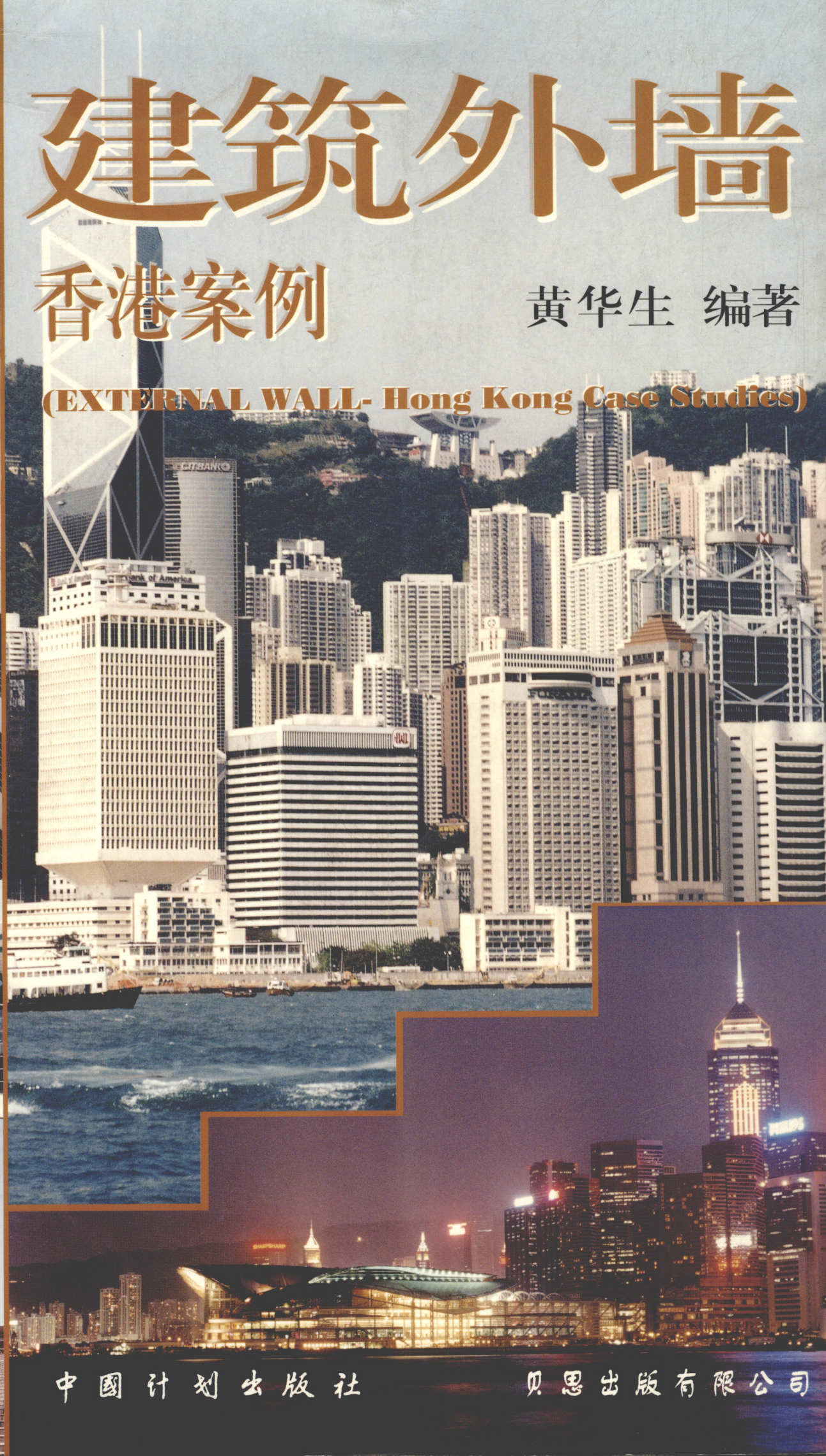
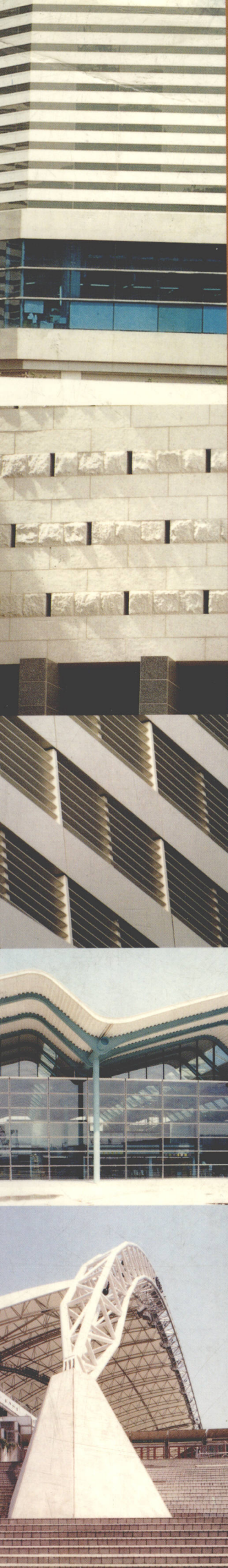


建筑外墙

香港案例

黄华生 编著

(EXTERNAL WALL- Hong Kong Case Studies)



中国计划出版社

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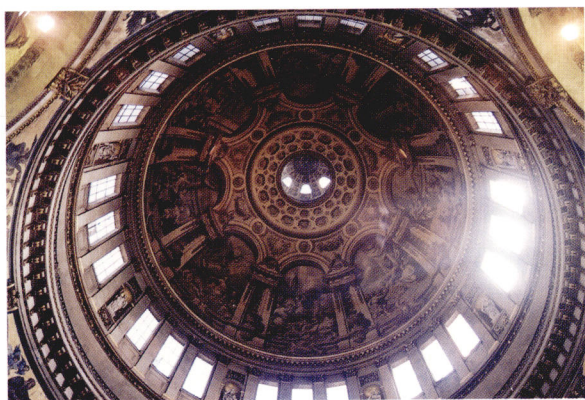
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序言

研究建筑物的外墙是研究建筑的现象学。建筑物的外观在人们头脑中产生一种直觉，使他们的意识受到影响并转变为感受理解。人们把这种理解与其经验作比较并在感觉上起正面的或负面的作用。

要引发感觉，建筑物的物质成分——颜色、质感、光泽、外形和硬度是重要的，但这些只有成为环境因素时才是有感情的，而这环境因素对观感而言主要是光。

因此，光是建筑艺术的环境发生器。理解这一点后，设计不仅要考虑材料及绘图板上的细节，而且与实际场合存在的光有关。光给予建筑物生命。



从背景观点看，外墙包含空间并反映内部空间。中文中“空间”一词描述“空”即虚空及（或）空白，“间”即隔开及（或）包围。因此，外墙建立内外之间和人为的与自然之间的边界，从而确定了空间。在此边界处，内部与外界交汇和人为的与自然界相接。所以，外墙可以视为内外之间的空隙，内部联系外界或外界联系内部的相互作用的皮层。



心中有了这些概念，读者可以从本书的建筑研究案例中探索感受和脉络。

黄华生

1997年7月

PREFACE

To research on the enclosure of buildings is to study phenomenology in architecture. The appearance of buildings imparts an intuition in the mind of people. The senses of people are affected and transformed into perception. People compare such perception with their experience and react with feelings, positive or negative.

To arouse feelings, the physical ingredients of buildings such as colour, texture, glossiness, profile and hardness are important but these are only sensible upon the fulfillment of environmental factors which in this case of visual perception is primarily light. So light is the environmental generator of architecture. Understanding this, design is considered not only for materials and details on the drawing board but in actual situation with the presence of light. This gives architecture life.

From the contextual point of view, the enclosure contains space and reflects the space within. The Chinese words ‘空间’ meaning space depicts this further as ‘空’ void/space and ‘间’ partition/enclosure. So the enclosure defines space by creating a boundary for the interior and exterior, artificial and natural. And it is at this boundary that the interior meets the exterior and the artificial meets nature. Therefore the enclosure can be seen as a ‘gap’ between inside and outside, an interactive skin for inside to communicate with outside and vice versa.

With these concepts in mind, it is left to the readers to explore the feelings and context imparted by the case studies in this book.

Wong Wah Sang
July 1997

前言

在我们看一幢建筑物时最注意的是什么呢？我以为总的外观形式也许是最显著的特征。然后，外观又被分为窗、外部材料、阳台和建筑设计特征等比较小的构件。可是，在有些项目中，这些构件组合得不好，许多构件比例不恰当，没有尺度感，还有就是细部处理欠佳，材料选择不当，这样就会导致极差的视觉效果。

公众通常认为建筑设计仅仅是建筑的外部形式。其实，外墙的作用要比公众所认为的要大一些，它并不局限于仅仅是赏心悦目。从实用角度而言，它有着更深的意义，它应成为一层环境隔膜，把外部自然环境与内部人工环境分开。该“隔膜”应提供：

- 1) 景观（外部连接）；
- 2) 光；
- 3) 空气（通风）；
- 4) 保护；
- 5) 支撑。

建筑设计的艺术和科学就是要将上述元素组合成一个建筑物的整体，使之既美观又符合功能要求。

在香港，因为地价极其昂贵，所以发展商主要考虑的往往是如何最大限度地提高可销售面积比例。因此，几乎没有建筑师去探索有意义的外部设计的空间。幕墙、瓷砖和喷涂未给适当考虑就被用到建筑物的表面，差不多像墙纸一样。使建筑物外墙尽可能薄，以便得到最大的室内建筑面积成为立面设计的目标。结果，香港现代建筑的外观就显得没有个性，与阳光角度、盛行风和温度之类的地区气候条件完全没有联系。许多现代建筑浪费能源、影响环境和投资不合理。

我很高兴黄华生先生已经认识到了建筑物外部设计的重要性，并选择它作为此书的主题。他的分析方法以及对香港建筑物各种外部设计的研究的确是值得称赞的。读者应把书中的插图不仅仅看作是插图，而且，他们应该进一步考虑“立面设计”的更深一层的意义，正如 Le Corbusier 曾经说过的：“如果一个人能够改变立面而不改变平面或剖面，那么一定是什么地方出错了”。

随着我们步入了 21 世纪，建筑设计特别是外部设计应打破外墙设计的框框。我们确实需要对我们的设计方法作一个改变。新的范例必须把重点放在如何重新建立建筑物与自然的协调上。在这一方面，建筑物的外观设计起着极其重要的作用。

何弢
香港建筑师学会主席
1997 年 10 月 6 日

FOREWORD

What do we notice most when we look at a building? I suppose the overall exterior form is probably the most prominent feature. Then, perhaps this form is subdivided into smaller components such as windows, exterior materials, balconies, architectural features, etc. Sadly, in some cases, these elements are not combined in a pleasing manner. Many are ill-proportioned, without any sense of scale, others are poorly detailed, with insensitively chosen materials. Such end result can be a visual disaster.

The general public usually only consider architectural design as being the building's exterior form. In fact, the purpose of exterior enclosure is greater, and should not only be designed to please the eye. From a practical point of view, it has a deeper meaning, and should function as an environmental membrane, separating the external natural environment from the internal artificial environment. This "membrane" should provide:

- 1) View (External Connection)
- 2) Light
- 3) Air (Ventilation)
- 4) Protection
- 5) Support

Combining the above elements aesthetically and functionally to form an integral part of a building is both the art and science of architectural design.

In Hong Kong, where the cost of land is very high, maximum provision of saleable floor area is often the main concern of the developer. Little is left for the architect to explore meaningful exterior design. Curtain wall, tiling, spray coatings are being applied to the surface of buildings without due consideration, almost like wall paper. To form the thinnest possible building skin in order to gain maximum interior floor area becomes the elevation design objective. As a result, the exterior form of modern buildings in Hong Kong can be characterless and totally unrelated to regional climatic conditions such as sun angle, prevailing wind and temperature. Many modern buildings therefore waste energy, are environmentally unfriendly and economically unsound.

I am pleased that Mr. Wong Wah Sang has recognized the importance of this issue and chosen it as the main theme of this book. His analytical approach, the study of various exterior enclosure of buildings in Hong Kong is indeed commendable. Readers should not only consider the illustrations as merely visual reference, but should also give some thought into the deeper meaning of "elevation design" as Le Corbusier once said 'there is something wrong if one can change an elevation without changing the plan or section'.

As we move into the 21st Century, architectural design, particularly its exterior enclosure, should move away from the exterior wall paper pattern mentality. We desperately need a shift in our design approach. This new paradigm must focus upon how to re-establish a friendly dialogue between building and nature. In this respect, the design of building enclosure plays a vital role.

Tao Ho
President
The Hong Kong Institute of Architects.
1997.10.6

1. 外墙建筑设计

建筑师所作出的对一座楼宇的外墙的选择表示他所采取的外观要表达他所期望的楼宇的内部。这种外部设计是一般人所感受的表面外观。要将一座楼宇装饰得漂亮,建筑大师级的技艺和一些初级作者相比,是大有区别的。建筑设计中堪称大师级的作品具有杰出的体形和精致优美的细部。通过对空间的结构、形体、色彩、色调、光照和阴影的综合处理将情感通过楼宇体现出来。这方面的处理是可能通过使用各种各样的材料和技术的手段来完成的。环境、工艺、社会文化和经济等因素渗入到外墙的设计中,最终会在已经完成的楼宇将这些因素表达出来。显然,查看历史设计的楼宇,这一点也是很清楚的。现在这些相互影响因素同样的存在于楼宇设计的范畴中,只不过所用的材料和工艺是极其不同而已。

简洁的形体

金字塔



1

代表了古埃及时期的最尖端工艺水平 (state-of-

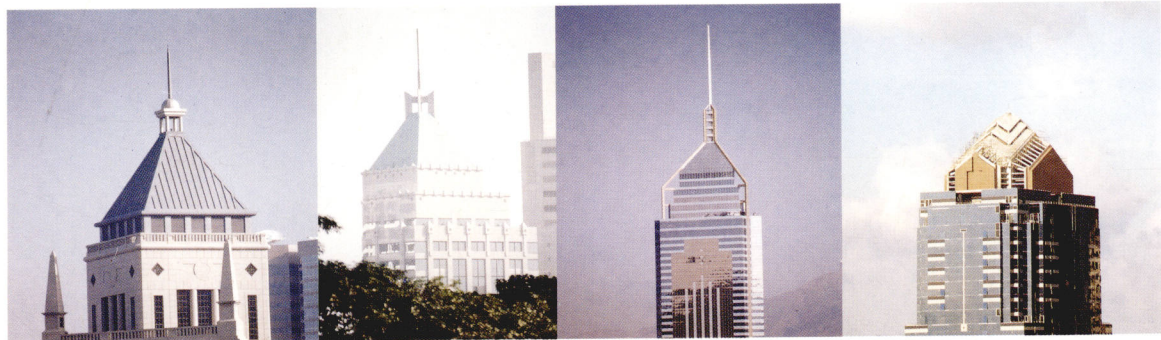
the-art technology)。在金字塔中将石灰岩作为基本的材料来使用是与周围的环境相协调的,并且使得简洁的金字塔形体给人一种神秘的气氛。然而,现代的材料能将这个同样的金字塔形体转换成完全是另一回事。在巴黎罗浮宫博物馆,



2

由一个受拉体系 (tension system)

支撑的玻璃形成了一个透明的玻璃金字塔,创造了一种流动空间的感觉,这样就给人以一种现代的神



3

秘感。现在香港可以看到在摩天大楼的顶上的一座座金字塔,用玻璃或是用金属围护构成,象皇冠一样安放在楼宇的顶上,形成了一个标志性的结构,并且描绘出一个大城市的空中轮廓线 (skyline)。

1. DESIGN TO ENCLOSE BUILDINGS

The choice of enclosure for a building made by an Architect means the design for the external outlook he has adopted to express what is expected in the interior. This external design is the appearance that is generally appreciated by common people. The skill to dress up a building distinguishes the Master from the amateur. Great pieces of Architecture possess outstanding form and elegant details. Emotions are imparted by manipulating texture, shape, colour, tone, light and shade. These are possible via using different various means of materials and technology. Factors of environment, technology, social culture and economics penetrate into the design of the enclosure which finally expresses these factors in the completed building. These are obvious even from buildings in the past. Interplaying factors fell into the same categories as today but the materials and technology were very different.

SIMPLE FORMS

The pyramid ¹ represented the state-of-the-art technology at ancient Egyptian times. The limestone blocks as the basic material for the pyramid harmonize with the surrounding local site and make up the simple pyramidal form giving an air of mystery. However, modern materials can transform the same pyramidal form to a very different matter. At the Louvre museum in Paris, ² glass supported by a tension system forms a transparent glass pyramid allowing a sense of free flow of space. A modern sense of mystery is imparted. Now in Hong Kong, pyramids are observed on tops of ³ skyscrapers and constructed of glass or metal cladding, crowning buildings and forming landmarks as well as defining the skyline.

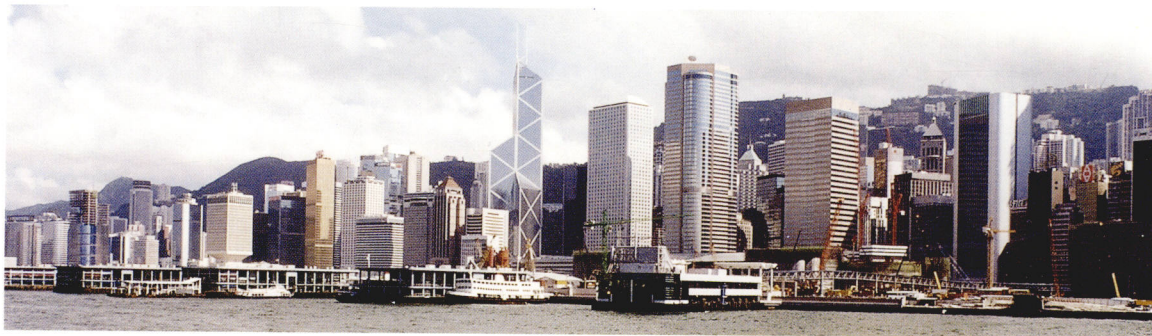
⁴ Another simple geometrical form, the circle, can generate impressive Architecture. Circular wall villages in South-east China ⁵ afford functional as well as aesthetically pleasing surprise. Earth as the basic material gives an appropriate simplicity to these vernacular architecture. The Temple of Heaven in China ⁶ is also based on a circular plan but with built-in mystical calculation and spiritual symbolism. With modern materials and technique, the circle in the form of a sphere can be constructed. In the Science Museum of Park De La Villate in Paris, ⁷ the reflective metallic surface absorbs the image from the environment like a spherical crystal. The circular form of the Hong Kong Jockey Club Environmental Building ⁸ by Simon Kwan implies advantage in energy saving and efficient enclosure to floor area ratio.

Variations based on the simple geometrical form ⁹ can produce great buildings. The Bank of China by I.M. Pei emerges from triangulation of the square plan to a powerful form. The Lippo Centre designed by Paul Ruldolph ¹⁰ derives its sculptural form from variations on its basic octagonal plan.

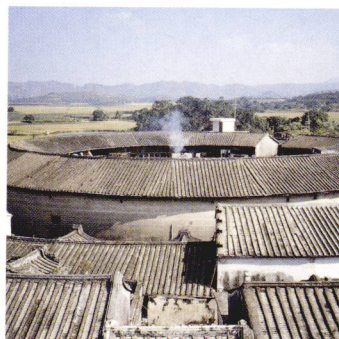
BUILDING REGULATIONS

Simplicity and purity may not apply in the complex modern society. Here in Hong Kong, maximization of development guided by the Building Regulations can shape buildings. "Form follows regulations" may be the slogan in extreme cases. For example, along the ¹¹ Central Des Voeux Road area, buildings touch with each other to form single elevation buildings due to maximum use of frontage. 3-dimensional architectural design is here turned into a 2-dimensional graphics forming urban 'canyons'. In another Hong Kong case, street shadow calculations have sliced and splayed off the top corners of buildings.

¹² Moreover, many residential buildings derive their form from complying with

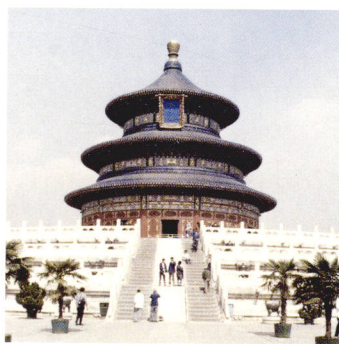


另外一种简洁的几何形体是圆形，也能够产生出令人注目的建筑艺术。在中国东南部乡村中的圆形围墙的土楼，



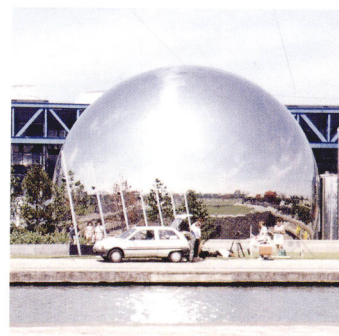
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它在功能上具有作用，而且在视觉上也能达到令人赏心悦目的惊讶 (surprise)。泥土作为这土楼的基本材料，其简洁性对于乡土的建筑是很恰当的。



6

中国的天坛也是在圆形平面的基础上建造的，但是具有埋藏在内的玄妙数理和宗教表义。如果采用现代的材料和科技，用圆球形体的建筑是可以建造的。



7

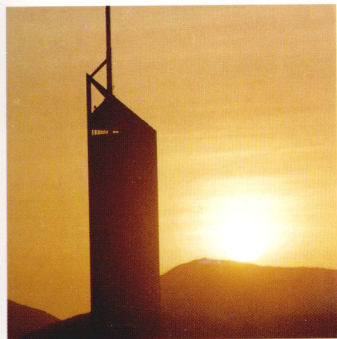
在巴黎的 Park de la

Villate 科学博物馆，有反光的金属表面收摄了周围环境的形象，就像一个水晶球的作用。



8

由关善明设计的香港赛马会环保大楼以圆形为平面主体，亦含有节能和良好的外墙与楼面面积比例的优点。



9

以简洁的几何形体为基础而创作各种变奏能够创造出伟大的建筑作品。贝聿铭设计的中国银行大楼是由方形平面上的三角形体组合起来而出现的一个强有力的形体。



10

Paul Rudolph 设计的力宝中心是以它的基本的八角形平面变异而成的雕塑状形体。

建筑条例

简洁性和纯正性可能不适用于复杂的现代社会。就是在香港，完全遵循建筑条例会将楼宇制造成受限制的形体 (restricted forms)。在一些最极端的情况中“形体遵照条例” (forms follows regulations) 可以成为工作中的信条。例如，沿中环德辅道



11

区域，楼宇与楼宇相互紧贴，为了最大限度地使用门面，形成了单一立面的楼宇，三维的建筑设计在这里变成了二维的图形，形成了城市中的“峡谷”。在另一个香港的例子中，街道遮影计算将大楼的顶部上削斜。



12

更有甚者，很多居住楼宇是遵照建筑条例和业主对住房单元的尺寸要求来推导出这些楼宇的形体的。

建筑条例之一对能源效率 OTTV (总体热转换值) (overall thermal transfer value) 的管理是以立法控制，其主旨是开始建立一个综合性的楼宇能源的规范以控制大楼内的总能源消耗。OTTV 测量了一座楼宇外墙与屋顶的能源消耗量，该量是与墙体的材料，玻璃的规格和尺寸，有多少遮荫和色彩以及朝

Building Regulations and client's size requirement for the residential flats.

One of the Building Regulations for Energy Efficiency allows legislative control over OTTV (overall thermal transfer value). The aim is to start establishing a comprehensive building energy code to control the total energy consumption in a building. OTTV measures the energy consumption of a building envelope which depends on materials, glazing type and size, provision of shading and colour as well as orientation of the wall. The building enclosure¹³ controls the heat and light emitted into the interior, this affects the extent of use for artificial lighting and mechanical ventilation.

The OTTV of the external walls of a building tower or a podium, OTTV_w, is calculated using the following formula-

$$OTTV_w = \frac{(A_w \times U \times \alpha \times TD_{EQw}) + (A_{f_w} \times SC \times ESM \times SF)}{A_{ow}}$$

where

A_w = Area of opaque wall, m_2

U = Thermal transmittance of opaque wall, $W/m_2^\circ C$

α = Absorptivity of the opaque wall

TD^{EQw} = Equivalent temperature difference for wall, $^\circ C$

A_{f_w} = Area of fenestration in wall, m_2

SC = Shading coefficient of fenestration in wall

ESM = External shading multiplier

SF = Solar factor for the vertical surface, W/m_2

A_{ow} = Gross area of external walls, i.e. $A_w + A_{f_w}$, m_2

According to regulations, the OTTV of a building tower should not exceed $35W/m_2$ and that of a podium should not exceed $80W/m_2$.

ENVIRONMENTAL CONTROL

The building skin is a composite structure of different materials put together. OTTV is one measure of its performance. The prime function of the technology of

building enclosure is to regulate the internal environment with building mechanics for human comfort which includes aspects of temperature, ventilation, noise and aesthetics. Conditions of comfort relates to local environment and adaptability of people so that comfort criteria varies from place to place. In Hong Kong, close to 30°C is considered hot and below 10°C is cold. An interior of around 23°C is felt to be comfortable.

Environmental control alone does not dictate all the design criteria for the building skin. Factors like vision, aesthetics and privacy all join to be considered in a balance condition. The Murray Building designed by the Architectural Services Department in Hong Kong¹⁴ uses sun shading walls to build up a pattern in fenestration helping to form an energy efficient building.¹⁵ In the Hong Kong Housing Society's Development of Verbena Heights at Tseung Kwan O, part of the windows for the residential blocks are added by Anthony Ng with sun shades as an outcome of solar angle modelling study. The result adds a good variety in the elevation design.¹⁶ Besides solar control, roof lights in the St. Thomas Apostle Church in Tsing Yi creates a stack effect to give good ventilation. The result is a pool of light to define architecture.

As a reference from our ancient times, environment had been dealt with in buildings or even in shelters. 5000 years ago around the Yellow River, people made the mud shelters with consideration of the angle of the sun in different seasons. The mud or earth formed¹⁷ the basic insulation material against the natural elements. Materials for the building skin can affect the external environment.¹⁸ For instance, highly reflective curtain wall can produce undesirable reflections and glare. Such is the contradicting environmental effect when curtain wall is normally considered for transparency and re-



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向有关。楼宇的外墙控制了传输到房屋内的热与光，这就影响到使用人工照明和机械通风的程度。

对于一座楼宇的塔楼或是裙房的外墙的 OTTV，用下列公式计算 OTTV_w：

$$OTTV_w = \frac{(A_w \times U \times \alpha \times TD_{EQw}) + (A_f \times SC \times ESM \times SF)}{AO_w}$$

式中： A_w = 不透明墙的面积 m²；

α = 不透明墙的吸收率；

A_f = 墙的开窗面积 m²；

ESM = 外部荫蔽乘数；

AO_w = 外墙的毛面积，即 $A_w + A_f$ ，m²。

U = 不透明墙的热导率，W/m²°C；

TD_{EQw} = 墙的等代温差，°C；

SC = 墙的开窗的遮荫系数；

SF = 垂直面的日照系数，W/m²；

按照条例，一座楼宇的塔楼的 OTTV 不应超过 35W/m²，而裙房的 OTTV 不应超过 80W/m²。

环境控制

楼宇的外表层是一个将不同的材料组合在一起的组合结构物。OTTV 是其工能的一种量度。楼宇外墙的科技的主要功能是为了人体的舒适用建筑的器材来调节内部环境，包括温度、通风、噪音和美学等方面。舒适的条件关系当地的环境和人们的适应性，因此舒适的准则随地方而异，在香港，接近 30°C 就被认为是热，而在 10°C 以下就被认为是冷的了。一个室内的温度在 23°C 左右时，从感觉上说，是舒适的。

环境控制不能单独对楼宇的外墙支配全部设计准则，其它因素如视觉、美学和不受干扰，都可以作为权衡条件加以考虑。香港的建筑署设计的美利大厦



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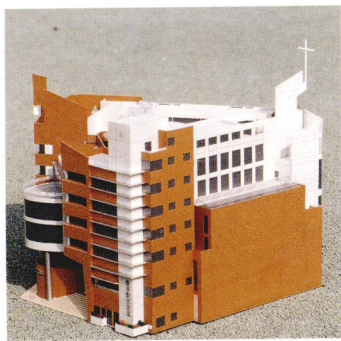
使用遮阳墙造成一种窗的图案，使大楼成为一座能源效果好的楼宇。



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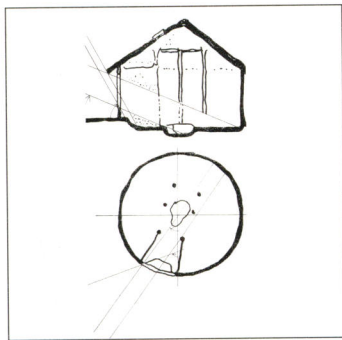
香港房屋协会将军澳的茵怡花园设计，在居住大楼的一部分窗由建筑师

吴亨洪加上遮阳板，是作为日光射角的模型研究的结果，这样做亦增加了立面设计的新变化。在日光控制之外，青衣岛的圣多默宗徒堂的屋顶天窗兼备排气口效果而提供了良好的通风。



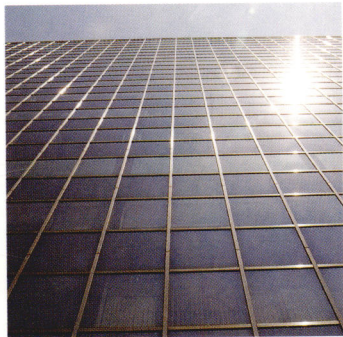
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参照历史的例子，在住屋中，甚至在窝棚中也要处理环境问题。五千年前，在黄河一带，人们用泥土建造窝棚时，



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也考虑到了在不同的季节中的太阳射角，泥土成为对抗那些自然因素的主要隔热或保温材料。用于房屋外墙的材料亦会影响建筑外围环境。



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例如，高反射性的幕墙 (curtain wall) 能够产生不希望有的反射和眩光，这真是适得其反的环境效应，因为幕墙的作用

正是为透视空间和反映周围的景观和蓝天而考虑的。

材料的表现特性

楼宇外墙的材料是在一定的功能特性并结合所要求的功能和所希望的使用期限而选定的。耐久性和功能表现是受环境影响的，并且也受到天然力和人为力的交互物理作用影响。材料的功能特性是根据结构的耐用性、安全性、可居住性、耐久性、兼容性和美学等方面而加以评价的。

结构的耐用性 (Structural serviceability) 包括对自然力的强度 (香港的台风和暴雨) 以及能够承受施工和组装情况下的结构强度。大幅玻璃墙经常是宁可悬挂在顶上，而不是象一个垂直的悬臂构件而耸立着。另一例就是帘墙的安装，由于楼宇的移支、下沉、日照的差异留出活动余位。



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由建筑署设计的香港体育馆中，在屋顶的防水薄膜上浇一层混凝土来防止薄膜由于风的吸力而上飞。

flecting the surrounding landscape and sky.

MATERIAL PERFORMANCE

Materials for the building enclosure are selected on certain performance characteristics in relation to the intended function and expected life span. Durability and performance are affected by the environment as well as physical interaction from both natural and man-made forces. Performance characteristics for materials are rated on structural serviceability, safety, habitability, durability, compatibility and aesthetics.

Structural serviceability includes resistance to natural forces (typhoon and strong rain in Hong Kong) and structural strength to stand against the construction and assembly situation. Large glass walls are often suspended from the top rather than standing like a vertical cantilever. Allowance for movement due to building movement, settlement, solar differentiation etc. has to be made for in curtain wall installation. In the Hong Kong Coliseum constructed by Architectural Services Department,¹⁹ uplift of the roofing membrane from wind suction was stopped by a layer of concrete.

Architects should consider the safety of buildings in connection with the lives of people and put a heavy weighing in such aspect when making decisions of design. Safety in fire aspect is considered on fire resistance, flame spread and possible development of smoke and toxic fumes. Fire resistance is regulated by the required fire resisting period for the material and compartmentation as well as separation from adjacent sites. Besides fire safety, safety in terms of use has to be considered. Harsh detailing for external walls may become dangerous. Glass used in location of certain external wall and rooflights has to be specified as tempered or laminated for safety. In the Lee Gardens, by Dennis Lau & Ng Chun Man, laminated tempered glass²⁰

is used for the skylights at the podium roof of the shopping arcade.

Habitability for building enclosure includes performance characteristics from thermal properties, acoustics properties, water permeability as well as properties related to comfort. For different materials, there are different thermal expansion coefficient so that structural strength and expansion joints have to be considered and sealants have to be provided. Noise transmission properties can be important for enclosures requiring sound isolation. Materials can be rated under sound transmission class (STC) value. Double glazing with high STC value is used in the residential blocks of Laguna City²¹ to screen off the traffic noise from the adjacent highways.

Resistance to wear and weathering as well as dimensional stability are measures of durability. Use of materials has to be considered not only for wear in normal use but also during construction works when the exposure situation can be very tough. Sunlight can induce fading to material coloration and ultraviolet radiation can cause degradation to natural rubber, neoprene and some sealants. On the other hand, dimensional stability is affected by expansion and contraction, loading and moisture content.

Compatibility is guided by the ability of materials to withstand reaction with adjacent materials in situation of chemical interaction, galvanic action, corrosion and material failure. Paint coatings can be applied on material surface for isolation of materials to stop incompatibility.²² Colour and texture contribute to the aesthetical and physiological effects of materials. Choice can be selected from the modern palette of glass, metal cladding, paint, granite, tiles, concrete, steel and timber.

TECHNOLOGY

Materials form the elements of construction. Now metal

建筑师应该联系到人们的生命来考虑楼宇的安全 (safety), 并且在设计中作出决定时, 在这方面加重权衡。在消防方面的安全要考虑防火、火的扩散以及烟和有毒气体的可能扩散。对于防火, 是由材料和分隔墙的耐火极限的要求以及和邻近现场的间隔距离而规定的。在火灾的安全之外, 建筑物使用中的安全也必须考虑。做在外墙上的粗糙的细部是可能有危险的。在外墙和天窗上的玻璃必须符合规范, 为了安全要用强化玻璃或是用夹层玻璃。由刘荣广、伍振民设计的利园中心购物步行街裙房屋顶上的天窗选用了夹层的强化玻璃。



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可居住性 (habitability) 包括热量性质 (thermal properties)、音响性质 (acoustics properties)、渗水性 (water permeability) 以及与舒适 (comfort) 有关的性质等的功能特性。对于不同的材料, 就有不同的热膨胀系数 (thermal expansion coefficient), 因此结构强度和伸缩缝必须加以考虑, 并且要使用密封胶。对于要求隔声的外墙, 噪声的传送性质会是很重要的, 可以根据声传送级 (sound transmission class) (STC) 值来评估材料。在香港丽港城



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的居住大楼, 建筑师使用双层的高 STC 值的玻璃来屏蔽来自邻近公路上的噪音。

抗磨损和抗侵蚀用以量度耐久性 (durability)。材料的使用不仅要考虑在正常使用中的磨损, 还要考虑在施工中, 暴露在外的条件会是很恶劣的。日光会引起材料颜色的变哑, 而紫外线会引起橡胶硬化、氯丁化和其他密封胶的老化。在另一方面, 整体稳定性受到膨胀和收缩、负荷和含湿量的影响。

适应性 (compatibility) 是指物料所能承受的化学作用、电流作用、腐蚀和物料老化的情况下, 物料所能承受所作出的变化而定的。在物料的表面上涂上漆膜可使它抵抗阳光的侵蚀。色彩与特性是影响到物料的视觉效果和耐用性。可以从现代的玻璃板、金属贴面、油漆、面砖、混凝土、钢材和木材中挑选出符合要求的物料。



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科技

物料是建筑的组成部分。现在, 金属可以做成几乎透明的薄膜, 贴在玻璃上, 造成玻璃幕墙。玻璃面的构造可以做成是吸声体, 或加以喷涂在面上, 看上去像是抛光花岗石。花岗石和大理石可以像对木材一样的用机器切割、磨平和抛光。多层胶合板可以达到作为结构构件的强度, 并且比钢材有更

好的防火性能。这些都是现代科技所创造的奇迹。

在香港公园的温室中，玻璃的形状被做成来覆盖几何形状的顶盖，看上去像是切割过的金刚钻那样子晶莹剔透。中国银行旁边



的花岗石装修将人工的精巧技艺与自然景

观组合起来造成对比强烈的空间构造。在香港文化中心的实心外墙上用哑光面砖拼排起来组合成图画，



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而在中环广场的外墙上，组成图案的照明与玻璃幕墙的设计结合起来成一夜景。当经济上能够承担得起时，工艺可以在建筑物的立面上再现辉煌。

霍朗明 (Foster) 设计的汇丰银行中环总行采取了一种高造价高技术的外墙来表示在香港商业上的宏伟。这里，大胆的设计和支持这种设计的财力使得材料和工艺结合成完美的产品。同样，Richard Rogers



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can be produced as an almost transparent coating on glass for use as curtain wall glazing. Glass can be textured to absorb sound or spray painted to look like polished granite. Granite and marbles can be machine cut, grinded and polished the same way as timber. Glulam timber can be structurally strong and better fire resistant than steel. Such are the wonders of modern technology.

In the green house in Hong Kong Park,²³ glass is shaped to enclose the geometrical roof form like the cutting to make diamond crystal. The granite works besides the Bank of China combines artificial skills with natural landscaping to form contrasting texture. Special articulated form of unglazed tiles make patterns on the external solid wall of the Hong Kong Cultural Centre. And in the Central Plaza external wall,²⁴ lighting as graphics has been integrated with the glass curtain wall design.

When economy can afford, technology can be a celebration on the building facade. Foster's Hong Kong Bank in Central²⁵ takes on an expansive high-tech external wall to symbolize the commercial magnificence in Hong Kong. Here, an honest production of material and technology is made possible by daring thoughts and supportive finance. Similarly, Lloyd's in London by Richard Rogers²⁶ uses a high-tech enclosure to construct an edifice of power and prestige.



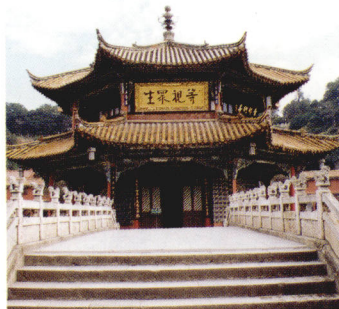
26

设计的伦敦劳埃德大楼 (Lloyd's Building) 使用了高科

技的外墙造出了一座象征权力和威望的大厦。完全形成一个对比，中国的古老建筑在它们的那个时代，

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同样表现高明的建筑科技。在云南的一座古庙用支撑屋顶的木斗拱体系和用木框架板墙来表现其精致的技艺。在这座建筑物中看到了简洁性和清晰性的表现。在应用到现代楼宇中，能告诉你材料的真实和构造的逻辑的工艺产生出了更为人理解的建筑物。



In total contrast, old buildings in China are also expressive of the building technology at their times. An old temple in Yunnan²⁷ expresses fine workmanship of the wooden bracketing system that supports the roof and the timber frame with the infill panels for the external walls. Simplicity and clarity are seen in this building expression. Applying to modern buildings, technology telling the truth of materials and the logic of construction produce more comprehensible buildings.

DISCOVERING CULTURE

Technology is used to suit people's customs and climate, thus forming a building envelop to express culture. The Institute du Monde Arabe in Paris designed by Jean Nouvel²⁸ uses a lot of steel and glass to form high-tech elevations representing Arab geometries. The South elevation contains windows resembling a mandola with many lenses. These have aperture open and close to control light admission.

A totally opposite approach can be seen in the interesting elevation of low-tech building elements created by the inhabitants expressing their likes on the facade of old post war medium rise residential buildings in Hong Kong.²⁹

This is a form of community architecture where personal character is announced on the building enclosure. Simple construction techniques are used by people to represent common liveliness. Just above ground level, local made signboard combine with the self expressive elevation gives a primitive form of media architecture.³⁰

This is culture expressed in an unpretentious manner.

Internationalism created by industrialization leads to global culture with non-identity. This type of 'international identity' has been well received in Hong Kong. Curtain wall internationalism, granite clad post-modernism, machine tailored high-tech... all establish their style of buildings on Hong Kong.

³¹ Perhaps this carnival of styles is the international image representing a modern metropolis.

COST OF ENCLOSURE

Expressing a cultured representation of architecture in the building skin has at least a direct construction cost to bear. Large public buildings like Foster's Hong Kong Airport at Chep Lap Kok³² are

文化的发现

科技是用来适应人们的习俗和风气的，这样就形成一个建筑物的外壳以表现文化。在巴黎的阿拉伯世界学院 (Institute du Monde Arabe in Paris) 是由 Jean Nouvel 设计的。



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他用了很多钢材和玻璃构成一个高科技的立面来表现阿拉伯几何学。南立面设置了像曼陀罗形状的窗并装上了许多透镜。透镜上装设有孔眼，可以开关来调节射入的光。

相反地从一座低科技楼宇的一部分，可以看到令人感兴趣的立面。这是一个完全相反的处理方法，是居民将他们所喜爱的形态在香港的旧式中高层居住建筑的立面上表现出来。



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这亦是一种社区建筑学 (community architecture) 的方式，在那里人的特性显示在建筑物的外墙上。人们用简单的建筑技术来描述普通的生活形态。就在地平面以上，当地制作的招牌与自我表现的立面显示出一种原始的媒体建筑 (media architecture)。



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这是一种毫无掩饰的文化表现。

由工业革命所引致的国际主义 (Internationalism) 将地球文化推向非个性化。这种类型的“国际单一性”已经深入香港。幕墙国际主义，外包花岗岩的后现代主义，机械精加工的高科技等等，全都在香港的建筑物上得到体现。

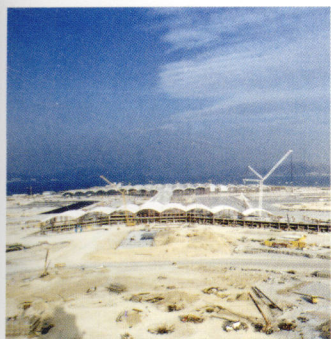


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也许是各种风格的嘉年华会成为代表一个现代大都会的国际形象。

外墙的造价

在建筑物的外墙上来表达建筑学的文化至少要承担一笔建造费用。像霍朗明 (Foster) 设计的赤鱘角香港机场这样的大型公共建筑物具有非常高的造价敏感性，并且是在财政上要加以控制以节约公众的钱。



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在外墙上用上不同的材料表明各种材料价格差异幅度是非常大的。下列是几种材料在 1997 年初的价格指标：

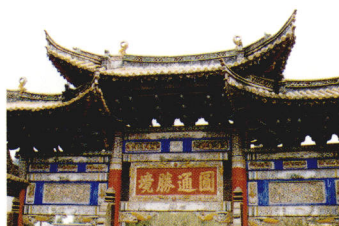
外墙单价比较（1997 年 3 月 1 日的资料）

大楼外墙做法	单价 每平方米港币 (H.K.\$/m ²)
表面精细的混凝土墙（125mm）外加保护面层	500~600
混凝土墙（125mm）外加做粉刷和喷漆饰面	650~720
混凝土墙（125mm）外加做粉刷和马赛克饰面	680~750
混凝土墙（125mm）外加做粉刷和有光面砖饰面	700~800
幕墙（单元化体系）配反光玻璃安装在混凝土框架上	3500~4500
幕墙（杆体系）配反光玻璃安装在混凝土框架上	2500~3000
混凝土结构上包裹铝合金墙扇	2200~3500
混凝土结构上包裹花岗岩墙扇	2800~4000
大幅玻璃附带悬挂系统	8000~10000
混凝土框架上安装预制混凝土墙扇	2000~3000

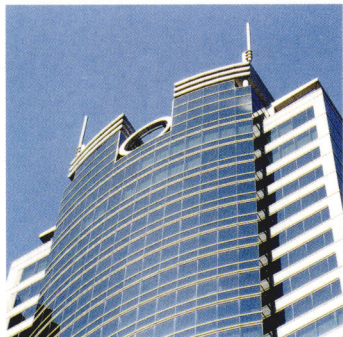
（上表由利比估算师供稿）

以上是由业主付给承包商的工程造价。从周围环境的考虑看，在建造之前和之后都有一些隐藏着费用。在建造之前，要花很多具体化的能源去取得原料，将原料转换成可使用的产品，将产品运输到现场，然后将它们建成楼宇。木材所花的具体化能源（embodied energy）最少。

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砖与混凝土亦比较少一些。至于钢材、玻璃和铝的具体化能源，则是非常高的。



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在建造之后，则要有维护保养、清洁、修理或更换的费用。

为了节能，也意味着节省造价，可以选用低耗能的材料，设计房屋时可以使用高质量和耐久的饰面。这样可以减少维修保养，并且使建筑物的使用寿命长一些。准确地设计细部，使之与所选用的材

very cost sensitive and financially controlled to save public money. The different materials used on the external wall account for very varied price range. A list of some materials at early 1997 cost index is as follows:-

Unit Cost Comparison for External Wall
(Data at 1st March 1997)

Description of Building Envelope	Unit Rate HK\$/m ²
Fair-faced concrete wall (125 mm)	550-600
with protective coating	
Concrete wall (125 mm)	650-720
with rendering and spray-paint finish	
Concrete wall (125 mm)	680-750
with rendering and mosaic tile finish	
Concrete wall (125 mm)	700-800
with rendering and glazed tile finish	
Curtain wall (unitized system)	3,500-4,500
with reflective glass on concrete structure	
Curtain wall (stick system)	2,500-3,000
with reflective glass on concrete structure	
Aluminium panel cladding on concrete structure	2,200-3,500
Granite panel cladding on concrete structure	2,800-4,000
Large glass area with suspension system	8,000-10,000
Prefabricated concrete panels on concrete frame	2,000-3,000

(by courtesy of Levett & Bailey Surveyors)

The above is the cost payable to the contractor by the client for the construction. Going back to environmental concern, there are hidden costs before and after. Before construction, costs are required for the embodied energy to get the raw materials, convert them to usable products, transport them to site and build them as structures. Timber has the lowest embodied energy.³³ Brick and concrete are relatively low. For steel, glass and aluminium, these are very high.³⁴ After construction, costs are necessary for maintenance - cleaning, repair or replacement.

To save energy and hence cost, lower energy materials can be chosen. Buildings can be designed for long life using high-quality and durable finishes minimizing maintenance. Designing details accurately to suit the selected materials or components can reduce wastage. Recycling is an important method to save costs of producing new materials. All these efforts contribute to saving environmental costs

料或是构件相适应会减少浪费。重复使用对节省生产新材料的费用是一项重要的方法。所有这些努力都是贡献出来节省环境费用的，因为这是不能予以重新补充的。



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于是逐渐地，一个持续性长久的环境 (sustainable environment) 就可以实现了。

可持续性

当我们将楼宇去替代自然时，



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which cannot otherwise be replenished.³⁵ Gradually, a sustainable environment can be achieved.

SUSTAINABILITY

When we replace nature with a building, part of the natural process will be disrupted.

This is human development. A sustainable development is one that does not harm the earth but is in harmony with natural processes. Solving the needs of the present will not handicap the needs of the future.³⁶ The building enclosure is the interphase between external and internal or between natural and man-made environment. Traditional culture often were more environmental-friendly. Taoism depicts harmony between men and nature.³⁷ Buddhism respects the opportunities of life as it happens in nature.³⁸ However, industrialization and technology invention have led men to become selfish and only in the end to make life difficult and even to destroy themselves. To reinstate a livable earth, the building enclosure is a good starting point to build up sustainability. Actually, the technology³⁹ for sustainable enclosure is available; what is needed now is a devotion to respect and preserve the environment for our future generations.

一部分的自然界的过程将要被破坏了，这就是人类的发展。

一项可持续的发展 (sustainable development) 是这样的一种发展，它不破坏地球，而且与自然过程相协调。要解决当前的需求，决不能不利于将来的需求。

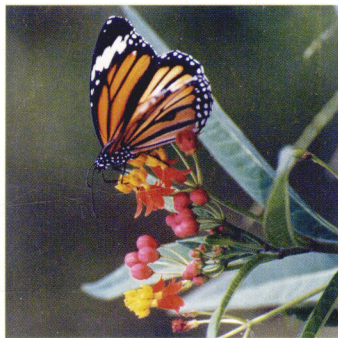
建筑物的外墙是内部与外部之间或者是自然环境与人造环境之间的中间相。传统的



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崇人与自然之间的和谐，佛教则尊重发生在自然中的生活机会。

文化往往是更为与环境亲近的。道教的学说就是推



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然而，工业化和科技将人们引导到成为自私的地步，而这只能到最后使自己的生活会困难，并且毁损了他们自己。为了要恢复一个可居住的地球，建筑物的外墙是一个良好的起点来确立持续性。事实上，可持续的外墙的工艺技术是可以做到的，现在所需要的是放弃自我，为了人们的后代而重视和保存好我们的环境。