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Geographical and Cultural Characteristics of Super High-Rises

探索超高层建筑地域文化特色



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Abstract

The Dong Ping New City Business Center's design notion emphasizes the mixture of architecture and local culture by integrating traditional Chinese Sky Lanterns at the top of office towers and applying abstract traditional Chinese tracery patterns into triangular ventilation windows on the façade. This article takes the Dong Ping Poly Business Center as a case study and explores the high-rise architectural design combined with geographical and cultural characteristics from the overall design creativity to the specific construction issues related to the process of implementing cultural inheritance.

Keywords: Dong Ping New City Poly Commercial Center, supertall buildings, regional culture

摘要

东平新城保利商务中心设计构思在办公塔楼顶部设计一盏中国传统习俗中的巨型天灯，建筑外墙的三角形幕墙单元的通风开启扇借用中国古典园林中的花窗，强调建筑与地域文化的交融。本文以此为例探索超高层建筑设计结合地域文化特色，从整体设计创意到建筑具体实施过程中如何实现文脉传承及其遇到的相关问题。

关键词：东平新城保利商务中心、超高层建筑、地域文化

Introduction

The Dong Ping New City Business Center is located in the center of the Fushan Dong Ping area. The building complex includes a 54-story, 249-meter high-rise office building and a 22-story, 99-meter high five star hotel. The building apron is six-stories with functions that include office and hotel retail spaces. There are two stories underground (part of it has three floors) designated for parking, mechanical and hotel administration and storage spaces. The two square-form buildings are set-back from the street intersection. The front and back offset layout establishes a visual buffer which also forms an urban square (see Figure 1). The key concept of this project is an abstraction of traditional Chinese Sky Lanterns, located at the top of the building. An exaggerated scale of the "abstract sky lantern" announces this high-rise as an icon which manifests the unique skyline of the Dong Ping New City Business Center (see Figure 2). Another key concept is the façade, which is composed of by multiple triangular curtain wall modules. That pattern is adopted from traditional Chinese tracery ornaments. The ornate ventilation with traditional Chinese tracery ornaments emphasizes the integration of local culture within architecture at a human scale. This project is designed

引言

东平新城保利商务中心位于广东省佛山市东平新城中心区，主要由一栋249米54层的超高层办公楼和一栋99米22层的五星级酒店组成，六层裙楼作为办公楼和酒店的商业部分，地下室两层（局部三层）满铺用地作为停车库、酒店内部用房和设备房。两栋平面接近正方形的塔楼向十字路口退让，前后错位布局形成视觉缓冲空间的城市广场（请见图1）。设计立意最大特色是在办公塔楼顶部设计一盏中国传统习俗中的天灯，将其尺度巨大化作为超高层建筑天际线的标志性元素，以凸显保利商务中心在东平新城中心区城市空间中独树一帜的风格（请见图2）。另一特色是建筑外墙由三角形幕墙单元组成，其细部设计中将中国古典园林中漏窗花饰图案运用在通风开启扇的构造上，在接近人体尺度的空间中再次强调建筑与当地文化的交融。本项目由德国gmp事务所完成方案设计，由广东省建筑设计研究院完成施工图设计。本文以东平新城保利商务中心为例，探索超高层建筑设计结合地域文化特色，从整体设计创意到建筑具体实施过程中如何实现文脉传承及其遇到的相关问题。

设计创意

超高层建筑不仅是人类财富和征服自然的

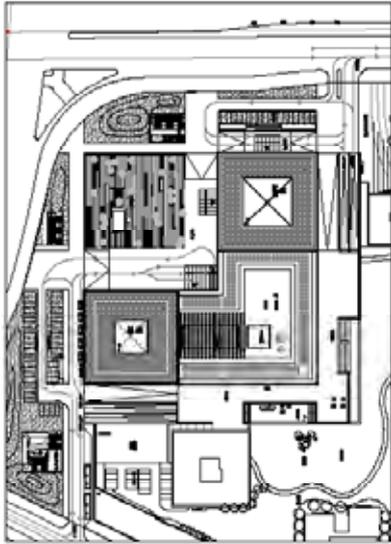


Figure 1. Dong Ping Metro Poly Business Centre Floor Plan (Source: Architectural Design and Research Institute of Guangdong Province)
图1. 东平新城保利商务中心总平面图 (出自: 广东省建筑设计研究院)

by the German architecture firm Architekten von Gerkan, Marg und Partner, and the local Architecture of Record team is the Architectural Design & Research Institute of Guangdong Province. This article takes the Dong Ping Poly Business Center as a case study to explore the high-rise architectural design in combination with geographical and cultural characteristics from the overall design creativity to the specific construction issues related to the process of implementing cultural inheritance.

Design Concept

High-rises not only illustrate human wealth and the conquest of nature, they are a representation of an architectural landmark of a city and a combination of local culture and modern construction technologies. In Chinese culture, people desire to be a step higher so they can see farther. The high-point captures the city essence of local culture and visual focus. Foshan is the third largest city in the Guangzhou province with a rich history and splendid culture. The inspiration of this project begins with exploring the close relationship between architecture, regional traditions, and different cultural elements.

First of all, the Dong Ping New City Business Center utilizes abstract custom traditional Chinese sky lanterns located at the top of the high-rise, as they were used in traditional customs. Sky lanterns are also known as "Kongming" lanterns, and according to the legend, they are said to be invented by Zhuge Liang to be used as signals to deliver messages during the Warring States Period. Nowadays, it has become a way of benediction during festivals and a tool for praying (see Figure 3). The integration of sky lanterns in the architectural concept represents wishes of harmony, peace, happiness, hopes of success, and good harvest. The height designated for sky lanterns at the top of the office building is 26.4 meters. This over-sized "Sky Lantern" not only provides a luxurious grand space, but the cutting-edge material and lighting design that are used in this architecture makes this "glowing" sky lantern visible to people who lives miles away. A "Sky Lantern" is embedded in a five-story cubic space at the top of the building. The first level of this "Sky Lantern" is an observatory of the silhouette space formed by the outline of the cube of sky lanterns. The rest of the four levels of the "Sky Lantern" are used for luxury office spaces. The city skyline can be viewed through the pale yellow transparent curtain walls (see Figure 4), In particular, come nightfall, when everything in

象征,是一座城市的建筑地标,也是地域性文化和现代建筑科技结合的典范。中国自古以来就有登高望远的传统,登高之处自然是这座城市文化精华缩影和视觉焦点所在。佛山市是广东省第三大城市,也是一座历史悠久的文化名城。东平新城保利商务中心在设计之初便从与地域传统文化之间的紧密关系着眼,结合不同文化元素寻找设计创意之源。

首先,东平新城保利商务中心在超高层建筑顶部设计采用了中国传统习俗中的天灯,又称孔明灯,相传为三国诸葛亮的发明,起初是为了传递消息之用,现代则被当成节庆祈福许愿的工具(请见图3)。天灯的设计代表着和谐、平安和幸福的美好祝愿,寄托着人们对丰收与成功的希望。办公塔楼顶部巨大尺度的天灯空间高达26.4米,不仅营造了气派的天景空间,同时运用最新的建筑材料和照明设计使人们在方圆几公里开外就能看到这座飞翔的天灯,令保利商务中心这座超高层建筑在东平新城区显得尤为独特、备受瞩目。天灯嵌在建筑顶部通高五层的立方体空间之内,首层为天灯轮廓与立方体之间形成的剪影空间用作观景台,其余四层均为高端办公空间,可以从内部透过淡黄色天灯幕墙俯瞰全城美景(请见图4)。尤其是夜晚来临,当天空暗下整座建筑灯火通明,天灯透着美丽的黄色灯光闪耀和温暖着整座城市。

另外,东平新城保利商务中心在建筑外墙设计上运用了中国古典园林中的花窗,又称漏窗,是古代建筑中装饰和美化窗的一种形式,洞窗由各种漏空的图案巧妙组合构图而成,不但能够装饰建



Figure 2. Dong Ping Metro Business Center perspective (Source: German gmp office)
图2. 东平新城保利商务中心透视图 (出自: 德国gmp事务所)



Figure 3. Sky lanterns in Chinese traditions and customs (Source: German gmp office)
图3. 中国传统习俗中的天灯 (出自: 德国gmp事务所)

the sky vanishes in the dark, the “Sky Lantern” becomes the only visible light floating in the sky with soft yellow shining lights that warm the whole city.

Moreover, the Dong Ping New City Business Center’s façade design pattern has adopted traditional Chinese garden tracery. Tracery is an ornamental method to decorate windows in traditional Chinese architecture. The tracery consists of a variety of hollow patterns that serve not only as the building’s envelope decoration, but the pattern can also take advantage of natural ventilation and light (see Figure 5). The utilization of the tracery minimizes the heavy feeling of solid walls made of stone or metal, which are materials that are normally used. Tracery can make the wall appear more “light-weight and translucent.” The specially designed tracery detail differentiates the Dong Ping New City Business Center from the rest of the high-rises in Foshan. Its façade consists of 90-degree angled isosceles triangular curtain wall units. One of the bevel edges becomes part of the glass curtain wall while the other edge operates as ventilation operable windows by using hollow aluminum tracery to achieve the natural ventilation for individual spaces. The bottom edge consists of solid stone curtain walls with 45-degree angles which can direct natural air into the interior space. The contrast of stone and glass along with solid and void increases the aesthetic strength of the building. The combination of hollow metal panels and natural stones contribute to the style of modernistic beauty and simplicity, which will upgrade the commercial image of the New City Business Center.

Concrete Implementation

A great work of architecture is not only composed of excellent design ideas, it is essential practice to implement these design ideas through quality construction so that the vision becomes reality. The sky lantern is the soul of the Dong Ping New City Business Center. The sky lantern notion has been limited in many different aspects such as material, technology, and code. The initial idea uses a steel cable truss structure (a fish-shaped parallel cable and beam) in the design from which hang the giant sky lanterns in the five-story-high space at the top of the building. The skin of the sky lanterns are made of bamboo and tensioned membrane, because the intent of the construction is to create a real lantern (see Figure 6). However, the design was not executed due to the unresolved solutions to several problems. The first issue addresses the 26.4-meter-high atrium space with an area of 2,000 square meters and a volume of 50,000 cubic meters. In the event of fire in the atrium, the fire and smoke would spread rapidly and leaving the top of the building very vulnerable, since it is so far from the ground. The smoke diffusion also makes fire suppression extremely difficult because the core tube cannot be directly placed on the roof structure due to the excessively high cost of fire service elevators, stairs cannot reach straight into the sky lantern layers, and the evacuation and rescue services are even more difficult. In addition, the low-space uses of the tall atrium space make the interior space extremely hard to divide for furniture and the acoustics for a staff-intensive office meeting space, so it can only be used as general office spaces instead of luxurious conference centers and office spaces. The most efficiently used and superimposed area is only 2,000 square meters total for five stories which makes it quite lavishing among high rental cost office buildings. The implementation of lanterns structure was chosen from a variety of possible schemes such as a skeleton with a tensioned membrane (the amount of the skeleton was too large and too messy, the tensioned membrane could not hold the arch outward) and a double-layer of inflated film (leaks easily, the combustion performance

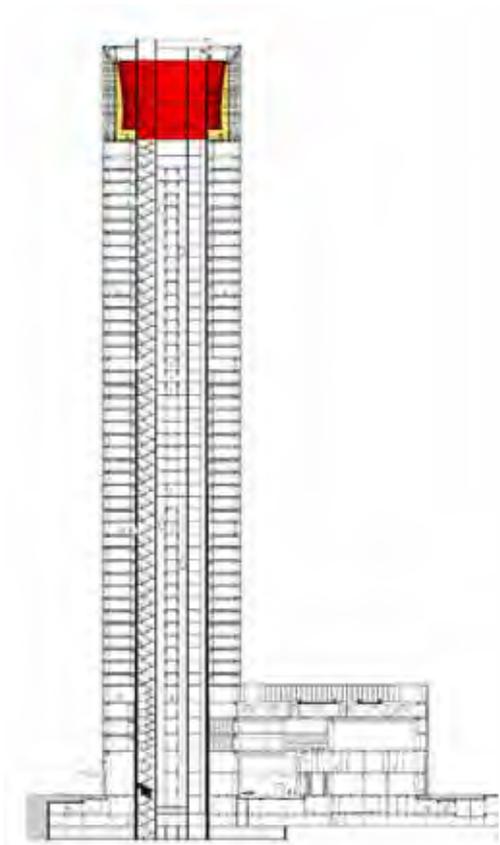


Figure 4. Sky lantern layering profile (Source: Guangdong Provincial Institute of Architectural Design)

图4. 天灯层剖面图 (出自: 广东省建筑设计研究院)



Figure 5. Window patterns in Chinese classical gardens (Source: <http://www.nipic.com>)

图5. 中国古典园林中的漏窗 (出自: <http://www.nipic.com>)

筑墙面, 而且可以隐约借景观、透风采光 (请见图5)。将花窗这些特点运用到建筑幕墙中削弱了普通石材或金属幕墙厚重的感觉, 增加了建筑表皮通透和轻盈的感觉, 此外, 经过独特设计的花窗图案也使保利商务中心在细节上与东平新城的其他高层建筑有所区别令人耳目一新。建筑外墙由一个个近似等腰直角三角形的幕墙单元组成, 其中三角形的一条斜边作为建筑玻璃幕墙的一部分, 另一条斜边采用镂空铝板花窗的形式作为通风开启扇, 以实现内部各个建筑空间独立的自然通风, 底边则采用实体石材幕墙形成近似45度角导流空气进入室内。建筑立面通过石材与玻璃的虚实对比产生刚劲有力的美感, 镂空金属板和天然石材的结合营造简洁明快的现代风格, 提升了保利商务中心典雅高贵的建筑形象。

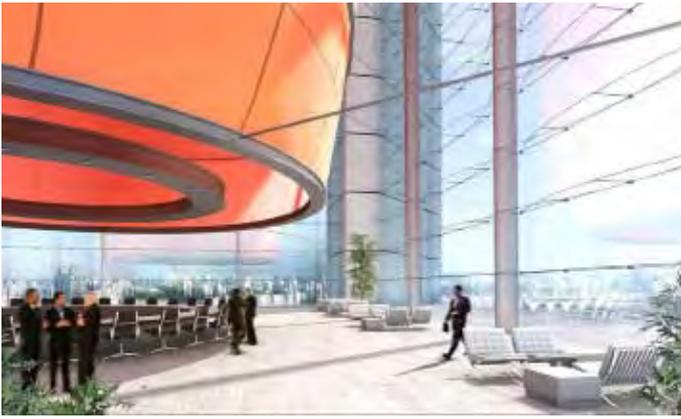


Figure 6. Sky lantern initial idea renderings (Source: German gmp office)
图6. 天灯初始构思效果图 (出自: 德国gmp事务所)

of membrane material could not meet the requirements of class A fireproofing material). A compromised solution was finally adopted after a series of adjustments and experiments to demonstrate sky lantern implementation in the program. The building maintains the clarity of sky lanterns on the façade by using enclosed glass curtain walls and extra-grade fireproofing roller shutters that completely divide the space between the sky lanterns, the central high space, and the interior space of the four levels, thus becoming a completely enclosed office space (see Figure 7).

The exterior wall is made of triangular curtain wall units. It breaks the tedious shape of conventional glass curtain walls by creating a dynamic façade elevation. The triangular curtain wall unit is also effective for natural ventilation and smoke extraction. Each curtain wall unit is an approximate right-angled isosceles triangle. Placed in the plane of the glass curtain wall construction of the hypotenuse are operable ventilation windows. Placed on the bottom edge of the exterior are granite curtain walls. Placed outside the hypotenuse are curtain walls of punched aluminum boards (ventilated windows). The arrangement and quantity of triangular units and the percentage of perforated punched aluminum boards (ventilated windows) are based on the calculation of the quantity of natural and smoke ventilation derived from the standard floor area and the podium area of the building area which allows the walls to become ornamental and structurally supported at the same time (see Figure 8). Due to mandatory requirements of the Chinese government on building energy efficiency, the method of open ventilation fans and its leaf structure are all carefully considered and tested. The leaf, originally made of clad aluminum, was changed from 3mm aluminum board, 6mm insulation, and another 3mm aluminum board to 10mm aluminum board, 200mm insulation, and another 10mm aluminum board, respectively. The addition still has difficulties meeting energy requirements so it can only be considered as large windows as a result. If the ventilation fans are considered to be a part of the window frames, then it can pass energy saving calculations, so the final leaf structure does not hold insulation values which are tantamount to the increasing window rate at the cost of increasing the rest of the thermal performance components in the building.

Introspection

Incorporating sky lanterns helps the Dong Ping New City Business Center meet the requirements of the "iconic landmark" of a commercial building among numerous large commercial buildings. This landmark title is an overwhelming requirement in terms of "function." Adopting



Figure 7. Final implementation of sky lanterns rendering (Source: German gmp office)
图7. 天灯最终实施效果图 (出自: 德国gmp事务所)

具体实施

一座好的建筑不但需要精彩的设计创意, 更加需要建筑实践去实施这些创意, 令理想化为现实。天灯作为整个东平新城保利商务中心的灵魂所在, 实施起来涉及建筑材料、建筑技术和建筑法规等等多方面的限制。设计之初构思采用钢结构索桁架(鱼腹形平行索梁)将巨型天灯悬挂于建筑顶部通高五层的空间之内, 天灯的表皮采用竹子和张拉膜, 毫不讳言这就是在制造一个真正的灯笼(请见图6)。实际上由于存在很多问题以至于最终未被采纳, 首先, 这个高达26.4m的中庭空间, 建筑标准层面积约为2千平方米, 建筑体积达到5万多立方米, 巨大的中庭空间一旦发生火灾火势迅速蔓延, 烟气加速扩散, 将这样一个巨大且严峻的消防难题置于建筑顶部远离地面为消防扑救带来极大的困难, 而且核心筒不能直上屋面结构代价过大, 消防电梯和楼梯也不能直上天灯层, 从而使疏散和救援更加不利。此外, 高大尺度中庭空间建筑利用率过低, 室内空间无比空洞难以进行间隔和装修, 声学设计也非常困难, 因此无法作为人员密集的高级办公会议场所, 只能作为普通的办公空间, 五层叠加后的有效使用面积仅为2千平方米左右, 在租金昂贵的办公建筑中显得尤为浪费。灯笼设计也采取了多种方案比较, 骨架+张拉膜(骨架太多太乱, 张拉膜难以向外起拱), 双层膜充气膜(容易漏气, 膜材料的燃烧性能也难以达到消防要求的A级防火材料)。经过多次调整论证最终天灯的实施采取了折中的解决办法, 保留了天灯通透的外观采用封闭的玻璃幕墙和特级防火卷帘将天灯与中庭空间完全隔离开, 内部分为四层均为全封闭的办公空间(请见图7)。

建筑外表面采用三角形幕墙单元的构造做法, 一方面可以打破常规类型玻璃幕墙的平淡, 创造生动活泼的立面效果, 另一方面三角形幕墙单元也是一种有效的自然通风和自然排烟设施。接近等腰直角三角形的幕墙单元, 置于建筑玻璃幕墙平面内的一条斜边是可开启的通风机, 置于室外的底边是干挂石材幕墙, 置于室外的一条斜边是冲孔铝板幕墙(漏窗), 三角形幕墙单元的数量和排布、室外冲孔铝板(漏窗)的穿孔率是根据标准层面积和裙楼面积计算通风量和排烟量后得出的, 使其不但具备装饰性也具备一定的科学性(请见图8)。由于建筑节能已经纳入中国政府的强制性要求, 通风机的开启方式及其门扇构造也进行了多次设计和验算, 起初门扇采用复合铝板构造, 从开始的3mm铝板+6mm保温棉+3mm铝板到整体加厚为10mm铝板+200mm保温棉+10mm铝板均难以满足节能要求, 最后只能按大玻璃窗考虑, 也就是说把该通风机也当成窗框的一部分, 节能计算才得以通过, 因此该门扇最终的构造并没有作保温措施, 当然这等于提高了开窗率, 但是以整体提高建筑其他维护结构的热工性能为代价的。

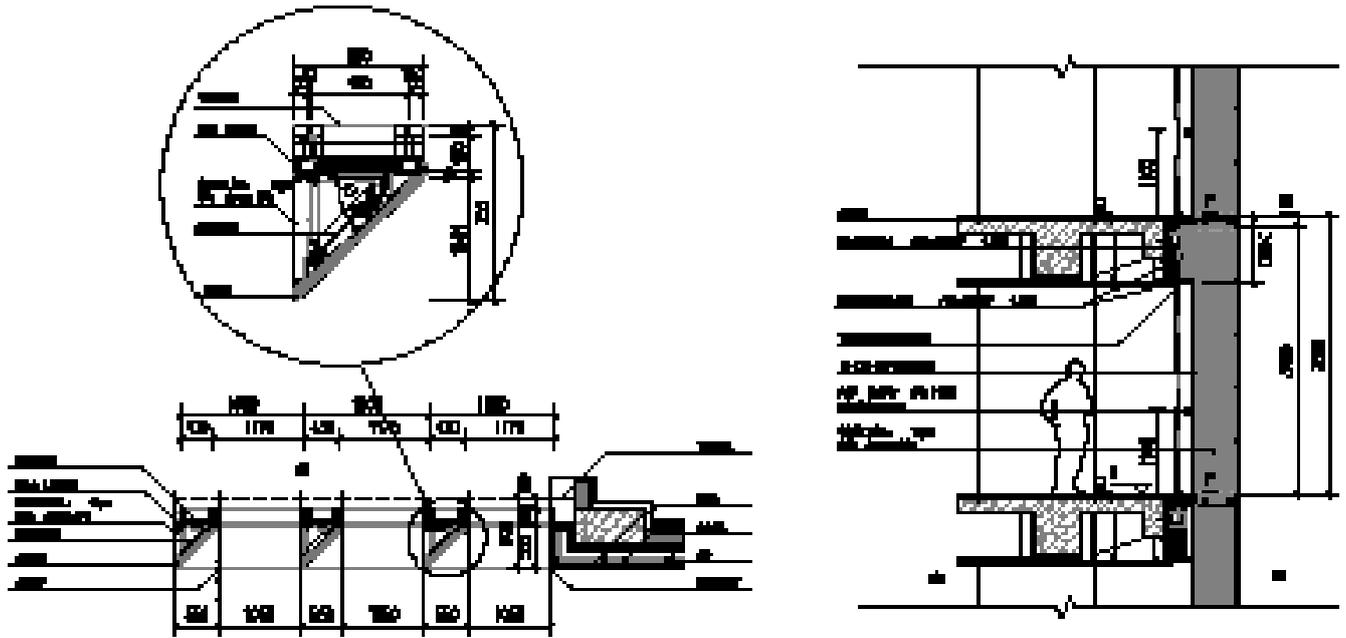


Figure 8. Triangular curtain wall unit constructed wall (Source: Guangdong Provincial Architectural Design Institute)
图8. 三角形幕墙单元构造详图 (出自: 广东省建筑设计研究院)

the idea of traditional Chinese tracery into the façade design solves the natural and smoke ventilation needs of the modern building. In comparison to “globalized” architecture, the Dong Ping New City Business Center integrates flavors of local culture and building appearance, engaging a story with strong local identities. Even though the business center incorporates two main cultural symbols of traditional Chinese culture, those two culture components do not completely convey the “cultural spirit”. But, the soul of the sky lantern is graceful inflight, and the essence of the window is taken and filtering view. This is one of the ways of imitating the formal analysis of expressing geographical and cultural characteristics of the building space, sequence, and, ultimately, the spirit of sublimation. After all, “visualization” is the beginning of everything, from certain perspective imitation is a necessary condition.

Foshan is in the Lingnan District in China. The Lingnan culture is an important aspect of Chinese culture and is characterized by their compatibility, practicality, and progressiveness. The Dong Ping New City Business Center is in search of a thorough understanding of the local culture. With the use of modern technology on materials and the traditional cultural symbols to refine modern features and content, the building can reflect reverence and respect to its traditional geographical culture. On the other hand, the architectural practices in the traditional urban space need to incorporate both local and regional culture while utilizing the sense of innovation to illustrate old and new customs in order to design unique supertall buildings in line with the urban character of its vicinity - an eclectic mix of Lingnan culture and its timeless existence.

反思

东平新城保利商务中心的天灯构思满足了商业建筑“标志性”的要求，这对于一些大型商业建筑来说这是一个压倒性的“功能”要求，花窗元素也较好的满足了自然通风和自然排烟等功能与现代建筑造型的矛盾，采用具有地域文化的符号也使建筑有了一定的故事情节和地方情怀，相较众多“全球化”的建筑来说保利商务中心更具有人情味。虽然在东平新城保利商务中心上运用的两个主要的文化符号都未能完整地传达出传统文化精神的内涵，天灯的灵魂是轻盈和飞翔，花窗的精髓是借景和透景，但是这种经过推敲的形式上的模仿也是表达地域文化特色比较重要的途径之一，从建筑形象（符号）感知到空间、序列乃至最终的精神升华，毕竟是从“眼观”开始，某种意义上来说形式模仿是必要条件之一。

佛山市位于中国岭南地区，岭南文化是中国文化的重要组成部分，特点在于其所具备的兼容性、实用性和进取性。一方面保利商务中心寻求一种通过对于地域文化的理解，运用现代建筑材料技术，对传统文化符号进行提炼和抽象并赋予其现代的功能和内涵，反映出该项目对于地域传统文化的尊重和敬畏；另一方面在传统城市空间中的建筑实践，既需要传承地域文脉，也需要运用创新意识展现新旧文化交融，从而设计出符合城市性格的独特的超高层建筑，这也是岭南文化兼收并蓄、与时俱进的精粹所在。