



1. 雨水花园远处的风车  
2. 总平面图  
1. Rain garden and the windmill at the far ground  
2. Master plan

## 生态景观技术与艺术探索 ——广东省东莞市万科建研中心生态园区

Art and Eco-Technology  
—Eco-campus of Vanke Architecture Research Center in Dongguan, Guangdong

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摘要 ……  
万科建研中心生态园区项目旨在探索如何在景观设计中将艺术与生态结合起来，使生态景观成为可供欣赏、教育和参与的场所。我们希望探索出一套适宜于中国当前的技术与经济状况的低能耗生态景观设计手段，包括三个方面的核心内容：预制混凝土模块的研发与应用；景观生态水循环处理系统的展示；景观生态材料与设计手法的实验与应用。

关键词 ……  
预制混凝土；雨洪管理；低成本；生态景观

Abstract ...  
The Vanke Architecture Research Center explores the relationship of art and ecology in landscape design, particularly the aesthetic, educational and participatory dimensions of eco-landscape. The center serves as an observational platform for the study of landscape methodologies that are compatible with current Chinese technology and economics. The project includes three core dimensions: the development and application of precast concrete modules, stormwater management demonstration systems, and experiment and application of environmentally friendly materials and design methods.

Key words ...  
Precast concrete; Stormwater Management; Low-cost; Eco-landscape

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项目面积：1.85hm<sup>2</sup>  
项目委托：万科建筑技术研究院有限公司  
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设计团队：赵桦、董万荣、张晓珏、张玫芳、秦姝涵  
设计时间：2010~2012年  
施工时间：2010年9月~2012年11月  
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Location: Dongguan, Guangdong  
Area (size): 1.85 hm<sup>2</sup>  
Client: Venke Architecture Research Institute Co., Ltd.  
Landscape Architecture: Z+T STUDIO  
Chief Designers: Dong Zhang, Ziying Tang  
Project Leader: Qiang DU  
Project Team: Hua Zhao, Wanrong Dong, Xiaoyu Zhang, Meifang Zhang, Shuhan Qin  
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### 时代问题

就景观设计而言，生态与艺术之间似乎一直存在一个悖论：生态的景观是原始的，往往意味着杂乱、荒芜，甚至蚊虫滋生。这与人们心中的“艺术”相去甚远。这种悖论引出了这样一个问题：景观是为了美化生活，应该更贴近艺术的方向，那么现在所提倡的生态景观是否与景观的初衷相违背了呢？然而，全球日趋严重的环境问题是无可回避的，尤其在中国。因此，当代景观设计师肩负着双重任务——实现低能耗的生态景观（不仅仅停留在概念上，还要体现在技术上），同时满足人们的审美需求。

### 项目背景

万科建筑研究中心这一项目的研究重点在于住宅产业的相关研究，其将成为一个主要包括建筑材料、低能耗，以及生态景观相关方面的研究基地。在景观方面将重点研发生态材料的应用，例如如何将预制混凝土（Precast Concrete，以下简称PC）模块应用在未来的地产项目中、探索不同类型的透水材料、植物配植等。此

外，这个项目最重要的目的是要探索如何在景观设计中将艺术与生态结合起来，使生态景观成为可供欣赏、教育和参与的场所。因此，该项目是动态的，并可根据对项目绩效的观察而进行调整。我们希望可以摸索出一套适宜于中国当前的技术与经济状况的低能耗生态景观设计手段。项目于2010年正式启动，2012年基本完工，包括三个方面的核心内容：预制混凝土模块的研发与应用；景观生态水循环处理系统的展示；景观生态材料与设计手法的实验与应用。

### 项目构成

（1）预制混凝土模块的研发与应用  
PC相关技术在欧美国家已发展得非常成熟，应用普遍。从外观上来看，PC模块能在尺寸、颜色、质感方面高度模拟花岗岩。同时，它的低能耗性能十分显著：首先，采用PC替代石材，可以避免大面积的矿石开采。其次，在中国，大部分硬质景观铺装都会采用混凝土垫层，那些硬质铺装区域——无论是车行还是人行区域——都无法实现雨水渗透。而PC的厚度较大，





可以省去混凝土垫层，从而加强了雨水向地面的渗透力。同时，PC还可以进行异形加工，使得嵌草铺装成为可能。因此，PC技术的应用使得停车场、消防车道等根据规范要求需采用大面积硬质铺装的区域视觉效果和生态意义都可得到提升。除此之外，我们还设计了多样的PC户外构件，比如坐凳、自行车架等。借助模具，其形式更加多样化，同时具有更强的耐久性，可在中国未来的居住区中加以推广。

（2）景观生态水循环处理系统的展示

广东地区具有暴雨期和干早期极度集中的气候特征。在这种气候条件地区设计雨水花园，意味着需要将暴雨季的大量雨水进行长期储存，以供旱季使用。如何保持大量雨水的水质，便成为该地区雨水花园真正实现低能耗的关键。

因此，我们的设计是让暴雨季节的大量雨水持续循环、流动起来，从而达到保持水质的目的。首先，通过32m高的风车所提供的动力，将最初收集的雨水提升到建筑屋顶上，经过屋顶的雨水花园进行曝氧处理，直至跌落到地面的水池中，实现初级净化；随后，雨水将流经一系列植物净化水池，这些水池同时构成了参观、维护的通道；得到再次净化的雨水将通过一个检测阀，若达到净化标准则可以进入一个镜面水池，成为儿童嬉戏活动的场所，而未达到净化标准的水将会重新回到水循环系统，再次进行净化。

以风能为动力，让雨季储存的雨水流动循环，不断净化，直至下一个雨季的到来。这样的雨水花园尊重地域特点，以节能为根本，同时提供了教育、欣赏及娱乐

的可能。

（3）景观生态材料与设计手法的实验与应用

自然界的雨水通过降雨、渗透、蒸腾等作用而循环往复。但随着城市的建设，大自然最基本的循环被粗暴地打断，雨水不再下渗而是被收集于地下雨水管网中，河湖得不到补给，地下水日趋减少，洪涝与干旱频发。

在本项目的两处波纹花园中，我们尝试去了解：哪些植被/材料，以及何种方式可以最大程度地使雨水渗入地下？在三角形的波纹花园中，我们采取了植物实验，结果发现与低矮的灌木和草坪相比较，乔木因为可以延长雨水落地的时间，成为雨洪管理中最有效的元素。因此，在这个地块中我们将乔木种植在三角形坡地的高点，与低矮植被形成对比和参照。由于坡地草坪会使雨水迅速流走，因此我们采用了波浪形的草坪，不仅从形式上创造了多样化的空间，在功能上也增加雨水的径流时间。草坪的坡度及波浪的曲度可以调整，从而实现最佳的渗透效果，而不会引起积水亦或出现流速过快等现象。

在无法种植植被的区域，哪些硬质材料可以最大程度帮助雨水下渗？在半环形的波纹花园中，我们对不同硬质材料进行了测试。半环形的波浪之间使用了不同



的透水材料（树皮、陶粒、碎石、细沙等），波浪的边界采用溢水设计，可供观察和比较不同材料的溢水量。

**思考**

在中国目前的经济与技术水平下，如何衡量什么是低能耗的生态景观？我们认为可以从以下三个方面来思考：

（1）最少干扰

如今，举国上下大兴土木，方法大多粗暴，无外乎推山填湖，打好混凝土基础，建好地下车库，最后堆些土，种些花草。依此看来，景观只发挥了装点门面之用。我国在规划报批过程中，设有“绿地率”这项指标，其“绿地”泛指植物覆盖的地方，这一指标实则无法用来说明项目的生态效益。例如，目前居住区绿地常用的排水方式是将种植区的雨水排入硬质铺装边缘的排水沟内，再汇入市政管网中，但更为生态的做法应该是尽量使雨水下渗，以补给地下水。对于一个实施性项目而言，其生态性应以项目整体是否实现对现有的生态环境的最少干扰来衡量，而非以最“绿”为标准。

（2）持久性

土地制度的缺陷、快速资金流动、盲目开发建设等诸多体制上的症结，使得中国的景观项目大多追求短期效益，而这带



来了最大的浪费。我们能否使景观更加持久耐候，使其具有更长久的使用寿命？我们应该去除“镶金镀银”的表面功夫，除了为开发商服务，我们还需要坚守基本的职业道德，使设计更好地服务于使用者。

（3）简单设计

我们提倡极简设计。简单，首先意味着要去掉装饰，因为任何装饰的实质都没有指向自然、生态；其次，反对为设计而设计。即设计的目的是要明确，去掉不必要的手段和技巧，去掉繁琐的材料变化；最后，简单也包含着顺其自然的含义。生态的事物一定不是强硬的、扭曲的，而应是符合场地、符合自然规律的。

景观设计的精髓不在于创造了何种惊人的形式，亦非展现设计师的个人价值，而是我们为社会提供了什么，可以让人们更健康、更富足地生活。LAF

**注释**

本文由唐子颖（张唐景观合伙人、首席设计师）撰写；周啸（张唐景观高级设计师）校对；现场照片均由张海拍摄。

3. 预制混凝土铺装与竹林结合  
4. 预制混凝土铺装与野草结合  
5. 预制混凝土自行车架  
6. 预制混凝土铺装与葱兰结合  
7. 大面积的特制预制混凝土铺装  
3. PC pavement with bamboo  
4. PC pavement with grass  
5. PC bike racks  
6. PC pavement with *Zephyranthes candida*  
7. Large area of customized PC pavement

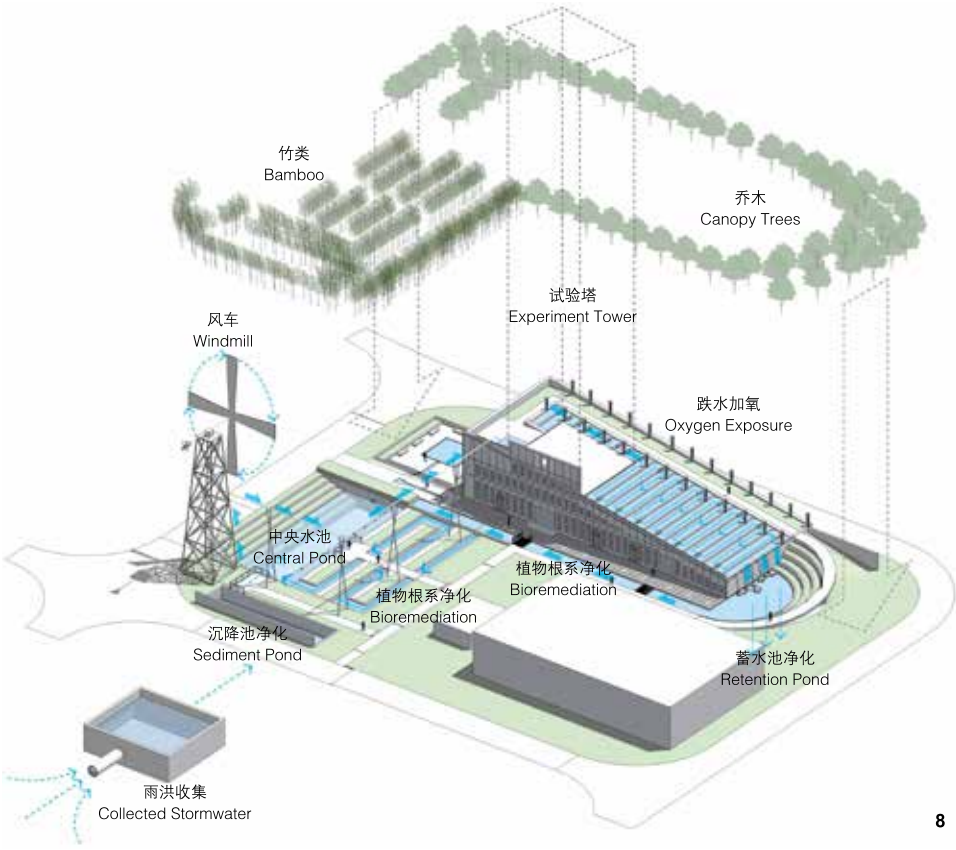


Time Background

Art and ecology are often misrepresented as incompatible opposites in landscape design. Given that landscape design should draw out the art and beauty of life, how do current trends that emphasize ecological productivity over art contradict the raw goals of landscape architecture? With increasing global environmental destruction, especially in China, landscape architects are tasked with two important missions: how to create low-energy, environmentally friendly landscapes (not only conceptually, but also technologically), and how to design and build beautiful, artistic spaces.

Project Background

The Vanke Architecture Research Center (VARC) is a research base focusing on housing industry related architectural material, low-energy technologies and eco-landscapes. At the core of this eco-landscape study is the development of environmental friendly building materials such as precast concrete modules, pervious materials and natives plants. The project explores how ecology and art can be combined to produce scalable and transferable aesthetic



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and educational landscapes, so the eco-landscape can be the aesthetic, educational and participatory spaces. Therefore, the project is dynamic, observational and revisable. We hope to produce a standard methodology that is compatible with current

Chinese economics and technologies. The project was begun in 2010 and finished in 2012, producing documents supporting three core research topics: the development and application of precast concrete modules, stormwater management demonstration systems, and experiment and application of environmentally friendly materials and design methods

Project Composition

(1) Development and application of precast concrete modules

Precast concrete is well developed and widely used in US and European countries. In terms of appearance, the size, color, and texture of precast concrete modules are hardly different from those of granite, however it has significant meaning for low-energy consumption. First, the use of precast concrete, instead of granite, reduces the need to excessive mining and transportation.



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Secondly, most paving in China uses a concrete slab support system, the penetration of rainwater cannot be realized anywhere there is pavement — both for vehicle or pedestrian passage. Precast concrete is thick enough, that the traditional concrete slab can be defaulted, and the rain water penetration can be strengthened. Meanwhile, precast concrete is can also be customized to include spaces for vegetation, such as spaces for parking and fire trucks. In addition, precast concrete is highly customizable. It can be used for outdoor structures such as benches and bike racks, which could be used widely in future housing projects in China.

(2) Demonstration of stormwater management systems

The climate of Guangdong province is characterized by extreme wet and dry seasons. The design of stormwater systems should include plans for long-term water collection that can be saved and used in the dry season. A key part of the demonstration system was guaranteeing water quality by continuously cycling the water. A 32 m windmill provides power for pumping collected stormwater to the building roof, where it is oxygen-exposed. The primary purification occurs as



- a. Constructed cascading wetland on the existing roof allows the stormwater to meander through Orange Daylily (*Hemerocallis fulva*) and provides possibility for phytoremediation and aeration.
- b. Steps for visitors to get close and learn how the wetland works. 为游客提供了近距离了解湿地净化过程的平台。
- c. Solar panels can provide energy for site lighting. They also act as a shade structure. 太阳能板为场地照明提供能源，同时具有遮阳的功能。

the water moves from the roof to the retention pool, and then passes through a series of phytoremediation pools. The cleaned water is tested, before entering a final reflection and shallow play pool. Water that does not meet purification standards is returned for another round of treatment.

Utilizing the energy from the windmill,

water stored from the rainy season keeps cycling and being purified until the next rainy season. The stormwater system meets the requirements of balancing art and ecology by respecting local design traditions using modern, energy efficient methods. Meanwhile, it enables the possibility of education, appreciation and entertainment.

(3) Application of environmental friendly materials and design methods

The most basic environmental patterns, such as rainwater cycles of infiltration and transpiration, have been disrupted by urban development. In most cases, stormwater is collected in sewage networks instead of recharging ground water. As a consequence, rivers and lakes are not adequately



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- 8. 风车花园示意图
- 9. 风车花园局部鸟瞰图
- 10. 屋顶人工湿地示意图
- 11. 雨水流经屋顶湿地，落入蓄水池，随后流入生态草沟。
- 8. The diagram of the Windmill Garden
- 9. Bird's eye view of part of the Windmill Garden
- 10. The diagram of the roof constructed wetland
- 11. Stormwater meanders through the constructed wetland on the roof, then falls into a retention pond and goes into a bio-swale.





replenished, and the ground water table is permanently decreasing as flooding and drought are respectively increasing in urban and rural areas.

For this study, two Ripple Gardens of the project site were studied to understand what and how vegetation and materials can maximize stormwater infiltration. We constructed planting design in a triangular

Ripple Garden to compare short bushes with lawns. As trees are the most efficient tools for storm water management, because of prolonged rainwater dripping periods. The slope of the lawn and the waves can be adjusted to realize best infiltration effect without triggering water-logging or speedy flow.

Alternatively, we wanted to know what

non-vegetative materials could be applied to aid rainwater infiltration. We applied different non-vegetative materials (such as bark, ceramics, gravel and sand) to a semi-circular Ripple Garden, and observed the overflow of different materials. The space between the waves adopts different pervious material. The edge of the waves is designed to observe and compare the overflow amount of different materials.

Reflections

Finally, how can we learn from this project while considering the economic and technological level of China? We suggest the following three perspectives:

(1) Minimal disturbance

The current large scale of construction in China is irrational, leading to over-simplified and often rude methods. Landscape is nothing but an industry guided by appearance and decoration — it is simple to removed hills and create lakes, to stack the earth and plant new vegetation. The “green ratio” is demanded during the project application process, but the “green” refers to any vegetated spaces.



The green ratio does not mean the ecological character of a project. For example, stormwater within the planting area is usually just emptied into the municipal grid, missing an opportunity for implementing eco-friendly techniques that would also replenish the groundwater. The ecological extents of the landscape should be measured by its relationship with the natural environment rather than a technical standard.

(2) Durability

The rapid cash flow and blind urban development in China drives landscape projects with short-term benefits, resulting in significant waste. How can the landscape become more enduring and resilient for the long term? We must remove ostentatious appearances and budgets. Design should be directed by public need rather than developer budgets.

(3) Simple design

Minimalist design advocates clarity and simplicity that complies with sustainable ethos. We should design what need to be designed, and be clear of unnecessary techniques and complicated materials. We should let nature take its course; design should be in harmony with site and nature.

The essence of landscape architecture is not about creating formidable patterns nor about demonstrating the designer’s individual value, instead, is to provide to society more happy and healthy lives. **LAF**

NOTE

This article was wrote by Ziying Tang (partner and chief designer of Z+T STUDIO); Proofread by Xiao Zhou (senior designer of Z+T STUDIO). All site photos were taken by Hai Zhang.

- 12. 三角形的波纹花园示意图
- 13. 三角形的波纹花园
- 14. 半圆形的波纹花园示意图
- 15. 半圆形的波纹花园
- 16. 半圆形波纹花园中的小径
- 12. The diagram of the triangular Ripple Garden
- 13. The triangular Ripple Garden
- 14. The diagram of the semi-circular Ripple Garden
- 15. The semi-circular Ripple Garden
- 16. The path through the semi-circular Ripple Garden

