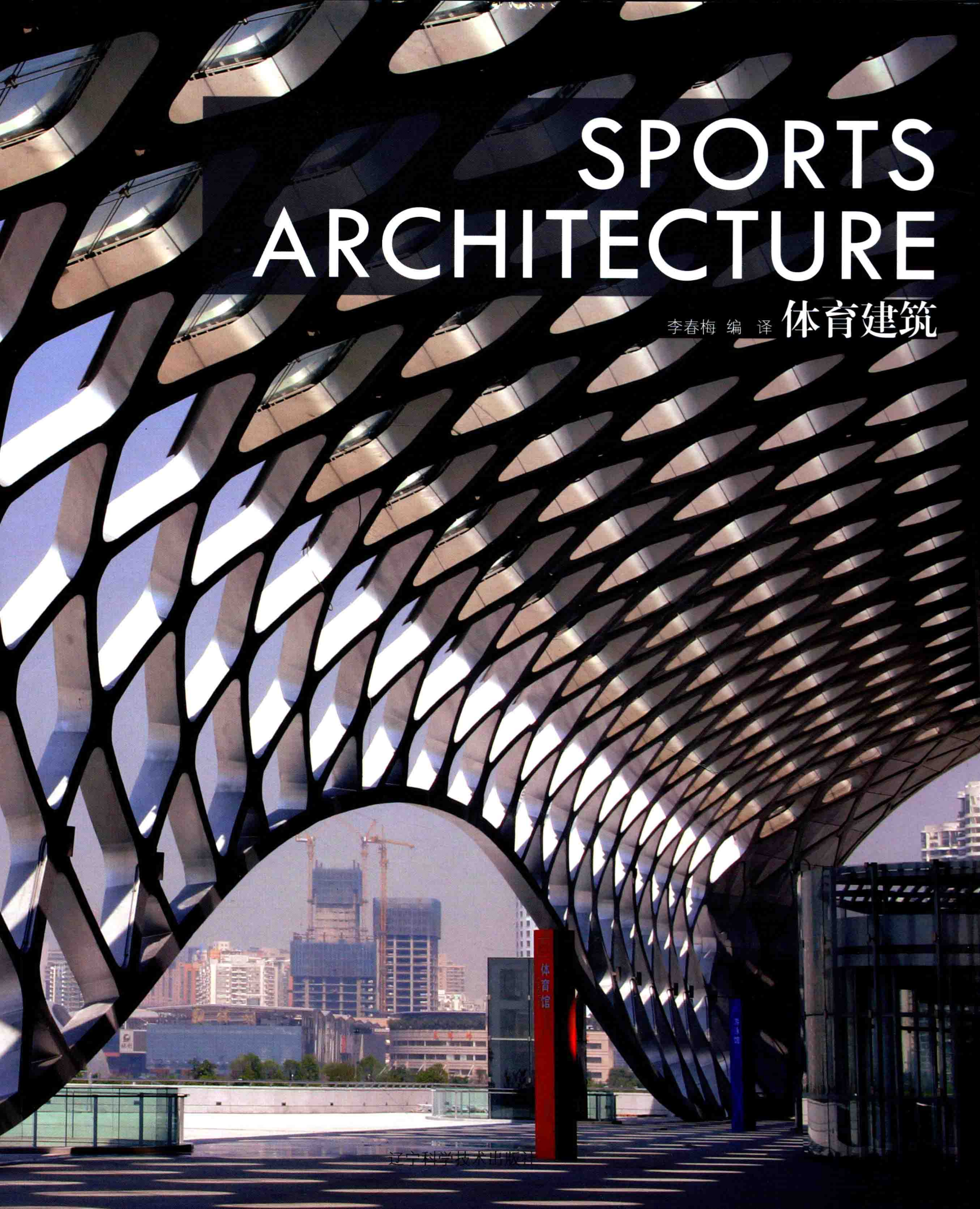


# SPORTS ARCHITECTURE

李春梅 编 译 体育建筑



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# SPORTS ARCHITECTURE

李春梅 编译 体育建筑

# The significance of Legacy in the design of tomorrow's major sports facilities

——Richard Breslin

# 设计遗产对于未来大型体育设施设计的重大意义

——理查德·布雷斯林

Major sports facilities often built for an international event. An event creates a huge global opportunity to showcase a city through a major stadium to millions of people around the world but equally important is the building's legacy afterwards. What's left behind after the main event should be as sustainable as it is beautiful, and that is sustainable in a widest possible sense - economically, socially and environmentally? Sometimes the sports facility might not even be permanent, and it can be disassembled after the event, taken away and built somewhere else, for another major event.

Populous is honoured to write this preface for the book Sports Architecture for Liaoning Science and Technology Publishing House. As members of the construction industry in the developed world, we feel particularly responsible for the environment, and as specialists and leaders in the design of major sports and entertainment buildings, we continually look for ways to approach the construction of the buildings sustainably. The key principal is that sports stadia are huge pieces of infrastructure and when it comes to sustainable design; their use of energy is a major issue. The industry must learn to reduce the energy use in their initial construction – the so-called "embodied energy" and to later reuse the building materials in future projects.

The Sydney stadium for the 2000 Olympic Games set the benchmark for the modern sustainable stadium. It was the largest Olympic stadium ever built and as Sydney was the Green Games, the stadium included innovative sustainable design measures such as passive ventilation and collection of rainwater, now included in stadium design everywhere.

London began to examine these issues immediately after it won the right to stage the Olympic Games for 2012. London already had Wembley stadium, it didn't need a second national stadium. London has also learnt from Sydney that it can take 10 years to turn a dedicated Olympics stadium into a truly useful community resource so legacy was considered right at the beginning and the Government established a legacy company to plan for all Olympic venues after the Games.

At the same time legacy was considered, so too were construction methods and materials. What emerged at the end of the design process was a watershed in stadium design: a building that is flexible, lightweight, and semi-temporary, yet one that still makes a statement as the landmark stadium for the grand ceremonies of the London 2012 Olympics. It is designed to be reconfigured after the Games into a smaller stadium for soccer. It is the most environmentally friendly Olympic stadium ever built, using less steel than any other comparable Olympic stadium. It also has a roof made of fabric. The construction methods and materials meant the stadium was also built ahead of schedule. Construction began in 2008 and it was completed in March 2011. The London Olympic Stadium will also be one of

大型体育设施通常是为了举办国际性赛事而建立的。一场赛事可以使一座城市有机会通过一座体育场向全世界数以百万计的人们展示自己，而赛事过后这座建筑文化遗产也同样具有重要意义。赛事过后所留下的建筑应该是既美丽又具有可持续性的，这种可持续性是从最广泛的层面上来定义的——经济的、社会的以及环保的。有时候体育设施可能是临时性的，赛事过后就会被拆除、移走或者在其他地方重建以满足另一场赛事的需要。

Populous公司非常荣幸地为辽宁科学技术出版社《体育建筑》一书作序。作为发达国家建筑行业的一员，我们觉得非常必要对环境负责，作为大型体育休闲类建筑设计的专家和领军者，我们一直在寻找可持续性建筑的方法。核心的问题是体育场是大片基础设施的集合，当其实现可持续性设计的时候，能源的利用是一个主要问题。此行业必须要学会减少最初修建的能源使用——即所谓的“蕴能量”，然后减少未来项目建筑材料的使用。

为举办2000年奥运会所建立的悉尼体育场为现代可持续性体育场馆设立了基准。这是有史以来最大的奥林匹克体育场馆，由于悉尼奥运会致力于成为绿色奥运会，因此体育场包含了创新型可持续性设计方法，如被动式通风机雨水收集，现在这种方法被用于各地的体育场设计之中。

伦敦在赢得了2012年奥运会举办权之后马上开始仔细研究了这些问题。伦敦已经拥有温布莱体育场，其并不需要第二个国家性体育场馆。伦敦也在像悉尼学习，利用10年的时间将一座专门的奥运场馆转变成真正实用的社区资源，因此建筑遗产在最初建立的时候就被考虑到，而且政府成立了建筑遗产公司对赛后的奥运场馆进行规划。

考虑到赛后建筑遗产问题的同时，也考虑到了建筑方法和材料的问题。设计过程接近尾声的时候出现的问题是体育场馆分水岭设计：一座灵活、轻便、半临时性的建筑，且又仍然作为2012年伦敦奥运会的标志性体育场馆。设计意在赛后将其改造成较小的足球体育场。这是有史以来建造的最环保的奥林匹克体育场，比其他奥运场馆所用钢铁都少。它还拥有纤维制成的屋顶结构。建筑方法和材料的使用使得体育馆提前竣工。建筑始于2008年，竣工于2011年3月。伦敦奥林匹克体育场也将成为最快从奥运模式转变成有益的、可持续性后奥林匹克场馆的场馆之一。

从伦敦这里学到的知识现在正被用于苏契2014年苏契冬季运动会体育场设计中，这是Populous公司设计的第三座奥运场馆。

遗产设计对于社区体育场馆设计也是非常重要的，因为处于奥运场馆之中。例如新西兰的达尼丁，在建立新体育场的时候就面临





the fastest buildings to transform itself from Olympic mode to a profitable, sustainable post Olympic venue.

The lessons learned from London are now being translated into the design of the Olympic stadium for the Sochi 2014 Winter Games, which is the third Olympic stadium being designed by Populous. Legacy design is as important in a community stadium as it is in an Olympic stadium. Dunedin, in New Zealand, for example faced a particular dilemma building its new stadium. It is one of the most southerly cities in the world, and its cold, wet climate posed particular challenges. A big city might have a budget to afford moving tiers and opening and closing roof which would be an ideal solution in such circumstances. But Dunedin needed a smaller community stadium, with 20,000 permanent seats, and there was never going to be enough money in the budget to build a fully enclosed roof, or to cover the expense of bringing grass pallets in and out of the stadium for games.

So after many years of research, an innovative solution was found - enclosing a natural turf stadium in a specially engineered plastic. Forsyth Barr was officially opened in August 2011 and is the world's only permanently enclosed natural turf stadium featuring a space age, transparent roof clad in ETFE, a transparent polymer or plastic. The ETFE covering is light, enclosed and translucent, allowing maximum sunlight onto the pitch, so that the grass keeps growing but the fans are protected from the elements whatever the weather. Once again the lessons learnt from earlier work, this time, enclosing the centre court at Wimbledon, in London, provided important insights to what would be needed in Dunedin.

We believe that a stadium, more than any other building type in history, has the ability to shape a town or city. A stadium is able to put a community on the map, establishing an identity and providing a focal point in the landscape. Stadias are the most "viewed" buildings in history and have the power to change people's lives: they represent a nation's pride and aspirations. They can be massively expensive to build, but they can also generate huge amounts of money. Consequently the stadium will become the most important building any community can own, and if it is used wisely, it will be the most useful urban planning tool a city can possess. Designing for adaptability and legacy, with innovation and a respect for the environment - these are the key ingredients in major sports facilities of the future.

非常尴尬的处境。它是世界上最南端的城市之一，其寒冷潮湿的气候为体育场建设带来了挑战。

一座大城市的预算可能可以负担移动式阶梯及可开关式屋顶结构，这对于此类环境是非常好的解决办法。但是达尼丁需要的是是一座较小的社区体育场，20000个固定座位，而且也没有足够的预算资金用于建立完全封闭式的屋顶或者为比赛来回的移动草地。

因此，通过几年的调查研究之后，发现了一个创新性解决方案——将一块天然草皮放入专门设计的塑料之中。福赛斯·巴尔体育场于2011年8月正式开放，是世界上唯一一座拥有天然草皮的体育场，带有太空时代的透明乙烯四氟乙烯屋顶结构，即一种透明的聚合物或者塑料结构。乙烯四氟乙烯结构是轻巧、封闭、半透明的，使得赛场可以享受最多的阳光，因此草一直保持生长的状态，而球迷们则可以躲避任何天气的干扰。从早前项目作品中学到的知识，即这次将伦敦温布尔顿中央球场封闭起来，又一次的为达尼丁体育场设计提供了重要的借鉴。

我们相信，体育场馆，相较于历史上其他任何类型的建筑来说，都更加有能力塑造一座城镇或城市。一座体育场可以将一个社区显现于地图之上，在一处景观之上建立一个标志、提供一个焦点。体育场馆是历史上最“显见的”建筑，且又可以改变人们的生活：它们代表的是一个民族的骄傲和志气。它们的建造可能是非常昂贵的，但是它们也能产生巨大的资金收益。因此，体育场馆将成为任何社区可以拥有的最重要的建筑，如果被广泛利用，它将是一座城市可以拥有的最有用的城市规划工具。为了适用性和文化传统所设计，带着创新性和对环境的尊重——这些才是未来大型体育设施的关键组成部分。

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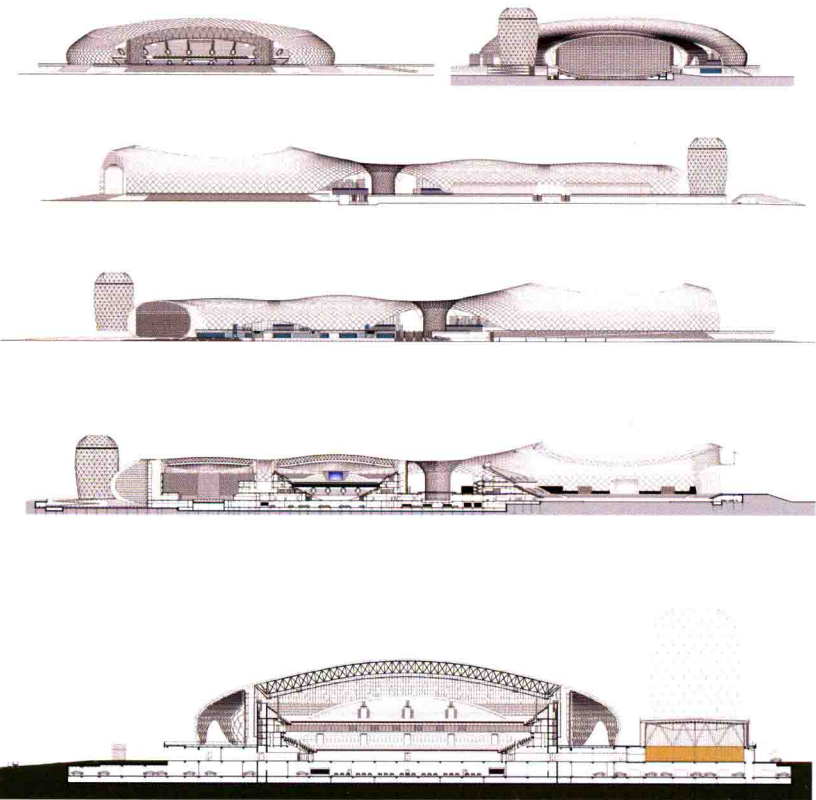
索引

深圳市南山区深圳湾体育中心

Shenzhen Bay Sports Centre

**Designer:** BIAD+AXS SATOW inc. **Architects:** Bing Wang, Xiaoli Kang, Yizhi Fu **Location:** Shenzhen, China **Completion:** 2011 **Photographer:** Chaoying Yang, Shaoming Xie **Building area:** 335,298m<sup>2</sup>

设计师：北京市建筑设计研究院+日本佐藤综合计画设计联合体 建筑师：**王兵** 康晓力 付毅智 项目地点：中国，深圳 完成时间：2011年 摄影师：杨超英 谢少明 建筑面积：335298平方米



Shenzhen Bay Sports Centre is located in the middle of Shenzhen Bay waterfront recreational district, northeast of the Nanshan Sea central district, in the Reclamation area of Shenzhen Bay and the southern edge of Binhai Avenue. It is adjacent to Keyuan Road to the west, Shahe West Road to the east, and inner lake of Shenzhen Bay to the south. Its west-east length is 720 metres, and north-south width is 430 metres. The total site area is 30.77 hectares, and total floor area is 326,000 square metres. Shenzhen Bay Sports Centre is the main venue of the 26<sup>th</sup> Summer Universiade held in Shenzhen 2011, taking the opening ceremony, table tennis finals, swimming competition and training functions. As major sports building complex, the centre facilities mainly include a stadium with 20,000 seats for audiences, a sports hall with 13,000 seats, a swimming hall with 650 seats, athletes reception centre, sports theme park and business operation facilities. After the universiade, the centre will be a sports and fitness venue for citizens of Nanshan district besides holding some of national comprehensive competitions, special competitions and sports training activities. Here will become a large comprehensive sports complex integrating competitive matches, fitness, leisure travel and trade expo activities.

As a new building complex located in Qianhai-Houhai district, which is one of the “Double Centres” of Shenzhen, Shenzhen Bay Sports Centre not only fully coordinates with the surrounding urban planning, and will also become an urban landmark of Nanshan district due to its spectacular, beautiful and extended pattern.

深圳湾体育中心位于深圳湾滨海休闲带中段，南山后海中心区东北角，深圳湾填海区内，滨海大道南侧，西临科苑路，东临沙河西路，南临深圳湾内湖，东西长约720米，南北宽约430米，占地约30.77公顷，总体建筑面积32.6万平方米，是深圳市2011年举办第26届世界大学生夏季运动会的主会场，赛时将承担开幕式、乒乓球决赛、游泳训练等比赛和训练功能。作为大学生运动会的主要体育建筑群，体育中心设施主要包括可容纳2万人的体育场、1.3万人的体育馆、650人的游泳馆、运动员接待中心、体育主题公园及商业运营设施。赛后除承担部分国内综合赛事、专项赛事及体育训练的功能外，主要作为南山区群众体育锻炼及健身场所，成为一个集竞技比赛、全民健身、旅游休闲、商贸博览为一体的大型综合性体育建筑群。作为深圳市双中心之一的前海·后海地区的新建体育中心建筑组群，深圳湾体育中心不仅充分考虑与周围城市规划格局的协调性，并以其壮观、优美、舒展的形态，未来必将成为南山的城市地标。

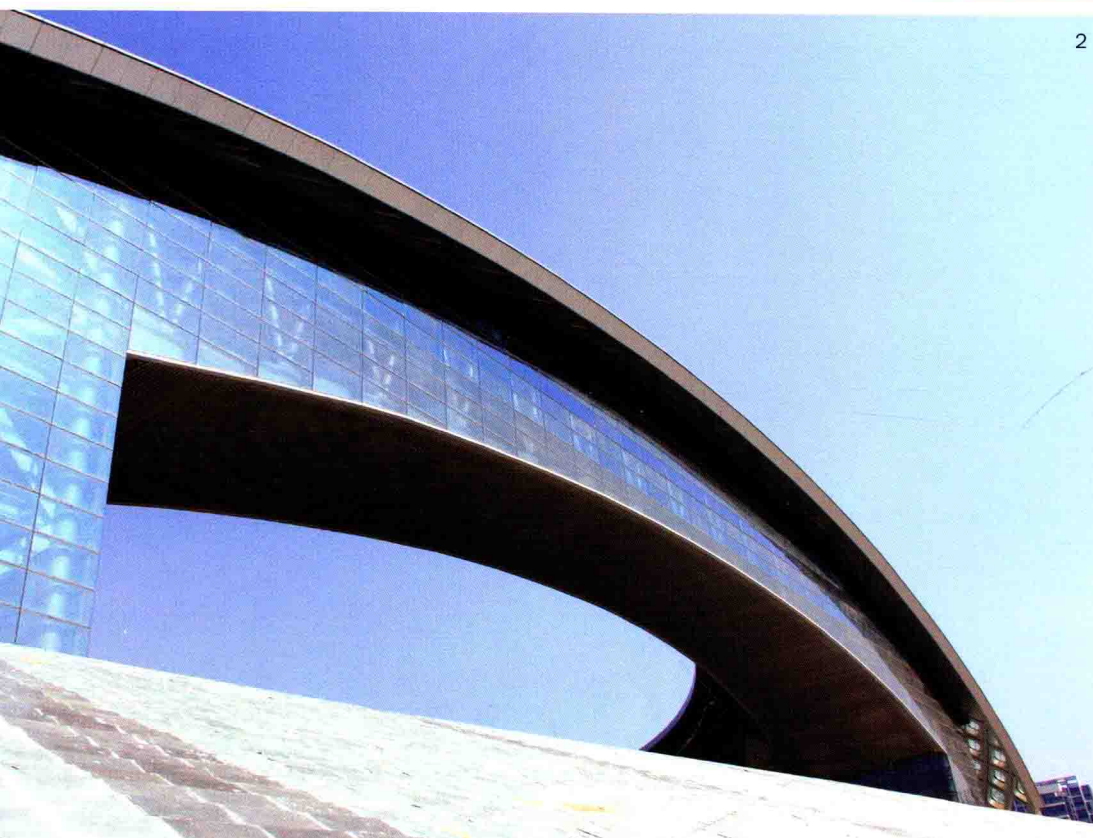
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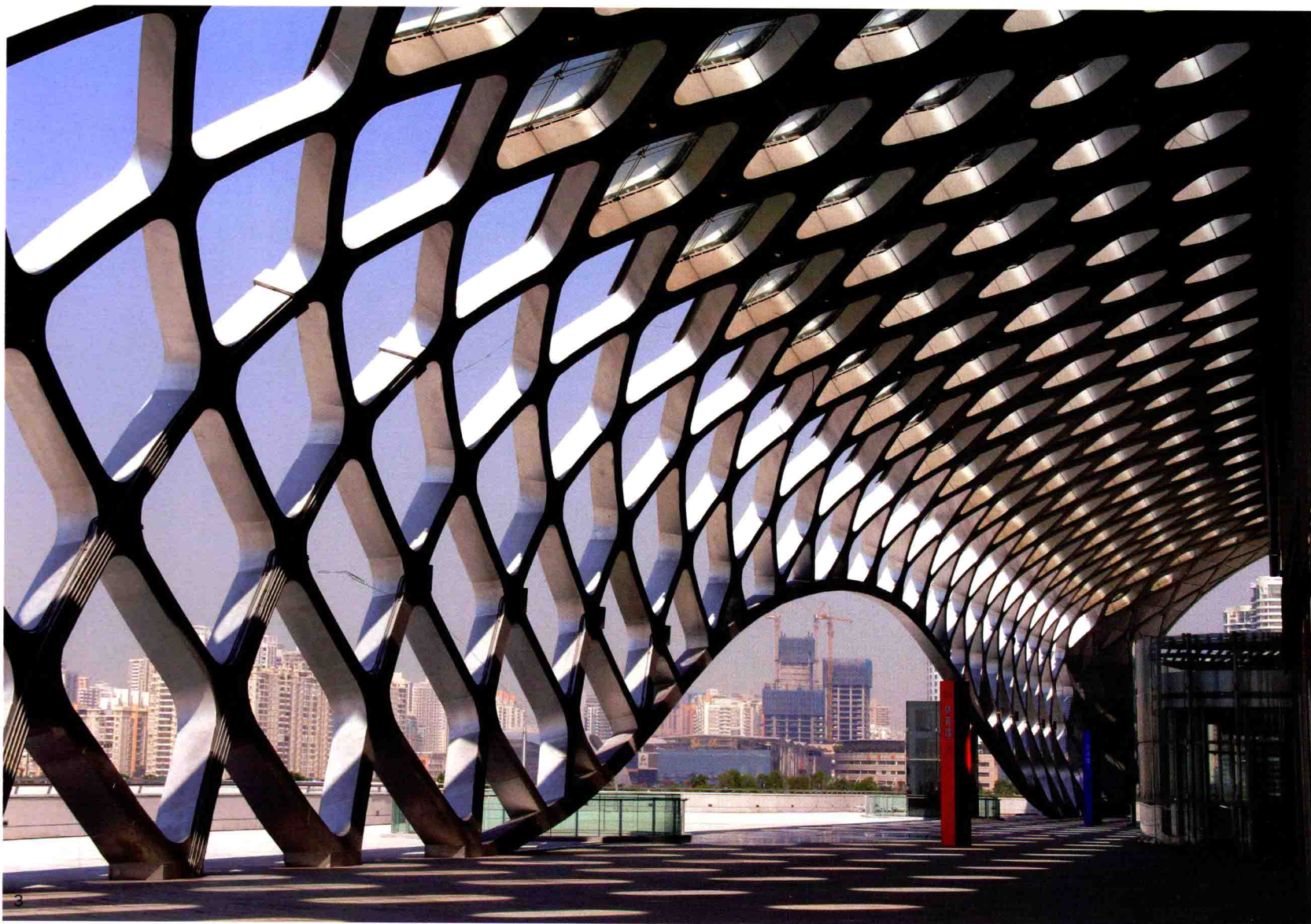




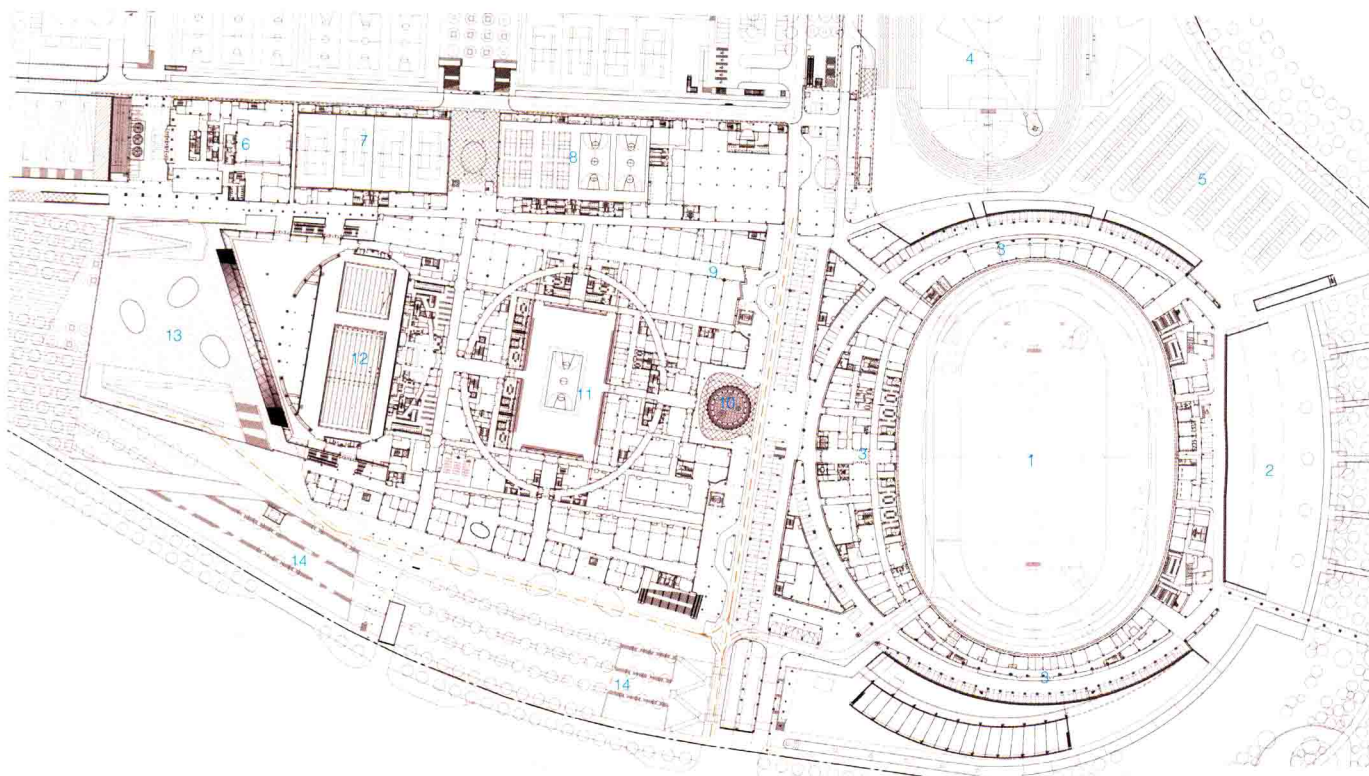
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- 2. Gate of Sea
- 3. Audience platform
- 1. 体育场
- 2. 海之门
- 3. 观众平台



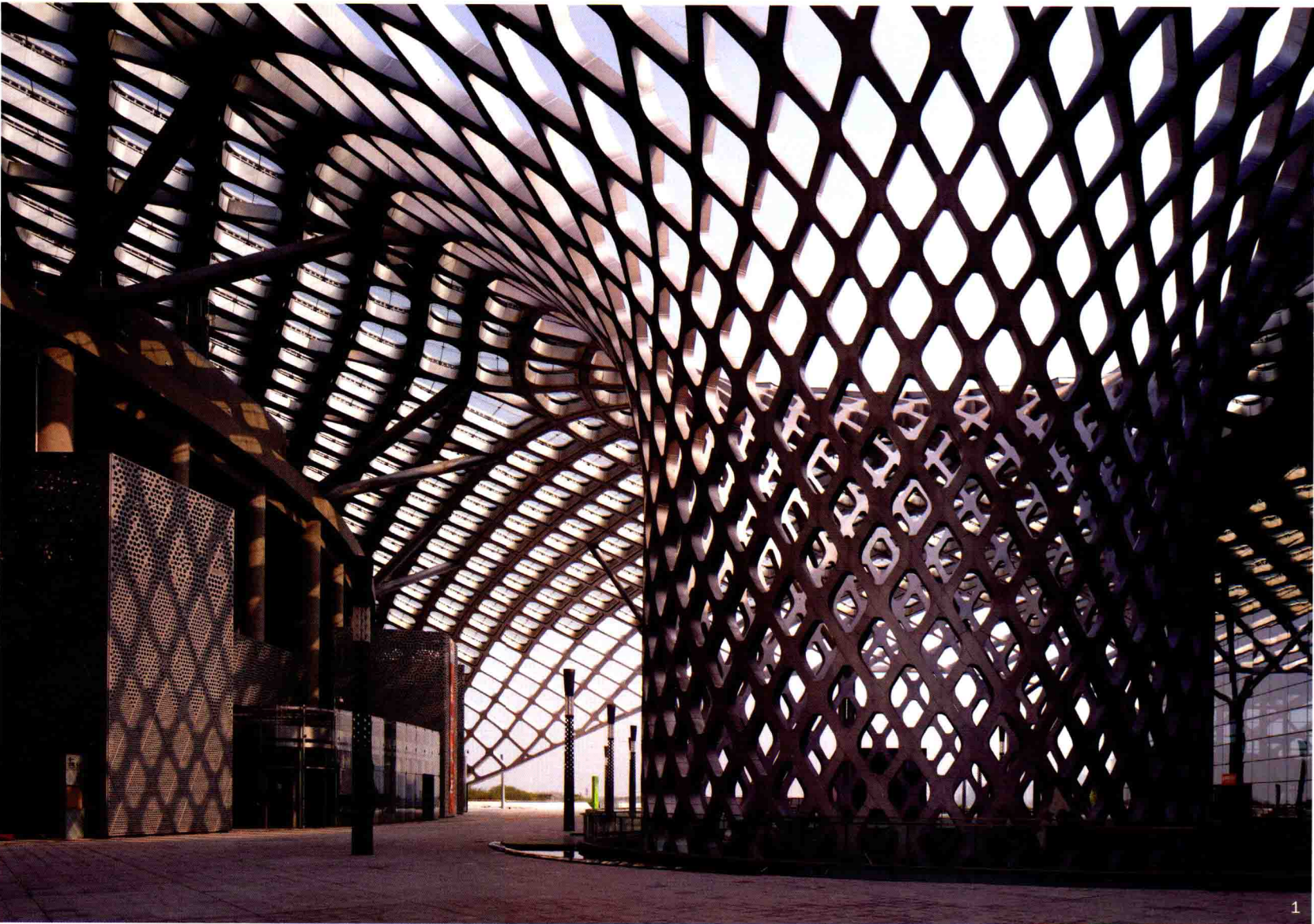


1. Stadium
2. Water pond
3. Rooms for competitions
4. Warm-up courts
5. Outdoor parking
6. Athletes reception centre
7. Tennis hall
8. Warm-up hall
9. Commercial rooms
10. The Tree Square
11. Gymnasium
12. Natatorium
13. Sunken plaza
14. Audiences entrance plaza

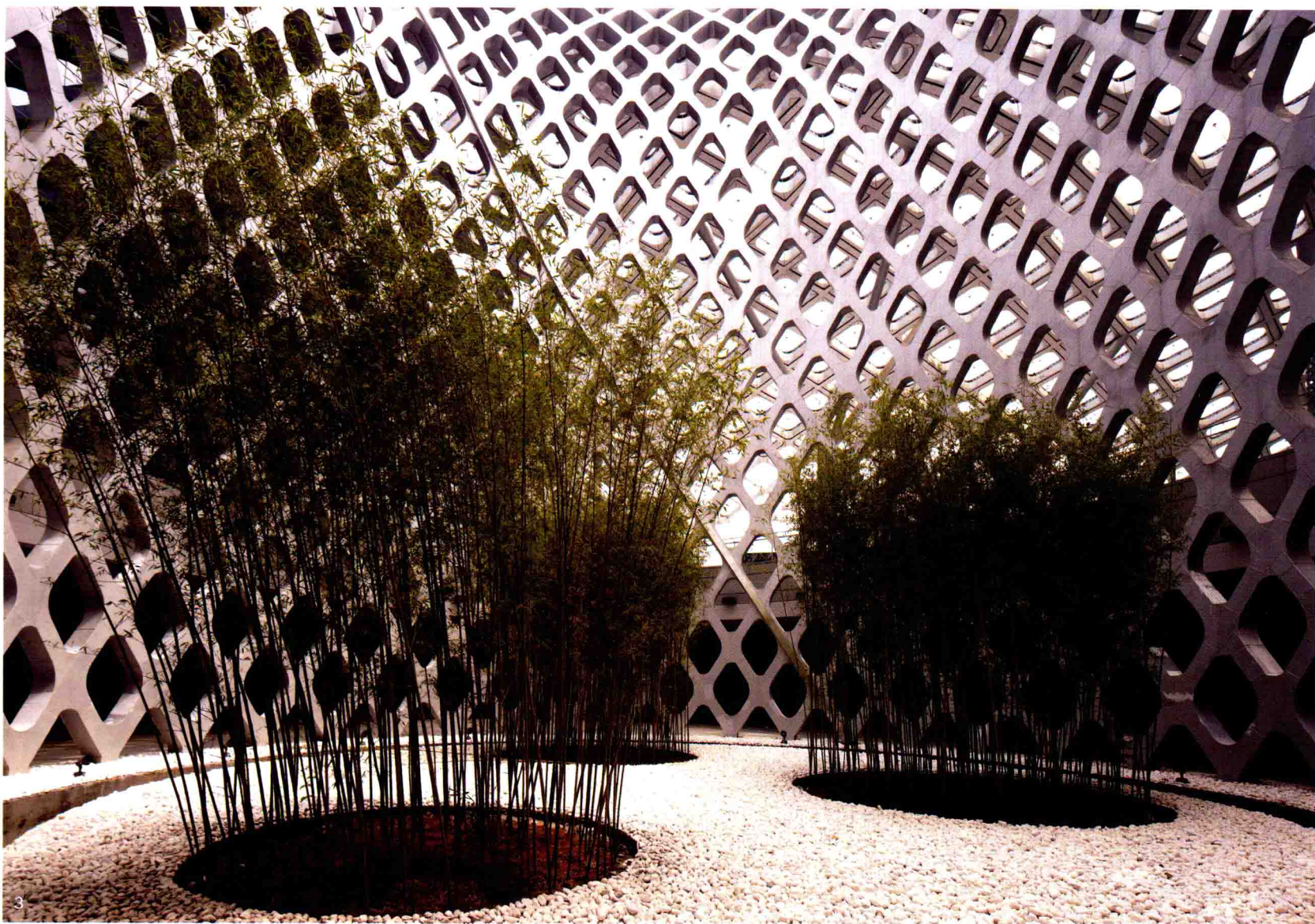


1. 体育场
2. 水盘
3. 赛事用房
4. 热身场地
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6. 运动员接待中心
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11. 体育馆
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13. 下沉广场
14. 观众入口广场



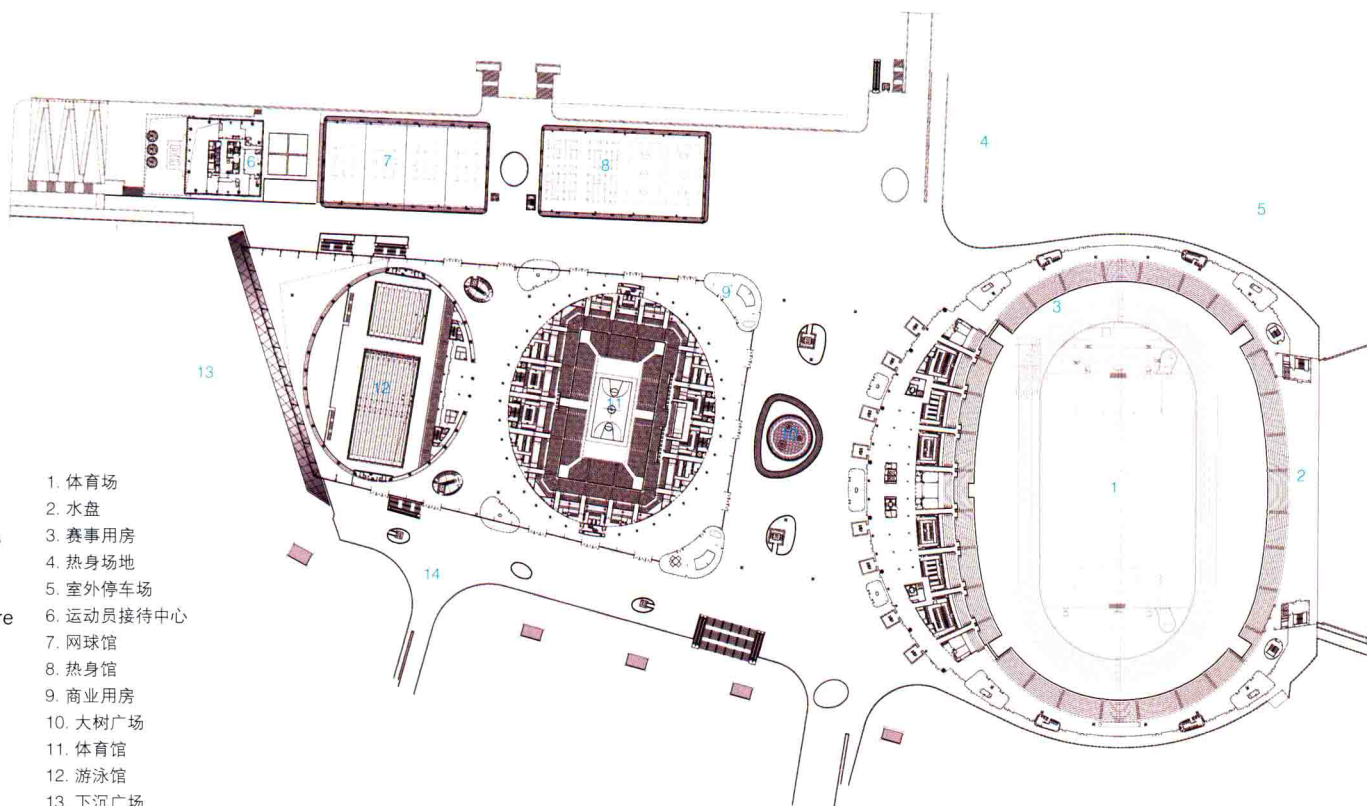






1. The Tree Plaza
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3. Heart of the Tree Plaza

1. 大树广场
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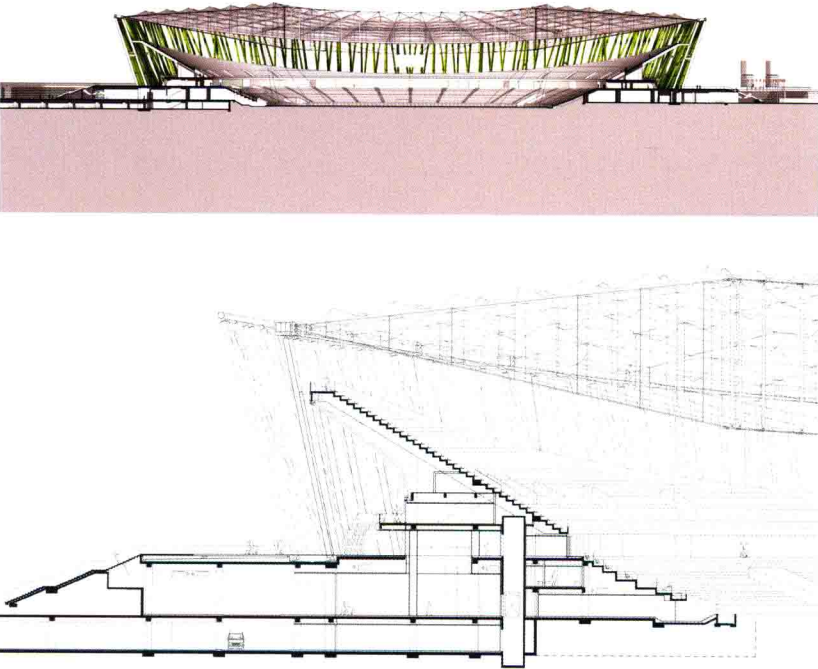
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| 13. Sunken plaza             | 13. 下沉广场   |
| 14. Audiences entrance plaza | 14. 观众入口广场 |



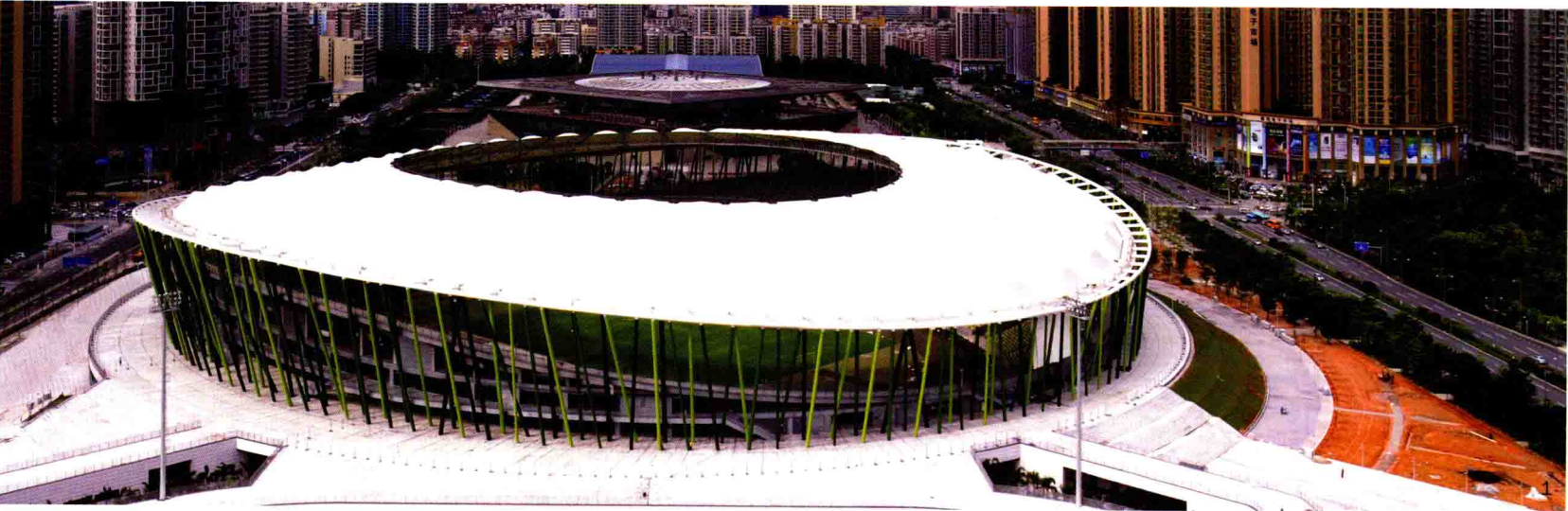
宝安体育场 Bao'an Stadium

**Designer:** gmp - von Gerkan, Marg and Partners Architects **Chinese partner practice:** SCUT South China University of Technology **Location:** Shenzhen, China **Completion:** 2011 **Photographer:** Christian Gahl **Building area:** 88,500 m<sup>2</sup>

设计师：冯·格康，玛格及合伙人建筑师事务所 中国合伙方：华南理工大学 项目地点：中国，深圳 完成时间：2011 年 摄影师：克里斯蒂安·盖尔 建筑面积：88500平方米



- 1. Bird view of the building in the daytime
- 2. Exterior view from the side
- 3. Overview of the building at night
- 1. 白天建筑鸟瞰图
- 2. 建筑侧面
- 3. 夜晚建筑全貌



For several weeks, the summer Universiade in Shenzhen, north of Hong Kong in the Pearl River Delta on the Chinese mainland, focused world attention on the up-and-coming city. The stadium (actually in the Bao'an district) is designed as an athletics stadium holding 40,000 spectators. However, during the 2011 Universiade, it was being used for football matches.

The extensive bamboo forests of southern China were the inspiration for the design. The bamboo look serves two purposes. It reflects the character of the region, and thus creates identity. And it serves as a structural concept for both the load-bearing frame of the stadium stands and the supports for the wide-span roof structure. The outermost part of the stadium unites façade, structure and overarching architectural theme in a single feature. The natural look of the bamboo forest, together with the interplay of light and shadow between the trunks, is interpreted structurally through rows of slender steel supports, as outsize, abstract versions of the bamboo shape.

The stadium is located in the immediate vicinity of a sports arena and swimming bath, which have already established an east-west axis. The stadium and the attached warming-up place fall in with this existing urban axis. The choice of a pure circle for the geometry of the stadium was a decision not to introduce any other geographical orientation into the urban-planning situation, and to emphasize the central character of the sports venue. Appropriately for the uses of the building, the stadium stands on a grassed plinth, which incorporates on the inside the lower tiers of seating and internal functional areas.

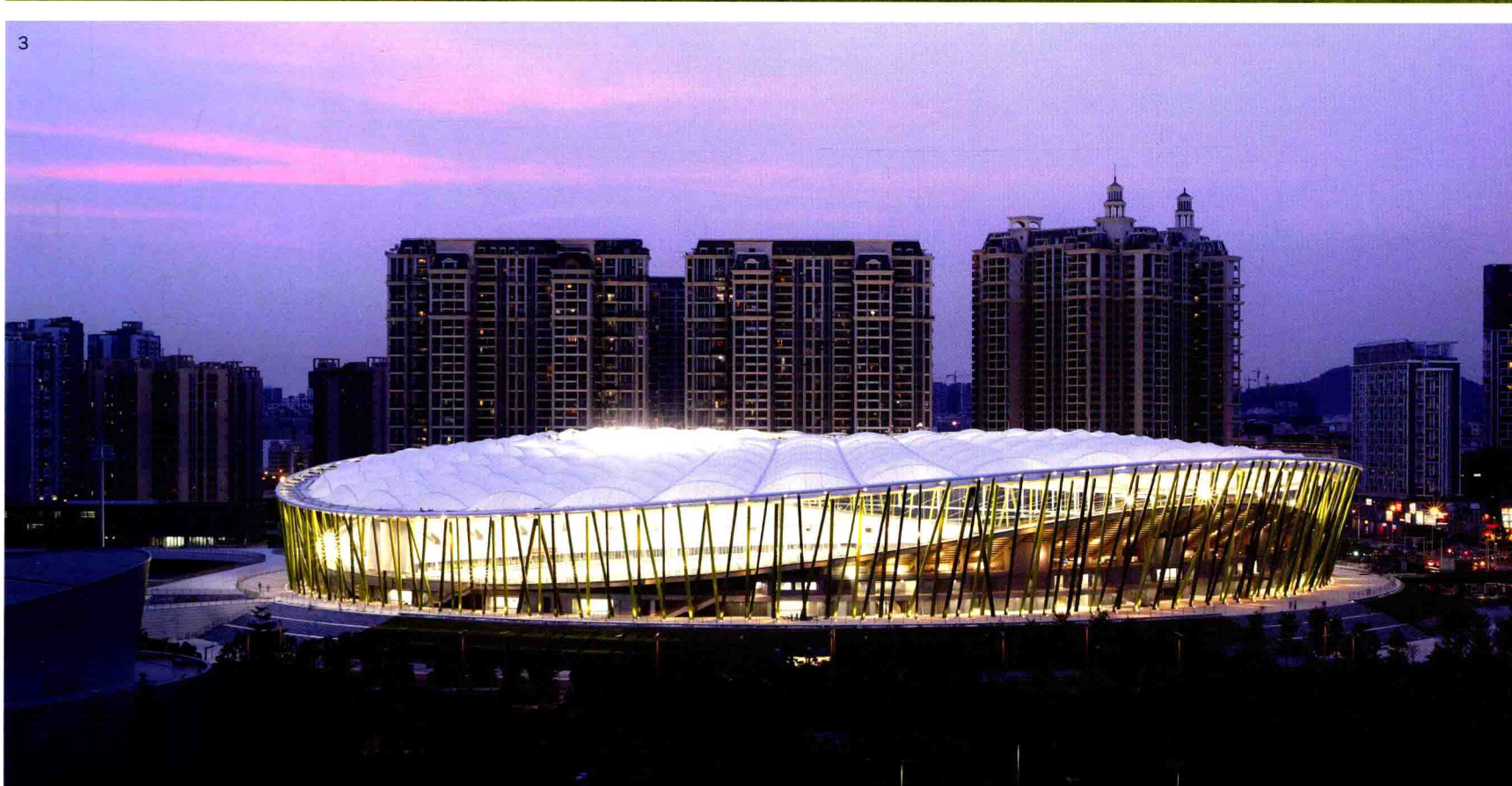
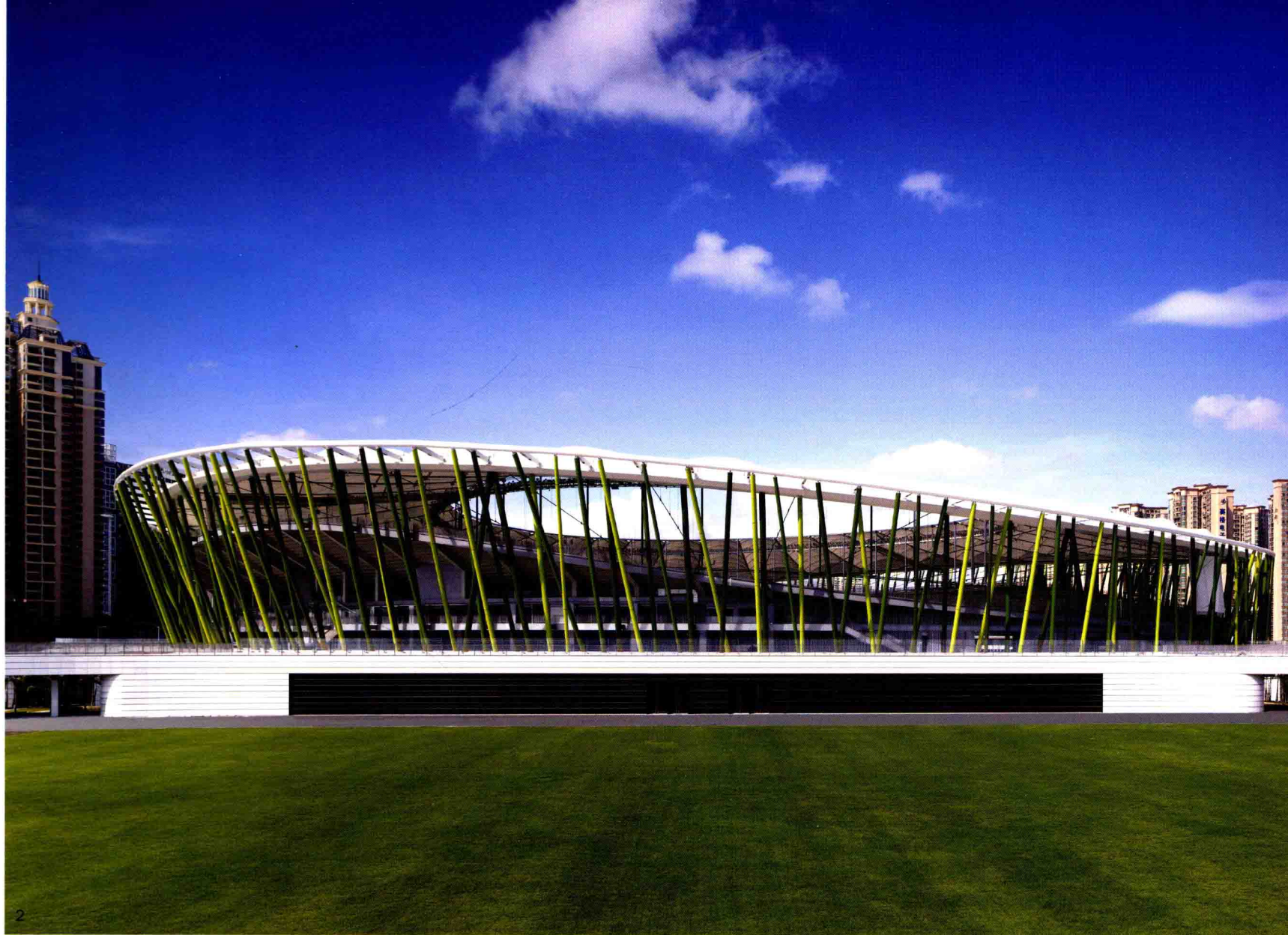
The geometry of the spectator seats involves a modulation from the oval of the athletics track into a perfect circle. The undulating upper tier of the stands is the result of this modulation, creating a large number of seats on the long sides of the pitch and fewer seats on the short sides. The curved line of the upper edge of the stands is repeated by the overall shape of the stadium.

Visitors to a sports event access the stadium via broad flights of steps that lead up to the podium on four sides. The flat podium allows free circulation around the whole stadium and easy access to the seats from any side. Visitors pass through the forest of steel supports into the first circulating area of the stadium, and thence go either up the steps to the upper tier or straight on to the top of the lower tier. The image of a bamboo forest is created by the double row of steel supports, which come across as irregularly spaced and angled as in a real forest. Every other support in the inner row is connected with the concrete structure of the undulating upper tier, thus carrying the vertical loads of the spectator seating.

Though the supports for the roof structure stand inside the rows of stand supports, they are completely separate from the concrete structure in order to cater for independent movements in the large roof. The steel tubes, which are up to 32 metres in length, differ qualitatively according to their load-bearing behaviour and function. In diameter, they range from 550 millimetre to 800 millimetre, varying in accordance with their differing static loads. The horizontal stiffening of the structure and drainage of the roof membrane is likewise provided by special supports.

Particular attention was also paid to the efficient use of materials during the design of the roof structure of the Bao'an Stadium, as a fundamental principle of sustainable building. This is why a membrane roof suspended from an outer frame was selected to cover the seating areas – the ratio of material used to the surface covered constitutes an ingenious optimum for wide-span structures.













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1. Close-up of the façade
2. Exterior stairs
1. 建筑外结构特写
2. 外楼梯

With a diameter of 230 metres and cantilevering of 54 metres on each side of the stands, the roof is carried by 36 pairs of cables whose pre-tensioning is brought together via a circular double tension ring of strand-bundle cables above the pitch. Placed at various heights, the tension rings are linked together by 18-metre-high air supports, and together with the compression ring at the edge of the stadium producing a balance of forces on the principle of a spoked wheel.

在夏季大学生运动会举办的几周时间里，位于珠江三角洲，与香港仅一水之隔的新兴城市——深圳，将成为世界瞩目的焦点。坐落于深圳宝安区的体育场，设计目标为一座容纳40000人的田径体育场，它在2011年世界大学生运动会召开之际将被委以重任，作为足球场投入使用。

场馆的设计灵感来源于极具华南地区风情的竹林场景，其在重现了华南地域特色的同时还构成了看台以及大跨度屋面的结构支承系统。建筑的外表皮将建筑立面、主体结构以及所运用的象征性建筑语汇整合为一个极具表现力的整体。修长的钢柱在光影中参差交错，如同抽象放大的竹枝，赋予建筑竹林的意象。

体育场紧邻体育中心和游泳馆，位于现有东西轴线之上。体育馆以及其附属的预赛场地的建成更加契合了城市的景观轴线。体育场圆形的几何形式强调了其作为主赛场的核心地位的同时，又避免了在市政规划秩序中引入更多的街道元素。体育场坐落于一个被抬起的平台之上，赛场的下层看台以及一部分内部功能分区被安置于这个平台之内。

为了创造理想的观赛视野，围绕椭圆形的田径赛道，一个正圆形的看台应运而生。这种圆形通过一个波浪形起伏的看台构成，其在椭圆形赛场的纵向分布着较多座位，而椭圆两端座位则相对较少。看台起伏的弧线边缘同时也是刻画建筑整体形象的主要元素。

观众可通过位于四个方向上的大型露天台阶到达体育场平台之上。巨大的平台广场可以汇集从各个方向上到达的人流。通过钢柱结构组成的竹林观众可进入体育场的第一环廊中，从这里，观众可直接经过楼梯到达上层及下层看台。分两排罗列的钢柱穿插交错，刻画出野趣盎然的竹林意象。内环支柱直接与波浪型的混凝土上层看台相连接，承担了观众席的垂直荷载。

建筑屋面的支撑结构位于看台支柱的内侧，构成独立于混凝土看台之外相互独立的结构体系，从而实现了屋面的相对位移，增强了其抗震能力。同为32米长的钢管由于其承重各不相同，管径设计为550至800毫米不等。这种特殊支撑结构系统不仅可以有很好的传导水平方向应力，还可一并解决屋面膜结构的排水问题。

在宝安体育场屋面结构设计中，建筑师遵循了一贯秉持的可持续性发展原则，对建筑材料的有效使用进行了充分的考虑。观众看台上部的屋面为拉索固定的张拉膜结构，通过一个位于中心的张力环和呈放射状的辐条结构支撑，巧妙的实现了巨大的跨度。看台的每一侧都伸出一个直径230米，长45米的悬臂，36对辐条拉索通过钢绞线构成的双张力环衔接一体，在赛场上空构成一个闭合的圆形。辐条拉索结构运用了张力环与压力环受力平衡的原理，两个张力环位于不同的高度之上，通过位于赛场上方18米高处的竖向支柱连接，且与体育场边缘的压力环相接，从而实现了整个结构的稳定性。