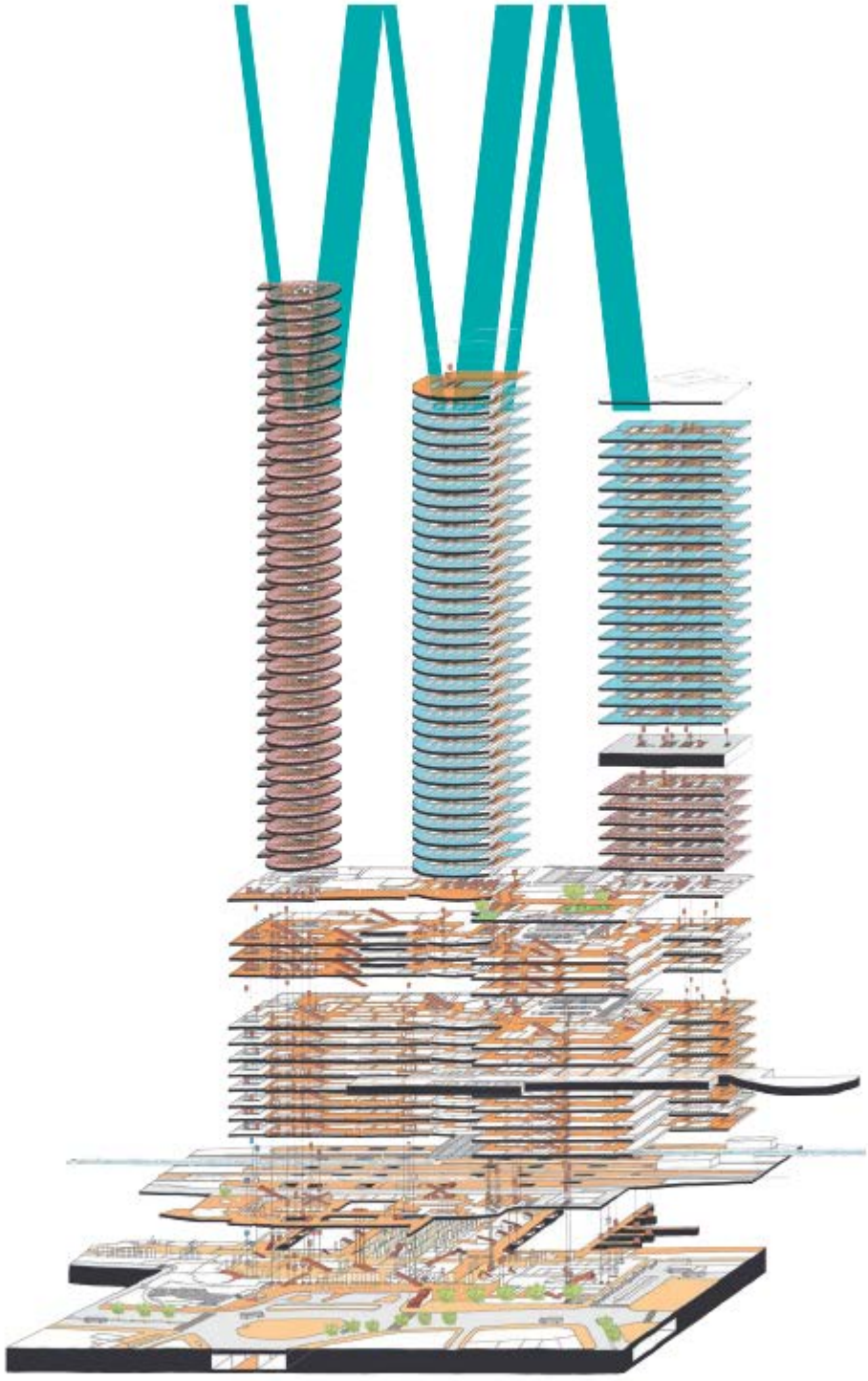

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世 界 建 筑
World Architecture

交通枢纽：关于站城融合的未来 | Transit Centres: Station as Urban Places

星宇项目，新加坡
The Star, Singapore, 2012

建筑设计：Aedas
Architects: Aedas

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星宇项目设计方案内涵丰富，无法单一解读。项目设计采用了多面可渗透的设计，富有穿透性，生动反映了室内丰富多样的活动，并模糊了公共区域、私人领域以及商业和文化部分之间的界限。

项目采用柔和流动的过渡设计，鼓励人们探寻，使得项目成为充满活力和吸引力的城市目的地。项目面积 62,000m^2，包括由 Rock Productions Pte Ltd. 管理经营的星宇表演艺术中心和由凯德商用产业有限公司管理经营的商业和娱乐区。项目不仅成为纬壹科技城的地标建筑，同时还为更大范围内的新加坡市民提供了优质娱乐、生活和商业体验。

项目旨在成为富有活力的城市节点，包括一座 5000 席的文化剧院和餐饮为主的商业部分，两个部分互为补充，提高了彼此的活力。

项目基地属于新加坡 Buona Vista 纬壹科技城总体规划的一部分。该总体规划旨在打造可举行各种市民和文化活动的区域中心，鼓励创意和创新产业发展。为符合纬壹科技城的大胆定位，建筑需要满足业主任务书对于打造标志性建筑的要求以及相关的功能和技术要求。

此外，总体规划说明了详细的规划限制条件，包括：连接人行道、建筑围护、建筑控制高度、保留基地现有地形与关键的基地特色，以及保留 / 移植重要的成材树木。

为满足上述条件，设计采用了如下措施：

（1）保留基地天然地形：《城市规划导则》要求保留原有地形标高，并强调重要的基地地貌。建筑物将底层划分为一层（从南侧，东南和西侧进入）和二层（从北侧和东北进入），适应了标高上的变化（+118.50 FFL – +111.00 FFL）。

（2）+111.0 FFL – +115.0 FFL 标高的不同出入口和落客点融入到开放式广场中，吸引游客从各个主要连接点进入项目。

（3）基地地形为山地，标高 +111.00 FFL – +118.50 FFL；设计采用一系列退台露台再现山地地形，同时在星宇表演艺术中心处设置了贵宾落客点。

（4）人行交通：设计了自然通风的有渗透性接地平面，中间设置 35m 高的大型广场，向来自地铁站，纬壹科技城和其他未来项目的主要人流量开放。

（5）融合公共空间：将非正式的公共空间精心融入到建筑物地下一层，二层和三层中，打造了多处带景观的公共区，可用于举办表演活动、展览、聚会和其他公共活动。

由于公共和文化区域的总建筑面积限制，机电竖向布置需要优化，为更加重要的表演、大堂和动线空间腾出更多建筑面积。

星悦汇

商业空间设计与复杂的基地地形响应，区域采用内凹设计方便设置主入口，并直达开放的圆形剧场。这种复杂的设计在确保功能性的同时，为大楼内各类活动的开展创造条件。

小面玻璃裂纹消解了体量的庞大感，确保实体空间与周边空间的动态融合以及平衡感。南向立面完全开敞，内部设施可从外部一览无余。大楼被设计成一个有机的整体，等待人们进行探索。人们可以在低区迂回漫游，流连其间，穿越各种坡道、扶梯、露台及公共花园攀至顶点。所有的流线、运动及内部形状均委婉柔和，交织各类活动。

文化分区与商业分区之间采用竖向柔性过渡的手法连接，由最开放、公共程度最高的零售商场渐次进入具有一定私密性的剧场空间。整个顺序及变换与 33m 高的大厅从视觉及空间上串联，连通了地下商业及顶部玻璃层的影院主大厅，坦露出建筑悬空部分的内部空间。

星宇表演艺术中心

作为市政及公共场所的星宇表演艺术中心的外观设计极富冲击力。与星悦汇一样，南向立面为开敞立面，将设施内部的运营展露在外。建筑剧场部分处于悬空，外立面玻璃幕墙分割为不规则多面体，

1.2 鸟瞰/Aerial views（图片来源/Sources: Aedas）
3 外景/Exterior view（摄影/Photo: ©Paul Warchol）

The design for The Star does not present one singular expression to describe the project; instead it celebrates the rich and diverse happenings inside the building with a multi-faceted, permeable and dynamic design, blurring the boundaries between public and private realms as well as retail and cultural components. The transitions are soft and flowing to encourage discovery and therefore make it a highly engaging and energetic attraction for the city. The 62,000m^2 development comprises The Star Performing Arts Centre, a Cultural Zone owned and managed by Rock Productions Pte Ltd; and The Star Vista, a Retail and Entertainment Zone owned and managed by CapitaLand Mall Asia Limited. The development provides a premier entertainment, lifestyle and retail experience not only for one-north but also the wider Singapore community.

The project aims to become a vibrant civic node with a 5000-seat cultural theatre and a food-and-beverage oriented retail sector, working together to enhance each other's viability. The site is located within the larger one-north master plan at Buona Vista, Singapore, which was established to create a regional centre for a wide variety of civic and cultural activities and promote innovation and creativity. In keeping with one-north's bold vision it was paramount that the architectural response to the client's brief married the functional and technical requirements of an iconic architectural form. In addition, the master plan sets out detailed planning constraints in terms of pedestrian connectivity, building envelope, height control, retaining of site topography and key site features, as well as retaining/transplanting of mature trees of significance.

The development implements the following strategies:

(1) Retention of the Natural Site Topography – The Urban Planning Guidelines required that the original topographical levels were to be retained and certain significant site features were to be emphasised. The building responds to the variance in levels (from +118.50 FFL to +111.00 FFL) by splitting the ground floor into Level 1 (accessing from the south, southeast and west) and Level 2 (accessing from the north and northeast).

(2) The varying access and drop-off points that range from +111.0 FFL to +115.0 FFL are integrated into the open plaza, welcoming visitors from all major connection points.

(3) The hilltop feature that rises from a ground level of +111.00 FFL to +118.50 FFL is re-created by a series of stepped terraces, housing also the VIP drop-off point at The Star Performing Arts Centre.

(4) Pedestrian Connectivity – A naturally ventilated porous ground plate with a 35m high grand plaza at its core opens up to the main pedestrian flows from the MRT, one-north Park and other future developments.

(5) Integration of Civic Spaces – Informal civic spaces are thoughtfully integrated into the lower floors of the building at Basement 1, Level 2 and Level 3, creating several landscaped communal zones where performances, exhibitions , gatherings and other civic activities can be held.

Constraints on gross floor area (GFA) available for the Civic and Cultural Zone also required MEP arrangements to be optimised and stacked to free up GFA for the more critical performances, lobby and circulation spaces within.

The Star Vista

The design for the retail space responds to the challenging site topography as the zone spirals inwards to address the major entry points and culminate in an open amphitheatre. The complex allows an array of rich and varying activities to take place inside the building whilst maintaining functionality.

Faceted glass fissures dissolve big masses and create a dynamic composition of positive and negative spaces as well as a sense of balance. The south elevation is completely opened up and its facilities are clearly visible from outside. The building is an organic object opening to public discovery. One can crawl under, move through, transverse around and climb onto the complex via a series of ramps, escalators, terraces and public gardens. All circulations, movements and internal forms are soft and sinuous as if the civic activities have shaped the inside of the complex.

Soft transition occurs vertically from the public, open retail to the private, enclosed theatre. The entire sequence and transition is linked visually and spatially to the 33m high grand foyer, connecting the below-ground retail and the top glass floor of the theatre's main lobby and exposing the volume floating above.

The Star Performing Arts Centre

The civic and public components of The Star Performing Arts Centre are paramount and outwardly expressed. Same as The Star Vista, the south elevation is opened up to present the inner workings of the facility as a "visible section". The mass of the theatre floating above is faceted with glass fissures, and utilises custom made ribbons with acoustic render for cladding, which help dissolve and break down the mass above, playing with a composition of positive and negative readings and in balance with the lower portions of solid and void.

The theatre contains over 5000 seats with two balconies, by far the largest venue of its kind in Singapore and is capable of staging musicals, concerts and other large scale performances. A cavity wall system prevents sound and vibrations coming in from the lobbies and external environment. The entire steel structure of the theatre is contained in a traditional "box within a box" approach.

Sustainability

The Star is first and foremost a social building. Its design aims to provide an active and welcoming social interface for the local neighbourhood through the publicly accessible forecourt and retail areas.

A series of climate ameliorated outdoor spaces that accentuate natural air movement has been created to protect visitors against Singapore's tropical rain and sun while at the same time providing outdoor patrons with physiological cooling.

To avoid confining and air conditioning public spaces as in many other parts of Singapore, the form of the building is shaped to collect prevailing northerly and southerly breezes and accelerate through the outdoor spaces, creating comfortable outdoor seating areas for patrons to socialise in a healthy outdoor environment.

Canopies are installed to provide shelter from direct sun and rain, further collect breezes and

并采用了阻止震动和噪音的定制材料，有助于缓和并分解上方庞大体量，巧妙组合排布正负空间，与建筑下半部分达到虚实平衡。

影院包含两个包厢，拥有超过 5000 个座位，是迄今为止新加坡同类设施中规模最大的演出场地，可以承担音乐剧、音乐会及其它大型演出。空心墙面系统阻挡了大厅内部及外部环境的声响及振动。影院的整个钢结构被包覆在传统的“箱中箱”结构内。

可持续性

本项目主要作为一栋社会性建筑，旨在通过对公众开放的公共区域及商业区为当地居民提供活力的社会界面。

项目打造了一系列强调自然风环境的防风雨室外空间，在为户外顾客提供自然制冷的同时，为访客提供空间，遮蔽新加坡的热带风雨及日光。

为了避免与新加坡其他众多场所内设置空调的狭窄公共空间一样，大楼外型可以收集南北向的盛行风，加速通过外部空间，为顾客打造舒适的户外座椅区，进而推广健康的户外环境。

此外，还设有雨篷阻挡日光及风雨的直接影响，进一步收集微风，并控制室内外环境之间的视觉对比，提高用户的舒适感。

大楼的设计灵感将成为可持续及被动设计的典范。随着被动设计中第一原则的应用，大楼与四周环境互为补充，融为一体。

设计应用了计算流体动力学，优化自然及生物学通风效果，在通常采用空调的普通流线区域内营造出舒适的热环境。

此外，在仅靠自然通风无法满足舒适要求的区域还实施了混合通风策略，以获得最佳舒适度。在地下市民广场内，安装了设有高容量低速风机的机械辅助蒸发冷却系统，在避免机械冷冻的同时，提供了户外热舒适所需的空气流动。

通过使用建筑物理技术，优化了项目朝向。并对采光、日照得热、眩光及热舒适均进行了分析。减少了东西外露面积，最大程度降低整体日光得热。对外立面的设计、性能及窗墙比进行了优化，最大化使用区域的采光，并进一步控制日光得热量。

除了上文所述的应用了第一原则的整体被动设计外，项目还采用了大量措施，来降低整体能耗：

（1）采用了设有变压变频及休眠模式的节能电梯及扶梯，来降低能耗。

（2）在公共区域（如楼梯及卫生间）内采用运动传感器照明控制，来降低照明能耗。

（3）观众厅采用了地板下送风系统，通过为温度稍高的使用平面传输凉风来减少制冷要求及能耗。

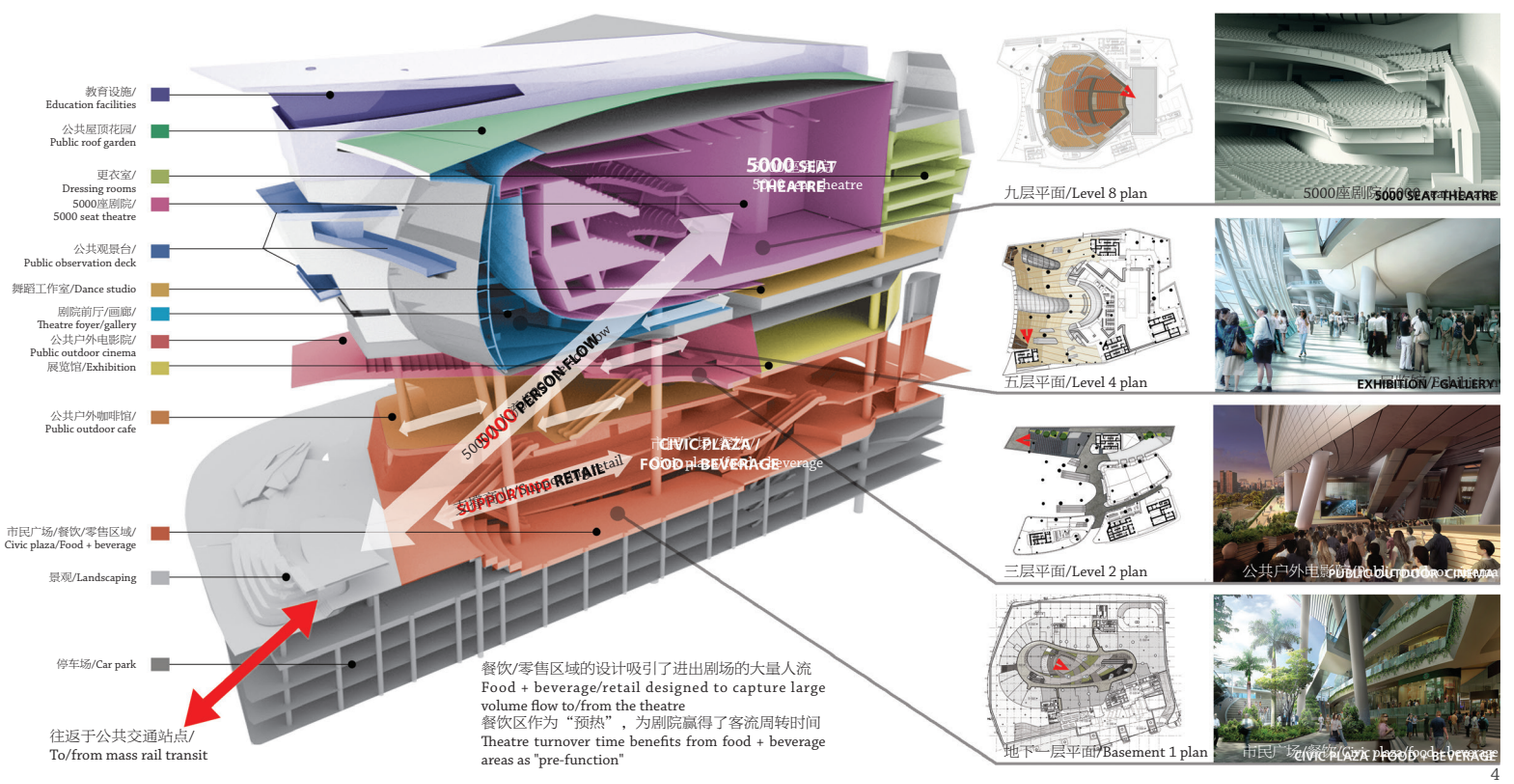
（4）地下车库采用了设有 CO 传感器的无管风机，最大化减少系统阻力降低能耗。

（5）开敞商业空间设计在空气调节方面节约了大量能源。

空调系统、空调泵及冷却塔设计分别为项目减少了 20%、39.1% 及 29% 的能耗。与非可持续设计项目相比，本项目的整体节能率预计为 15%，预计年度运营耗电量为 499kWh/m^2。这些数据均满足新加坡建设局绿色建筑标志金奖要求。

项目的设计也侧重于减少饮用水的消耗和水污染。对雨水和空调冷凝水进行收集，并用作灌溉种植区域的替代水源。这种替代水源也用于冷却塔，由城市的新生水（经过处理的未使用的水）来补充，无需使用饮用水。

此外，遍布整个基地的入渗沟有助于减少雨水



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4 轴测剖面分析/Axonometric section（图片来源/Sources: Aedas）

control the visual contrast between inside and outside environments to enhance the occupants' sensory comfort.

The aspiration for this building is to become an exemplar of both sustainable and passive design. With the use of the first principles in passive design, it complements and integrates with its surroundings.

Computational Fluid Dynamics is used to optimise natural and physiological ventilation effects and create comfortable thermal conditions in the common and circulation areas that would otherwise have to be air conditioned.

A hybrid ventilation strategy is also implemented to maximise comfort in areas where comfortable conditions cannot be achieved by natural ventilation alone. A mechanically assisted evaporative cooling system which employs high volume, low speed fans is deployed in the basement civic plaza, providing air movement that is required for outdoor thermal comfort while avoiding mechanical refrigeration.

The orientation of the development was optimised by using building physics techniques. Daylight, solar heat gain, glare, and thermal comfort were all analysed. East and west exposure was reduced to minimise the overall solar heat gain. The design, performance and window to wall ratio of the façade were optimised to maximise daylight in occupied areas and also further control solar heat gain.

In addition to the holistic passive design by the first principles described above, the development also implements a number of strategies to reduce overall energy consumption:

(1) Energy efficient lifts and escalators with VVVF and sleep mode features reduce energy consumption.

(2) Motion sensor lighting controls in common areas such as staircases and toilets reduce lighting consumption.

(3) An underfloor displacement ventilation system in the auditorium reduces cooling requirements and energy consumption by delivering cool air at a slightly higher temperature at the occupied levels.

(4) Ductless fans with CO sensors are used in the basement car parks, minimising system resistance and reducing energy consumption.

(5) The open space retail design brings a huge energy savings in air conditioning.

The current savings in air conditioning systems, air conditioning pumps and cooling tower for the development are 20%, 39.1% and 29% respectively. The overall energy saving is currently estimated at 15% compared to a non-sustainably designed development, and it is estimated to operate at about 499kWh/m^2/ annum. These figures meet the requirements of the BCA Green Mark Gold rating.

The design of the development also focuses on reducing potable water consumption and water pollution. Rain water and air conditioning condensate water is collected and used as alternative water source to irrigate site planting. This alternative water source is also used for the cooling tower, which is supplemented by the city's NEWater (treated unused water) without the need for potable water.

Besides, infiltration trenches throughout the site help reduce storm water runoff, minimising stress on local infrastructure and reducing pollution. In addition to these initiatives, sub-metres for all major water uses are linked to the building management system to monitor water consumption and help set water saving guidelines in the future.

In addition to maximising human comfort and minimising operational resource consumption, issues such as transportation, waste management and air quality were also considered when designing the development. The following list outlines the additional initiatives that are implemented within the site.

(1) Original trees on site were removed during construction and restored post construction.

(2) Recycled horticultural waste is used for compost.

(3) Recycling bins are provided for operational waste diversion.

(4) The building is located in close proximity to

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5 内景/Interior view（摄影/Photo: ©Virgile Bertrand）

径流，最大化减小对当地基础设施造成的压力，并减少污染。除了这些措施之外，所有主要用水计量分表都与建筑管理系统相连，以监控用水量，有助于在未来建立节水的指导方针。

除了尽最大可能增加人体舒适性、减少资源消耗之外，运输、废物处理和空气质量等问题在设计之时也得到了精心的考虑。下列为在基地得以实施的额外举措：

（1）在施工期间移走现场的原始树木，竣工后重新栽回。

（2）回收园艺垃圾用于堆肥。

（3）为操作性废物转移提供了垃圾箱。

（4）建筑的位置靠近 Buona Vista 地铁站和公共汽车站，促进了公共交通的使用。

（5）提供自行车停车场及相关设施。

（6）在停车场设有混合动力车和电动汽车充电站。

（7）在停车场安装导引系统，方便分区，并在必要时暂时关闭没人使用的地方。

（8）安装了制冷剂泄漏检测系统，以免制冷剂泄漏。

（9）为保护室内空气质量，使用了低挥发性有机物涂料和低甲醛黏合剂。

（10）为尽量减小对整体环境的影响，在施工中采用了环境规划方案。

（11）在租赁协议中限制租户的能耗水平。

该发展项目在社会、经济、环境和生态方面均高水平融入了这个密集的城市环境中，并在热带地区设立了全新的先进公共空间的设计标准。

安保系统和无障碍设计

开发一种表达项目中商业及市民元素的建筑语言是至关重要的。其南立面完全对外开放，从室外景观区域清晰可见内部设施运营状况。上部文化部分采用小块玻璃的设计，以减少整体体量的视觉影响，在对剧场正负空间解读的同时，与商业部分的虚实空间保持平衡。

在运营第一年，预计仅在此举办新加坡 36% 的文化活动。

（1）完全符合无障碍要求。

（2）商业区域及文化区域遍布家庭休息室、婴儿换尿布设施及哺乳室。

（3）二层、三层及屋顶的景观空中廊道增强了室内空间的空气流动及绿化效果。

（4）位于商业区中心的绿化市民广场活动空间供市民 24 小时全天候使用。

（5）三层的景观“开放式”圆形剧场供公众使用。

（6）通过街区行人通道可随时进入。

材料&施工方法

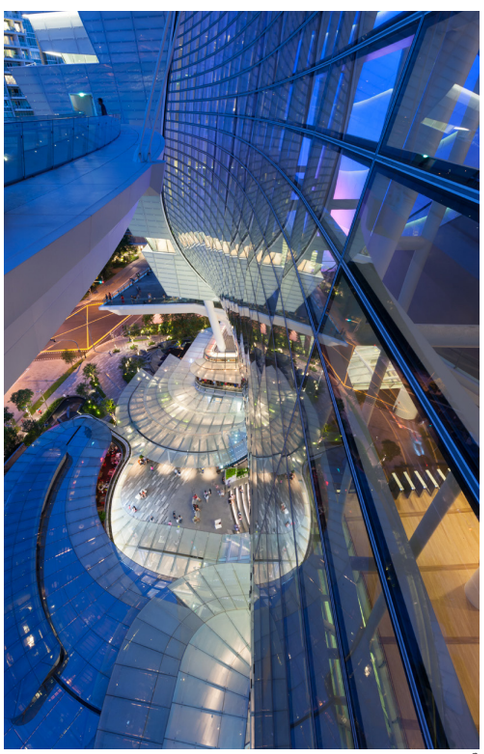
整个项目利用含纤维玻璃夹层的高性能三重釉面玻璃系统，以大大减少烈日烘烤，同时提供了一个透明的建筑外观，其内部体验从外部清晰可见。项目商业区域及室外区域采用了回收利用的防滑花岗岩铺路石。剧场前厅区域采用的是本地竹子制作的竹地板。剧场采用的是防过敏地毯，剧场室内包层则采用含单层吸音毡衬板的轻质锌铝穿孔板。

项目采用的主要方法为逆作施工法。通过采用特殊技术，确保了地下室及上层结构施工的同时进行。也就是说，当一个施工队伍进行底部 4 层施工的同时，另一个施工队员正在进行上方建筑的施工。

三层以上的结构总共包含 11,000t 的钢结构。由于形状不规则、跨度大，且楼层高度较高，设计考虑了大型横梁及桁架装配的上下输送。这些重型塔吊由承包商负责；完全伸展至 50m 时，每个塔吊的臂端吊重为 7~8t，当吊臂靠近中心时，其吊重可达 24 吨。在处理靠近建筑边缘一些重达 25t 的重型货物时，还采用了移动式起重机。

从钢结构处理、设计、放线、工厂及安装施工图到为工厂计算机数控机床创建输入的钢结构过程中广泛采用了 BIM 技术。

外立面材料在中国制造，运至基地进行安装。由于外立面造型复杂，需要大量的规划、协调及密切监控工作。□



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6 夜景/Night view
7 剧场/The Theatre
（6.7图片来源/Sources: Aedas）

the Buona Vista MRT station and public bus stations, promoting the use of public transport.

(5) Bicycle parking lots and associated facilities are provided.

(6) Recharging stations for hybrid and electric vehicles are available in car parks.

(7) A car park guidance system is installed to facilitate zoning and temporary closure of unoccupied areas when necessary.

(8) A refrigerant leak detection system is installed to avoid leaking of refrigerants.

(9) Low VOC paints and low formaldehyde adhesives were used to protect internal air quality.

(10) Environmental programmes were adopted during construction to minimise the overall environmental impact.

(11) Tenancy agreements limit tenants' power consumption.

This development achieves a high level of social, economic, environmental, and ecological integration into this dense urban environment and sets new standards for the design of progressive public spaces in the tropics.

Safety, Security & Accessibility

Developing an architectural language to express both commercial and civic components of the project is paramount. The design opens up the south elevation, allowing the inner workings of the facility to be visible from and to the outdoor landscaped areas. The mass of the upper cultural component is faceted with intersecting glass fissures to reduce the visual impact of the overall volume, playing with a composition of positive and negative readings of the theatre in balance with the use of solid and void in the retail component.

It is planned to run only 36% of cultural events in Singapore during the first year of operation.

(1) Fully barrier free compliant.

(2) Family friendly restrooms, baby changing facilities and nursing rooms are available throughout the commercial and cultural areas.

(3) Intermediate landscaped sky terraces on Level 2, Level 3 and the rooftop promote airflow and greening of the building interior.

(4) Landscaped civic plaza activity space at the heart of the retail zone with 24-hour accessibility for communal use.

(5) Landscaped "open air" amphitheatre at Level 3 for communal use.

(6) 24-hour accessible through block pedestrian linkage.

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Materials & Method of Construction

The entire development utilises a high performance triple glazed glass system with a fibreglass interlay to significantly reduce solar heating and provide a translucent appearance, allowing external expression of internal experience. The retail zone and external zones of the project use recycled no-slip granite pavers. The flooring of the pre-function spaces of the theatre is locally procured bamboo. Hypoallergenic carpet is used for the theatre with the internal theatre cladding utilising light weight zinc-aluminium perforated panels with simple acoustical absorptive felt behind.

The main method used was top-down construction. With this special technique, the basement and superstructure were constructed concurrently. In other words, while one team was working downwards to construct the balance of the four basements, another team was working on constructing the building upwards.

The structure from Level 3 onwards consists of about 11,000 tons of structural steel. Due to the irregular shapes, long spans and high floor to floor heights, lifting of large beam and truss assemblies was envisaged and planned for. Three heavy duty tower cranes were erected by the contractors; and each crane could take a tip load of 7~8 tons when fully outstretched at 50m and up to 24 tons when closer to the centre. Mobile cranes were also brought in the handle some of the heavy lifts of up to 25 tons which occurred near the building edge.

BIM was employed extensively throughout the steel structure process, from design, setting out, and factory and installation shop drawings to creating input for the factory's CNC machines.

The façade materials were fabricated in China and shipped to the site for installation. Given the complex geometry of the façade, it required tremendous planning, coordination and close supervision.□

项目信息/Credits and Data

地点/Location: 新加坡纬壹/One North, Singapore

客户/Client: Rock Productions Pte Ltd., CapitaMalls Asia Ltd.

设计团队/Design Team: Aedas

结构工程师/Structural Engineers: Parsons Brinckerhoff, Thornton Tomasetti (Before DD Stage)

环境工程/Environmental Engineer: Arup Singapore Pte Ltd.

消防工程/Fire Engineer: Arup Singapore Pte Ltd.

立面/Façade: Alt Limited

机电工程/MEP: Mott Macdonald

室内设计/Interior Design: Aedas

剧场与声学顾问/Theater and Acoustic Consultant: Artec Consultants Inc

工程测算/QS: Langdon & Seah Singapore Pte Ltd.

照明设计/Lighting: Lighting Planners Associates(S) Pte Ltd.

景观设计/Landscape: ICN Design International Pte Ltd.

基底面积/Built Area: 19,200 m^2

总建筑面积/Total Floor Area: 62,000 m^2

建筑高度/Height: 75 m

造价/Cost: 453.7 MSGD

竣工时间/Completion Time: 2012.10

摄影/Photos: Paul Warchol, Virgile Bertrand

8 夜景/Night view（摄影/Photo: ©Paul Warchol）