlight and nature for centuries.

[3] California Academy of Sciences: architecture in harmony with nature, p.6

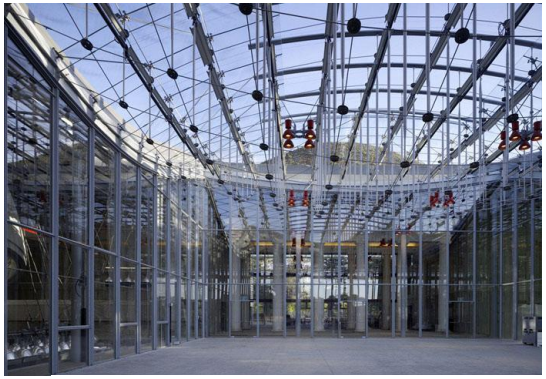

Figure 6: skylight over courtyard

The Academy features an aquarium, a natural history museum, a living rainforest, a planetarium, and world-class research and education programs under a 2.5 acre green roof.[4] The waving series of hills and valleys in the green roof are modeled upon the natural landscape around it. The concept is to "lifting up a piece of the park and putting a building under it"[5], resulting in green roof garden that provides a unique experience and helps the project to achieve the highest level of sustainability. Even in a busy and crowded space like subway station, Lifting natural landscape creates a dramatic sense of space and raises public awareness.

Figure 7: green roof with skylight

Figure 8: green roof

[4] California Academy of Sciences: architecture in harmony with nature, p.8

[5] California Academy of Sciences: architecture in harmony with nature, p.11

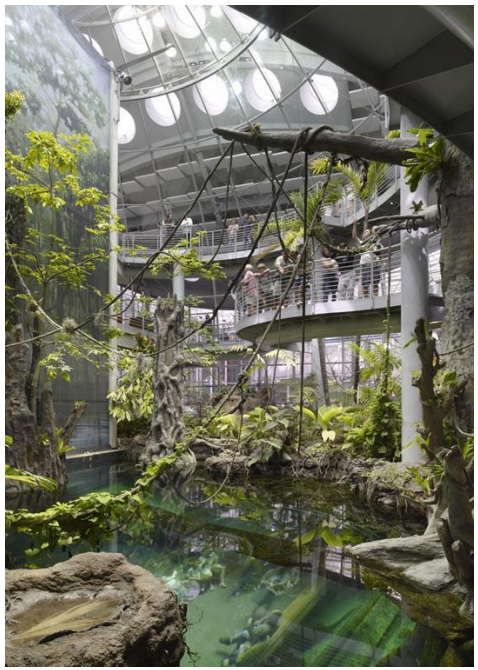

Figure 9: rainforest museum under curved green roof

The roof's contours conform to the major exhibit components, collections and administration facilities below. The two largest domes with skylights rise above the planetarium and rainforest exhibit, providing the space with natural light and ventilation.

This steeply sloped dome presents challenges for the installation of the plants. The key to solve this problem is the BioTray, a biodegradable, reinforced, modular propagation tray made from rapidly renewable coconut coir fibers.[6]This tray provided water retention for the plants and helped to hold the growing medium in place during plant establishment. It also encourages plant growth by using a mycorrhizal biological inoculum that facilitates nutrient uptake and helps roots to grow through the tray, providing further stabilization.

Figure 10: rainforest museum under curved green roof

[6] California Academy of Sciences: architecture in harmony with nature, p.29

Figure 11: skylight

Additionally, the steep slopes of the roof act as a natural ventilation and cooling system. Fresh air which is cooled by the vegetated surface is funneled into the building, whose skylights peel back to allow cool air to sink into the building to offset mechanical cooling.

Creating an artificial landscape in subway station seems inefficient; unlike the Academy which itself is a romantic garden, subway station is highly functional and extremely mobile. However, lifting the landscape into the ceiling which does not interrupt people's life directly infuses the space with new identity and vitality, redefining the definition of subway not being a boring waiting spot but an interactive public park. Structurally similar to the Academy's green roof, material such as BioTray can be used to put this idea into practice. Also, plants in the "green ceiling" are natural air conditioner and freshener, improving underground air quality.

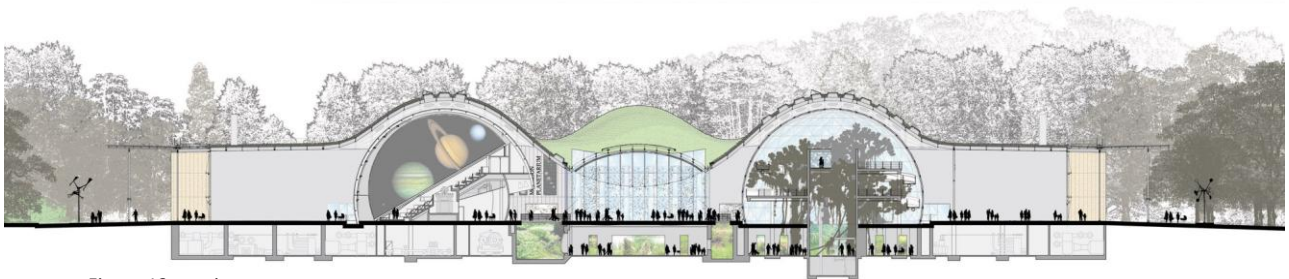

Figure 12: section

Figment 2010 City of Dream Pavilion Competition, Winner: Living Pavilion
New York, USA, 2010

Figment and the Structural Engineers Association of New York host a competition to design and install a pavilion for the 2010 summer on Governors Island. The City of Dreams Pavilion is to be a temporary gathering place for people, enjoying performances and experiencing the historic context of Governors Island. This competition asks designers to consider the full lifecycle of their proposals, with as little environmental impact as possible, considerations including the materials, placement, de-installation, and the future of the pavilion after demolishing.[7]


Figure 13: rendering


Figure 14: rendering

[7] http://figmentproject.org/2010/long-term-exhibitions/living-pavilion/

Figure 15: actual installation of pavilion

The Living Pavilion, designed by Ann Ha and Behrang Behin, is a low-tech and low-impact installation that employs milk crates as the framework for growing plants, similar to a green wall. On the underside of the structure, a specific shade tolerant species of plant called liriope is used to fill the interior surface. The top side of the structure is planted with grass seeds that helps keep the roots of the liriope shaded and cool. A similar design challenge faced by this project and the Velux competition is how to keep the plants upside-down and still maintain their life. It requires stabilizing and rooting the plants on the back side of the milk crates and enough watering. Their investigation of how the structure withstands the hanging plants adds a valuable lesson to the formation of the “green ceiling” for the subway station. And the fact of successfully installing the pavilion has proven the feasibility of this proposal.

The Design: Velux Lighting Competition

Figure 16: interior rendering

The proposal for the subway station revolves around the idea of transporting sunlight into the underground transportation platforms. The technology is called fiber optic solar lighting. The science of fiber optics has been around for decades, but the concept of capturing and actively transporting sunlight is fairly new. The system has small lens mechanisms that are able to follow the path of the sun across the sky with an implemented photo-sensor controlled tracking system. The received sunlight captured into fiber optic cables is transmitted into a light fixture at the other end.

The canopy, similarly with the canary Wharf Underground Station, takes the shape of a simple convex curvature. It incorporates glass-reinforced plastic roof which supports a network of solar panels and sunlight-collecting lenses that connect to the underground portion through fiber optic cables. The glass panel walls of the canopy provide users with a visual connection of the fiber optic cables as they run from the underside of the structure down to the subway platform interior.

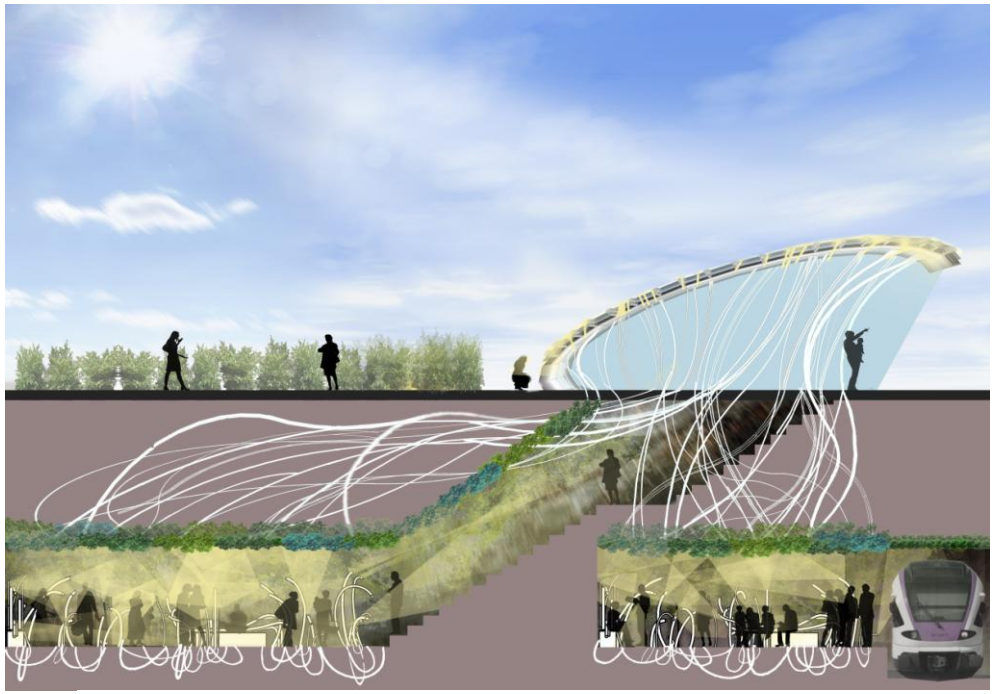

Figure 17: section

At underground level, in the common area the inverse of the above ground happens. Green plants are suspended against the ceiling, as suggested in the Living Pavilion. Light from the sun transported underground, now emit from the ends of flexible tubes-like shapes that sprout upward from the floor and house the ends of the optical fibers from the canopy above. The flat greenery now becomes the sky and the sun is “grown” from out of the ground. Renzo Piano created a kingdom of wonder and greenery above the ceiling while this project tries to inverses the position, moving the greenery underneath the ceiling. The green ceiling not only creates an interesting visual effect, but also actively produces oxygen inside the subway system so that travelers can enjoy fresh air. To incorporate human interaction into this space, the tubes were designed to be flexible so that people could alter their position, bend them, or even sit on top of an array of them like a bench. People are also able to control the direction of lights in the vicinity of the space they are using.

This design aspires to create a synthesis of form, structure, light and life, imagining a future in which nature is brought back into the underground. Technologies such as green roofs and green walls will not erase the dense vitality of the station, but add some green to the mix. These developments will not only have a positive impact on the city’s environment, but will also enrich the lives of people: they will add a new dimension to the urban experience, making possible new forms of spatial and architectural expression.

Images Reference

Figure 1-2: http://www.fosterandpartners.com/Projects/0579/Default.aspx

Figure 3: Foster + Partners: Catalogue. p.255

Figure 4: http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

Figure 5: Academy of Sciences: architecture in harmony with nature. p.89

Figure 6: Academy of Sciences: architecture in harmony with nature. p.82

Figure 7-8: http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

Figure 9: Academy of Sciences: architecture in harmony with nature. p.106

Figure 10-11: http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

Figure 12: Academy of Sciences: architecture in harmony with nature. p.73

Figure 13 -14: http://www.bustler.net/index.php/article/figment_2010_city_of_dreams_living_pavilion/

Figure 15: http://www.nad-design.net/design_center/author/nuno-abreu/

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