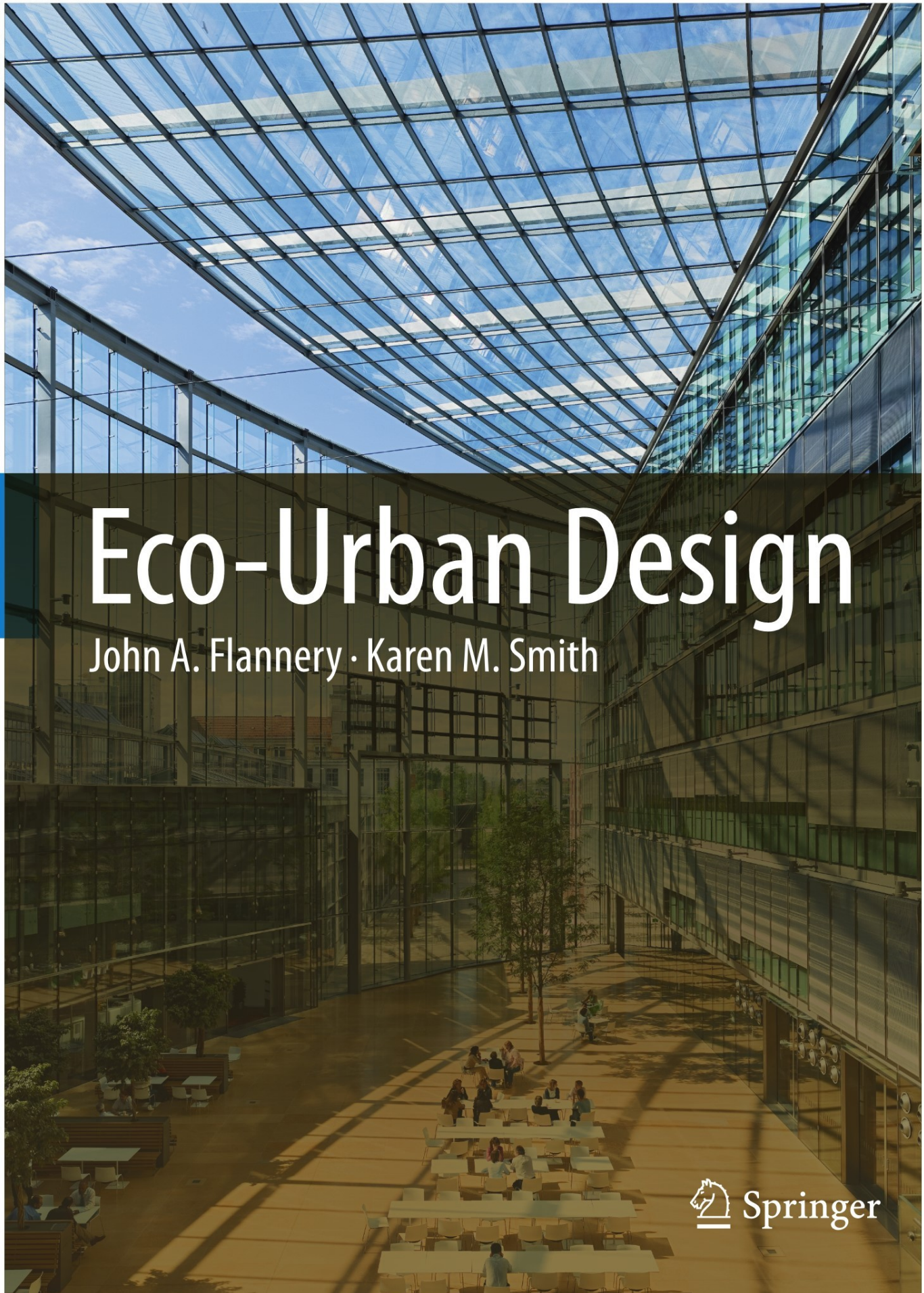
Eco-Urban Design
John A. Flannery · Karen M. Smith
Springer

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ECO-URBAN DESIGN

John A. Flannery and Karen M. Smith

ECO - URBAN DESIGN

Social Housing

Private Homes

Introduction

"I hope the next generation of architects design buildings that breathe with, work with, and make use of nature, so that it's not just architecture as usual plus a bit of green on top."

Renzo Piano, Architect (Q. and A. Miyoko Ohtake 26/12/2008)

Mankind's original primitive habitat, the cave, provided shelter from wind and rain, shade from the sun, and natural ventilation. Fuel for heat, light and cooking was found locally from sustainable sources. Successive generations of cave dwellers left minimal impact on the environment. However, since the moment early man was compelled to venture further afield in search of food and shelter for a multiplying population, subsequent building activity has gradually impacted on the resources of the planet. We have now reached the point where these resources have become seriously depleted.

The challenge now facing 21st century mankind is to provide evolved buildings that no longer endanger the Earth's fragile ecological systems. Eco-Urban Design demonstrates how design teams world-wide are rising to this critical challenge.

The featured projects consider how best to provide the basic functions of a building, air of adequate quality, controlled balance of lighting and shade, economical provision of energy and consideration of the health and well being of its occupants. Architects and engineers, mindful of the consequences of their design decisions, are now setting the precedents for both the renewed and the new built environment.

"Eco-Urban Design", reviews the full spectrum of building activity, beginning with publicly funded buildings. The more responsible government agencies now strive to commission buildings which are not only fit for purpose but are also models of energy efficiency and sustainability. A culture of waste and egocentric design is gradually being eradicated. Buildings such as the Environmental Protection Agency building in Denver epitomise this new ethos without diminishing the architectural merit of an important public building.

In the competitive world of commercial property, developers looking to gain an advantage now see investment in green technologies and energy saving designs as vital to the success of a project. This initiative directly responds to the demands of today's more discerning potential occupiers.

Similarly, increased consumer demand for affordable housing has sparked a revival in community based schemes. In many cases both public and private sectors join forces to provide value for money solutions. Many of these sophisticated residential schemes are able to trial renewable energy technologies on site, contributing greatly to the common cause.

Where a single family has ambitions to tailor a dwelling to their own individual needs, architects and designers now work closely with these clients to advise on strategies for an economical, sustainable lifestyle. It is evident that these aspirational clients need not compromise on architectural style in creating these inspired, ecologically sound, private homes.

The projects featured are extremely varied in terms of use, scale, geographical location and financial budget. Individually and collectively, they all provide a valued contribution to the evolution of good design, and positive proof that it need not cost the Earth. *J. A. Flannery*

Environmental Protection Agency Region 8 Headquarters

Denver, USA

2007

Zimmer Gunsul Frasca Architects LLP

www.zgf.com

The year of 1858 saw prospectors from Georgia begin the tenuous gold rush to Pikes Peak, Colorado. In the subsequent land grab the South Platte River formed the basis of aspirational claims on both banks. Confusion reigned, tension rose and violence was threatened by the rival prospecting camps. Eventually, a whisky fuelled agreement was brokered at Cherry Creek Bridge resulting in Denver prevailing as the predominant city in the shadow of the Rocky Mountains.

The topographical combination of mountains to the west, the Great Plains to the east and an elevation of 5,280 feet ensures that Denver has a semi-arid steppe climate with four distinct seasons.

Denver's weather is generally mild, with around 300 days of prolonged sunshine a year. The winters vary from mild to cold. Large amounts of snow fall on the mountains, west of the city, however the drying air stream passing over the Front Range (orographic lift) restricts annual precipitation to a relatively low 15.81 inches in the city.

Monitoring these climatic conditions, relative to the performance of the new Region 8 headquarters building, is high on the agenda of the Environmental Protection Agency (EPA). The Denver building was designed to serve as a living laboratory and a sustainable design educational tool for the construction industry.

Located in an urban brownfield site adjacent to the Union station (Fig. 1), the building's masonry base reflects the surrounding historic warehouses, whilst the glass and aluminium facade are characteristic of the Lower Downtown (Fig. 2).

Population | 566,974

Coordinates | 39°44'21"N
104°59'5"W

Elevation | 1,609 m (5,280')

Precipitation | 402 mm (15.81")

Temperature | Average High:
17.9 C (64.2 F)
Average Low:
2.1 C (35.8 F)

Humidity | 53.5%

6 Environmental Protection Agency | Denver | USA | Fig. 1 above | Fig. 2 opposite

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16TH ST
LOWER
DOWNTOWN
DENVER
HISTORIC DISTRICT

The primary design strategy was to organise and orientate the building's form following extensive daylight and thermal modelling of the site. From this study, two "L" shape buildings emerged, totalling 292,000 square feet. A southeast/southwest sunward unit designed to control solar radiation, and a northeast/northwest windward unit designed to deal with the predominant winds (Fig. 2).

Consequently, differing facade design strategies could evolve to cope with the varied heat gain, and glare. External shades and interior blinds were customised appropriately.

Between the two "L" shaped units, a central atrium was formed to bring daylight into the building's interior and create an informal gathering space for EPA employees and the visiting public (Fig. 4).

In considering the challenge of reflecting the daylight within the atrium into the building's core and also preventing glare, mirror installations were abandoned at the research stage. Subsequently, a developed series of sail-like reflectors with a "C" plan shape and a parabolic structure were produced. A sail maker local to the design team offices was consulted and commissioned to produce the sails. The rigging was designed and installed by a company specialising in theatre set work. The resulting installation is dramatic, effective and was provided within the restraints of the budget (Fig. 6, Fig. 8).

Other sustainable design strategies employed include the flexible floor plate layouts for future adaptation to the needs of other tenants (Fig. 9).

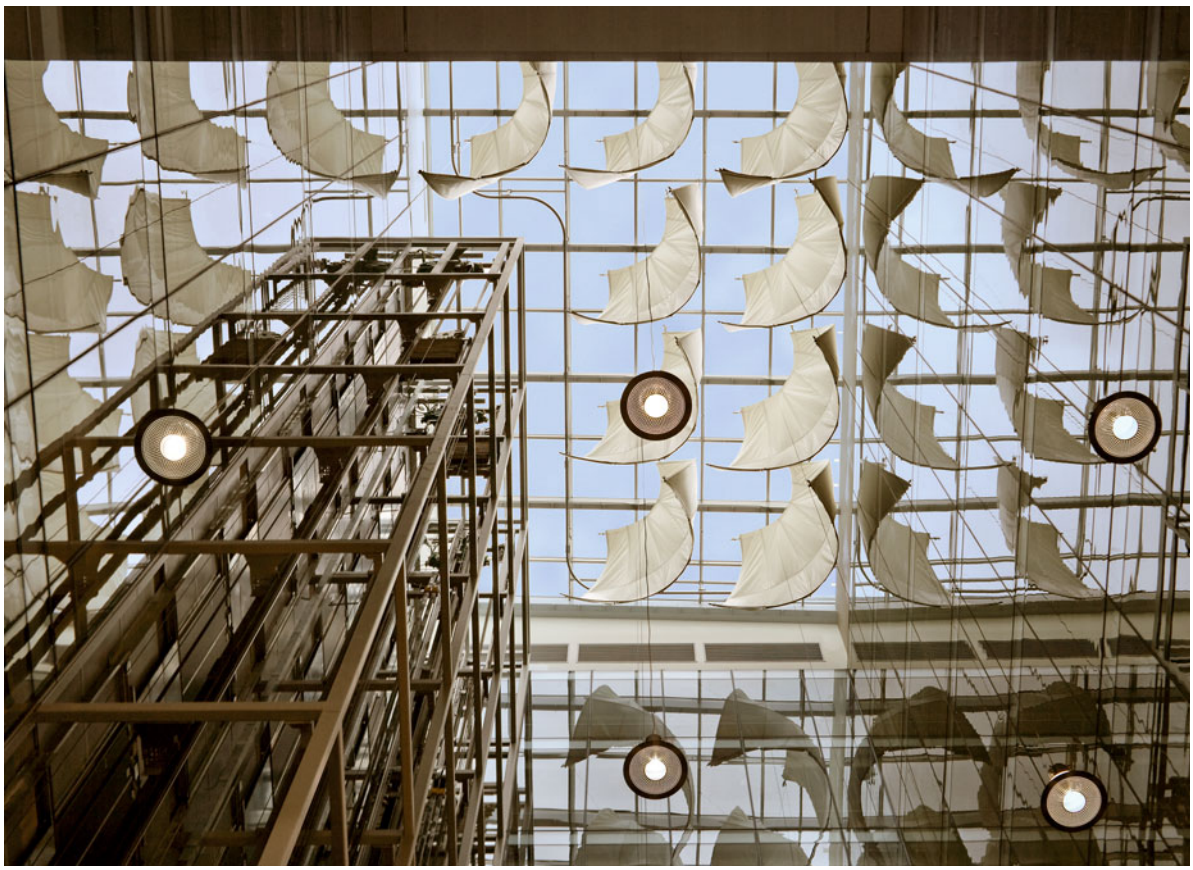
Concrete finishes are exposed reducing the need for further finishing materials, these masses also form part of the thermal strategy and facilitate the under-floor air distribution system.

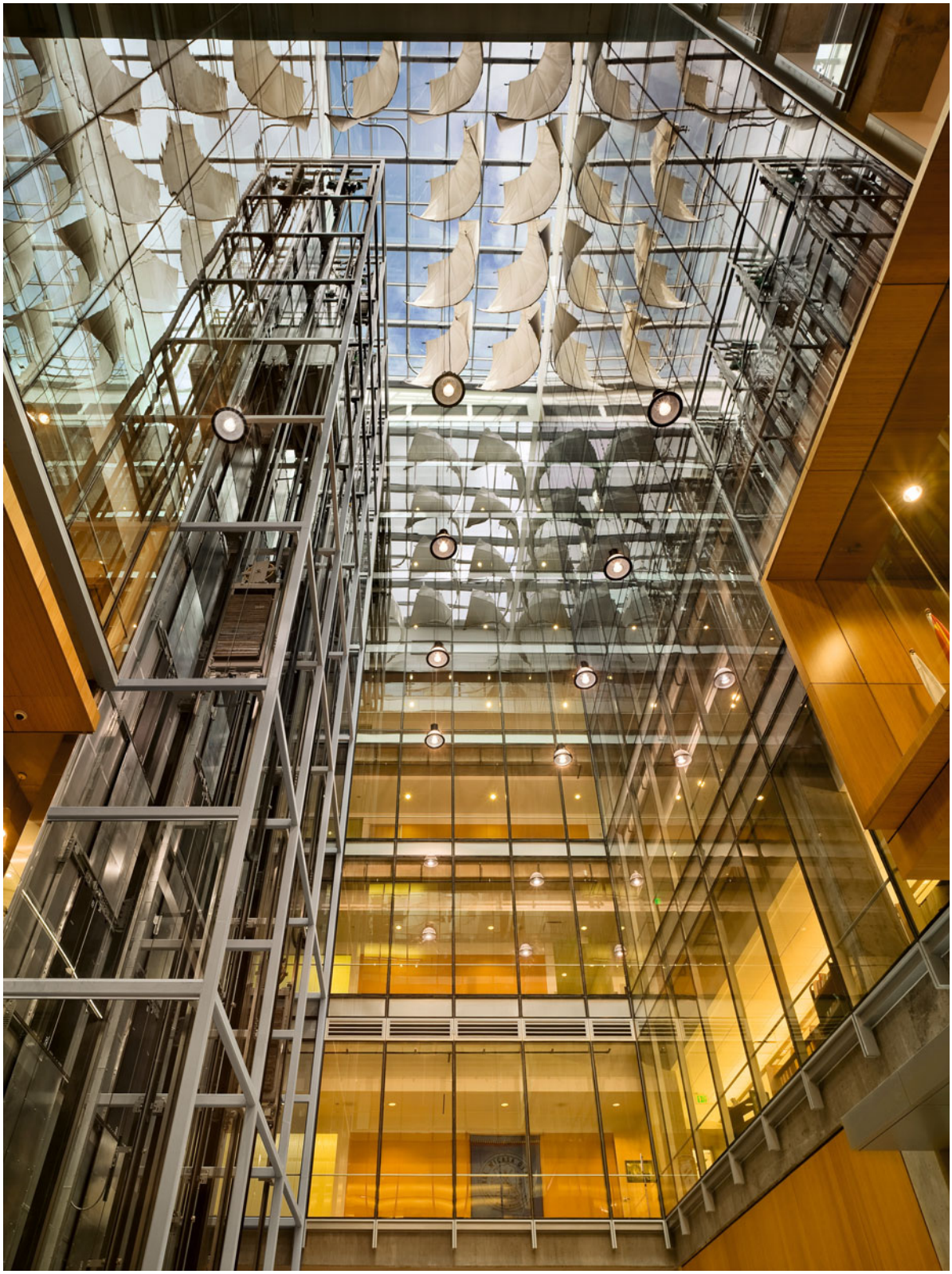
Roof mounted photovoltaic cells generate electricity for the facility (Fig. 5, Fig. 7).

Additionally, energy efficient, daylight responsive lighting is used throughout (Figs. 4, 8, 9, 10).

These combined strategies are designed to reduce energy consumption by 40% compared to that of a code baseline building of similar size.

Fig. 5 below





To achieve Leed Gold certification, the project's Construction Management policy and use of materials was closely scrutinised and implemented.

Construction waste was reduced through recycling. Fly-ash was used in the concrete sections of the building. Additionally, glass tiles, steelwork and carpets all included recycled material.

Renewable materials included cork floors, bamboo wall panels and doors made with rice hull cores. All wood-based materials were certified in accordance with the Forest Stewardship Council's principles and criteria. A regional sourcing policy on materials was also adopted in an attempt to reduce transportation as far as possible.

The development of the EPA's eco-roof (Fig. 11) was implemented by the designers, Zimmer Gunsal Frasca, in consultation with the EPA's own experts in this field.

In the Front Range climate zone precipitation is scarce. The team's goals were to demonstrate to local authorities that Denver's first eco-roof could remove pollutants from storm water and reduce the run-off rate of this precious resource.

It is thought that green roofs, where appropriate, adopted as a city policy can greatly reduce the 'heat island effect' produced by conventional, dark, untextured roofing in dense urban areas.

The EPA roof was installed over three terraced levels totalling 20,000 square feet. The vegetation is made up of native plant species and soil media.

The performance of the roof's components is being monitored by various groups including the EPA, the city, the Department of Horticulture at Colorado State University and the Denver Botanical Garden. This study hopes to inspire the future development of these technologies in the Denver region.

In a further effort to achieve a 44% water saving compared to standard buildings, high efficiency and waterless plumbing fixtures are employed throughout the building.

In order to fulfil the EPA's mission statement "To protect the public's health and safeguard the natural environment", post completion evaluations are conducted by the EPA and architects, Zimmer Gunsel Frasca demonstrating that the project's aims have been achieved, including the predicted significant energy and water usage savings.

California Academy of Sciences

San Francisco, USA

2008

Renzo Piano Building Workshop / Stantec Architecture (San Francisco)

www.rpbw.com

The Pacific Ocean's cool currents combined with the higher temperatures of the California mainland, produce the fog and mist which clings to San Francisco's famous hills in spring and summer. These landmark hills of Twin Peaks, Nob Hill, Pacific Heights and Russian Hill are now to be rivalled by the newly formed mounds presiding over the verdant roof of the California Academy of Sciences in Golden Gate Park.

The new Academy's mission statement is "To Explore, Explain and Protect the Natural World". A major component of this philosophy was to incorporate a sustainable design, construction and operational policy into the project. Many of the sustainable design principles used in the reconstruction of the facility were intended to be a working exhibit for the visiting public to view and understand.

The new Academy is located on the same site as the previous halls. This required the demolition of the existing buildings which were previously constructed over a 50 year period from 1916. To provide the best possible facility, the architects formed a design team to lead and collaborate with consultants in various specialist fields including Ove Arup and Partners (engineering and sustainability).

Organised around a central Piazza, the Planetarium Dome, Rainforest Biosphere (Fig. 2) and Steinhart Aquarium represent Space, Earth and Ocean. These three iconic exhibits create the new San Francisco "hills" in the undulating green roofscape (Fig. 3, Fig. 4, Fig. 5, Fig. 6).

This roof, set at the same height as the original, seeks to unify and consolidate the new Academy.

Population | 808,976

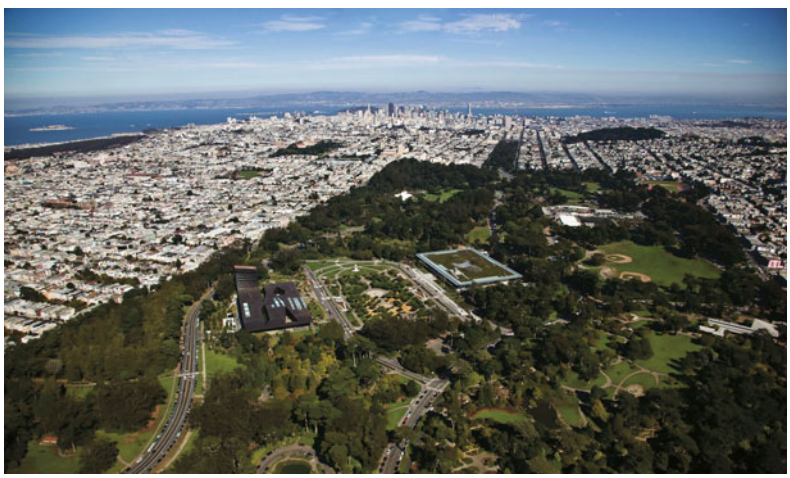
Coordinates | 37°46'45.48"N
122°25'9.12"W

Elevation | 16 m (52')

Precipitation | 566 mm (22.28")

Temperature | Average High:
18.4 C (65.1 F)
Average Low:
14.6 C (58.3 F)

Humidity | 73%



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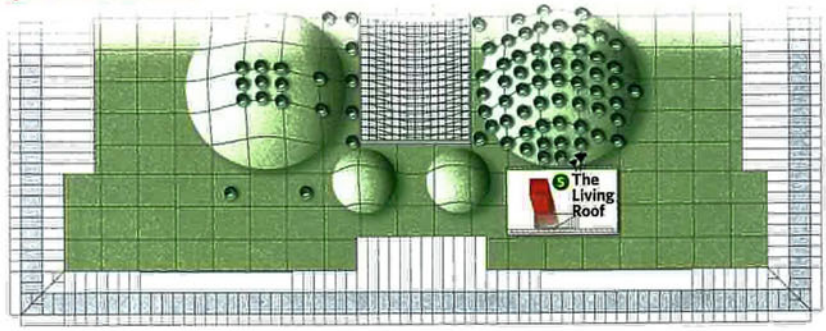
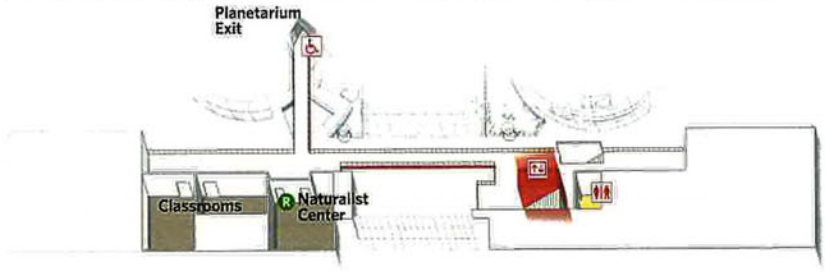
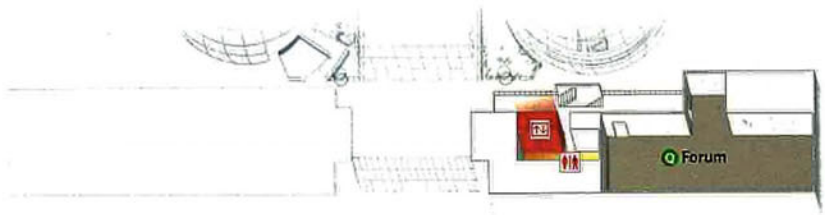
California Academy of Sciences



Roof



Level 3

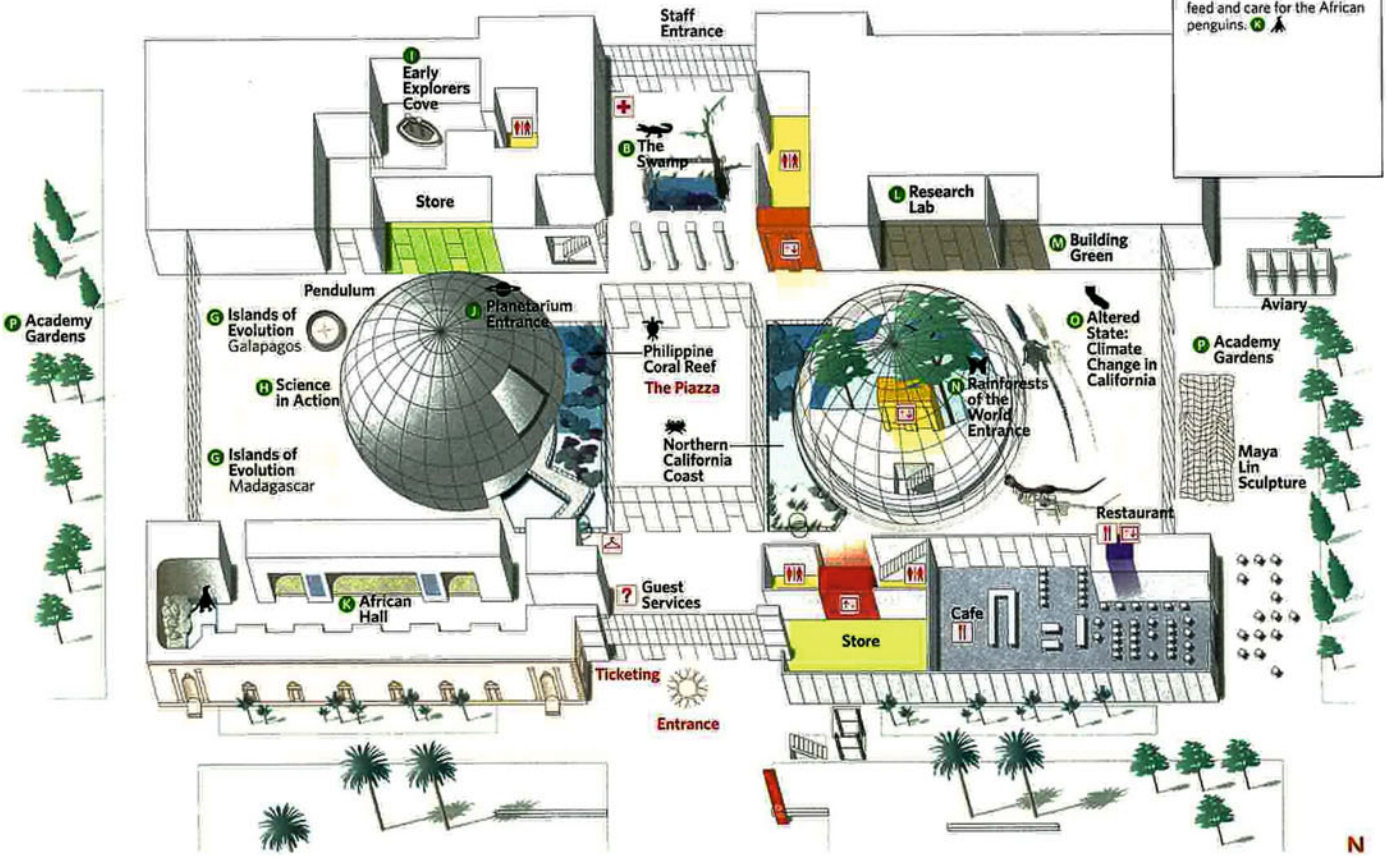


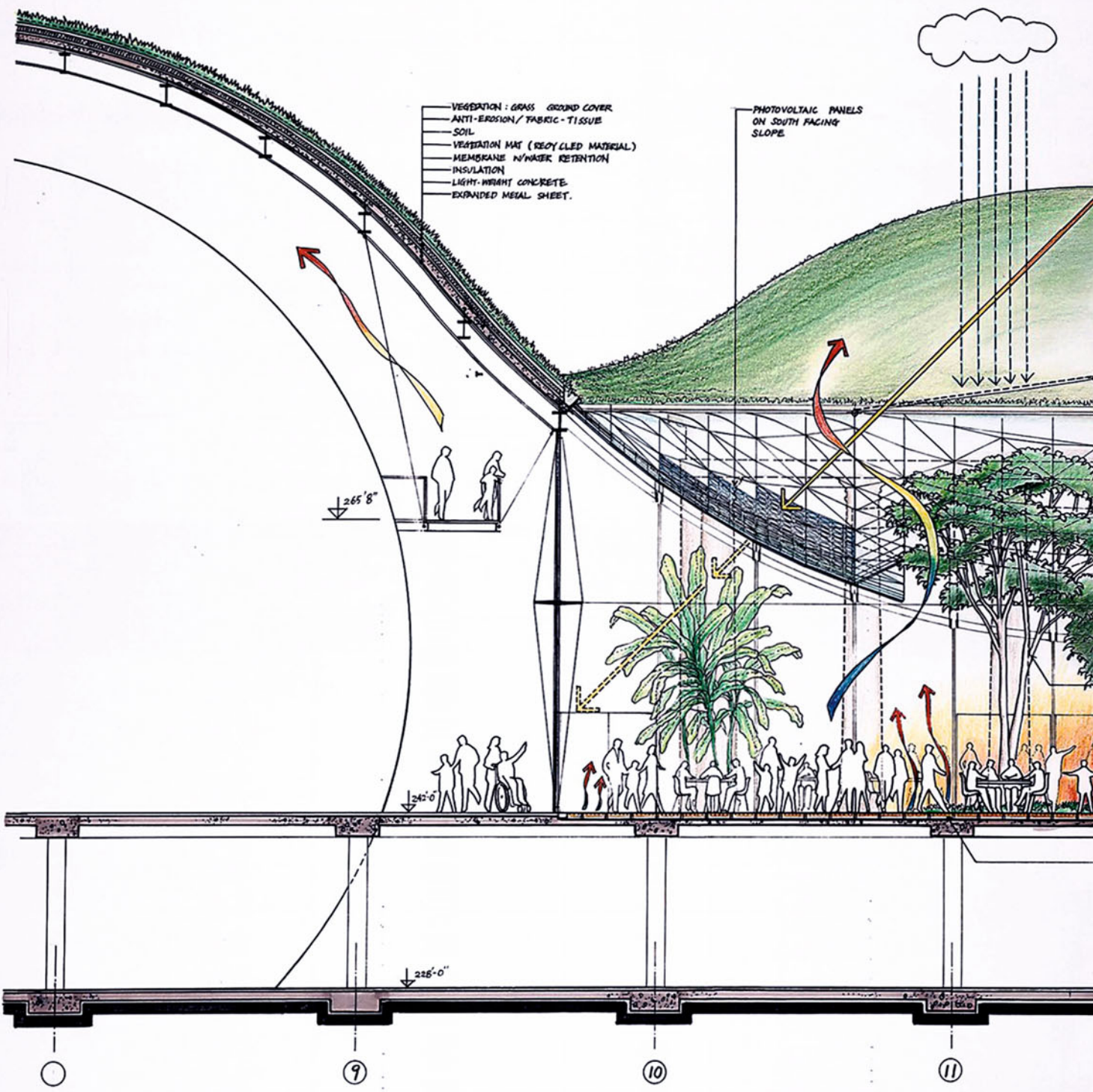
Level 2

Daily Programming
Schedule varies. Visit the Guest Service desk for showtimes.

Planetarium
Fly through the Universe in the Academy's state-of-the-art planetarium. Visit the kiosk at the planetarium entrance to select your showtimes. J

Penguin Feedings
See how Academy biologists feed and care for the African penguins. K




VEGETATION : GRASS GROUND COVER
ANTI-EROSION/ FABRIC - TISSUE
SOIL
VEGETATION MAT (RECYCLED MATERIAL)
MEMBRANE W/WATER RETENTION
INSULATION
LIGHT-WEIGHT CONCRETE
EXPANDED METAL SHEET.
PHOTOVOLTAIC PANELS ON SOUTH FACING SLOPE
265'8"
242'-0"
225'-0"
9
10
11