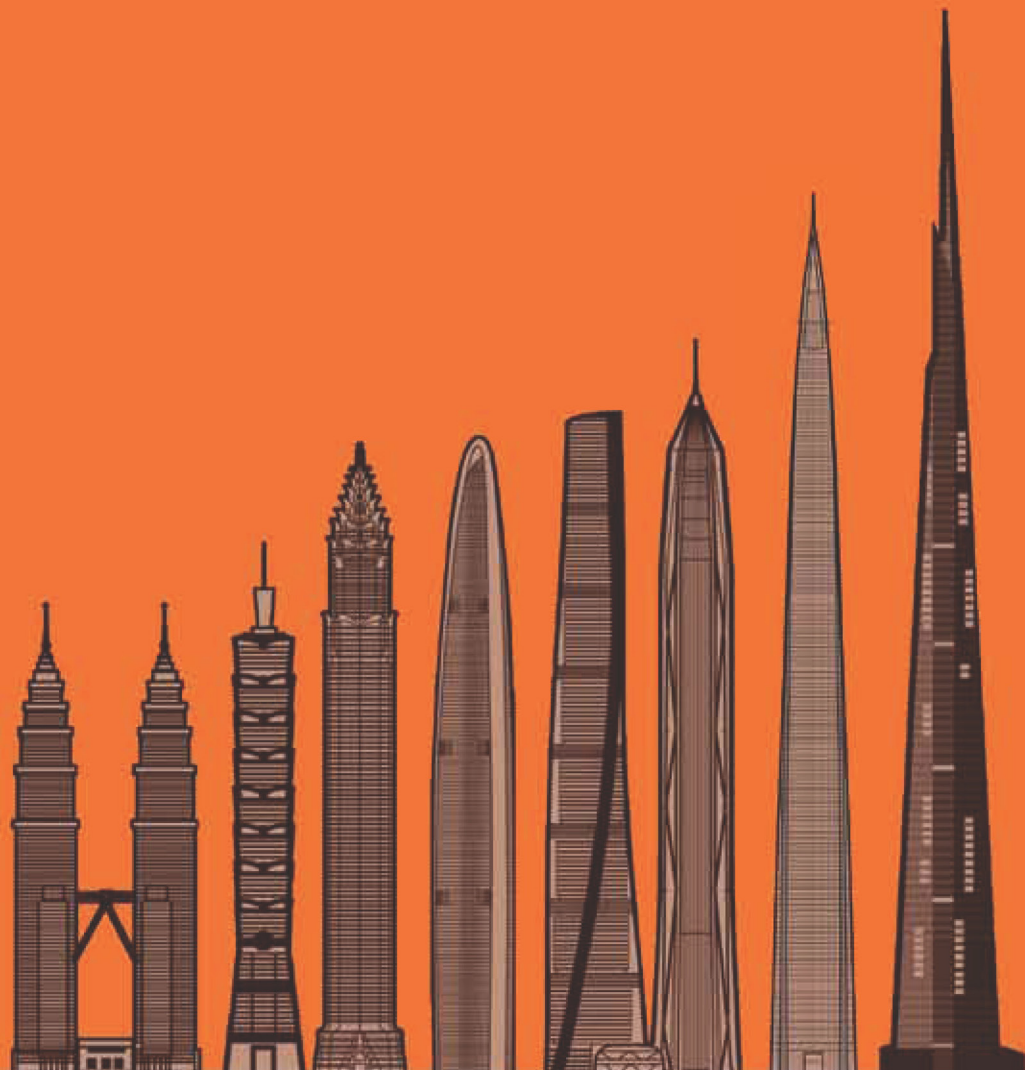


# 宋腾添玛沙帝 Thornton Tomasetti

建筑工程设计专家



可持续化设计 结构设计 建筑性能  
施工支持 幕墙设计 财产损失评估



◀ 王国塔  
(1,000 米以上)  
沙特阿拉伯，吉达

我们为王国塔项目提供结构设计服务。王国塔位于占地 2300 万平方米的新城市开发区“王国城”中央，建成后将成为世界最高建筑。我们提供的结构设计可以满足严格的超高层建筑性能目标，同时满足国际及当地的建筑规范。

建筑设计单位：Adrian Smith + Gordon Gill Architecture  
业主：Kingdom Holding Company  
总建筑面积：530,000 m<sup>2</sup>

**Kingdom Tower  
(1,000+ meters)  
Jeddah, Saudi Arabia**

We are providing structural design services for Kingdom Tower, the centerpiece of a new 23-million-square-meter urban development known as Kingdom City. Upon completion, the tower will be the world's tallest building. The design of the structural system is based on stringent performance criteria for supertall structures, utilizing both international performance standards and regional building codes.

Architect: Adrian Smith + Gordon Gill Architecture  
Owner: Kingdom Holding Company  
Total Area: 530,000 m<sup>2</sup> (5.7 million SF)

**Image Credits**

Kingdom Tower  
© Adrian Smith + Gordon Gill Architecture

Suzhou Zhongnan Center  
Courtesy Gensler

Shanghai Tower  
Courtesy Gensler

Ping An Finance Center  
Courtesy KPF

Wuhan Greenland Center  
© Adrian Smith + Gordon Gill Architecture

Signature Tower  
Courtesy Smallwood, Reynolds, Stewart,  
Stewart & Associates

Chengdu Dongcun Greenland Tower  
© Adrian Smith + Gordon Gill Architecture

Taipei 101  
Dugald MacKay

Petronas Towers  
Michael Goodman

Plaza 66  
Philip Gostelow

Taikoo Hui  
Courtesy Arquitectonica



◀ **苏州中南中心**  
**(700米以上, 137层)**  
中国, 苏州



苏州中南中心包括了一栋高度超过700米, 137层的超高层多功能塔楼, 包括5A级办公区、高档住宅区、7星级酒店和一栋用于宴会厅和会议厅的八层大跨度裙房。项目建成之后, 苏州中南中心将成为世界第三、中国第一高楼。

塔楼采用了独特的“核心筒-外伸臂桁架-巨型框架”抗侧力系统以满足中国规范的要求。地基基础由钻孔灌注桩支撑6.3米厚的筏板组成, 以达到支撑巨型塔楼和控制沉降量的作用。塔冠通过采用简洁的结构体系, 将外部建筑优雅造型和内部结构高效简洁进行了有机结合。

建筑设计单位: Gensler  
业主: 中南建设集团  
总建筑面积: 500,000 m<sup>2</sup>

**Suzhou Zhongnan Center**  
**(700+ meters, 137 stories)**  
Suzhou, China

Suzhou Zhongnan Center is a mixed-use complex, consisting of one 700-meter skyscraper with a 137-story superstructure. It features class “5A” office space, high-end residential space, a seven-star hotel and an eight-story, long-span podium structure. When completed, it will be the tallest building in China and the third tallest in the world.

A “core-outrigger-mega-frame” lateral system is used to meet China code requirements. The foundation system, consisting of 6.3-meter-thick mat supported on bored piles, helps to support the massive tower and to control settlement. The tower crown uses a concise structural system that realizes architectural elegance and achieves structural efficiency.

Architect: Gensler  
Owner: Zhongnan Construction  
Total Area: 500,000 m<sup>2</sup> (5.4 million SF)



◀ **上海中心大厦**  
**(632米, 124层)**  
中国, 上海



作为上海中心大厦的结构设计顾问, 我们提供的结构系统简洁、安全、经济, 使建筑极具创造性的外形得以实现。建筑平面形状近似尖角削圆了的等边三角形, 从建筑底部开始沿竖向逐渐缩进且一直扭转至顶部。塔楼核心区域由九个圆柱体叠加而成。我们设计了“巨型框架-核心筒-外伸臂”这种创新结构体系, 有效加强了建筑抗侧力刚度。

建筑设计单位: Gensler  
业主: 上海中心大厦建设发展有限公司  
总建筑面积: 372,000 m<sup>2</sup>

**Shanghai Tower**  
**(632 meters; 124 stories)**  
Shanghai, China

As the project’s structural engineer, we designed a simple, safe and cost-effective structural system that enables a creative architectural form. The exterior of the tower is a twisting triangle that tapers as it rises, and is draped around an inner concrete structure comprising nine cylinders stacked one atop another. We developed an efficient design of super-columns with outrigger trusses that also support the twisting curtain wall. The outrigger trusses and super-columns derive stiffness from the concrete inner building, comprising an effective system for resisting wind and seismic loads typical of supertall buildings.

Architect: Gensler  
Developer: The Shanghai Tower Construction & Development Company  
Total Area: 372,000 m<sup>2</sup> (4 million SF)



◀ **标志塔**  
(638米, 113层)  
印度尼西亚, 雅加达

标志塔位于世界上最活跃的地震带之一。考虑当地松软的土壤条件和高地震频率, 我们设计的抗侧力体系采用了组合核心筒—外伸臂桁架结构。外围巨型框架包括巨柱和九道环带桁架。为使结构效率和安全性最大化, 我们在进行传统的基于建筑规范的设计外, 还进行了性能化设计, 以评估不同地震水准下的建筑结构性能。

建筑设计单位: Smallwood, Reynolds, Stewart, Stewart & Associates  
业主: PT First Jakarta International  
总建筑面积: 520,000 m<sup>2</sup>

**Signature Tower**  
(638 meters, 113 stories)  
Jakarta, Indonesia

This supertall building is in one of the world's most active seismic zones. To accommodate the soft soil conditions and high seismicity, we designed a primary lateral system that links a composite core wall with super-columns and steel outrigger trusses. In addition, the exterior mega-frame includes nine steel belt trusses, six steel floor trusses and additional super columns. To achieve an efficient and safe structure, we applied performance-based design to evaluate the building's performance under various levels of seismic hazard, in addition to the traditional code-based design.

Architect: Smallwood, Reynolds, Stewart, Stewart & Associates  
Owner: PT First Jakarta International  
Total Area: 520,000 m<sup>2</sup> (5.6 million SF)



◀ **成都东村绿地中心**  
(468米, 100层)  
中国, 成都

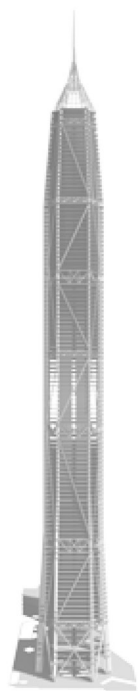
成都绿地中心主塔楼高468米, 共100层, 包括酒店、行政公馆和办公空间。Thornton Tomasetti 为本项目提供方案和扩初设计阶段的结构设计和施工图设计阶段的同业审查。本项目在中国超高层建筑的核心筒中首次采用了斜墙的设计, 为建筑增加了可用楼面空间, 同时也节省了施工成本。

建筑设计单位: Adrian Smith + Gordon Gill Architecture  
业主: 绿地集团成都蜀峰房地产开发有限公司  
总建筑面积: 425,413 m<sup>2</sup>

**Chengdu Dongcun Greenland Tower**  
(468 meters, 100 stories)  
Chengdu, China

Design-phase structural engineering and construction document phase peer review services for a 468-meter mixed-use tower. The 100-story building will include hotel, CEO suite and office space. The structure is the first supertall building in China to use a sloping core wall system, which increases usable floor space and reduces construction material and cost.

Architect: Adrian Smith + Gordon Gill Architecture  
Owner: Greenland Group Chengdu Shu Feng Real Estate Development Co., Ltd.  
Total Area: 425,413 m<sup>2</sup> (4.6 million SF)



▶ **平安国际金融中心**  
**(600米, 118层)**  
中国, 深圳

我们为这座超高层塔楼提供完整的包括性能化设计的结构设计服务。其基坑开挖及基础施工已于2010年初开始。根据大量非线性动力时程分析的成果,我们设计的结构体系包括组合混凝土核心筒、八根巨柱以及连接核心筒和巨柱的外伸臂桁架。外围框架包括七道位于机电层和避难层的双重环带桁架。外围的巨型斜撑与环带桁架在建筑外表面相交。

建筑设计单位: Kohn Pederson Fox  
业主: 中国平安保险(集团)股份有限公司  
总建筑面积: 468,600 m<sup>2</sup>

**Ping An Finance Center**  
**(600 meters, 118 stories)**  
Shenzhen, China

We provided structural design services including performance-based design for this supertall tower. Excavation and foundation work for the tower began in early 2010. The main structural system, checked under extensive nonlinear dynamic time history seismic analysis, consists of a composite concrete core with steel outriggers connecting to eight super-columns. The exterior frame comprises seven sets of double-layer belt trusses at the mechanical and refuge floors. The super-diagonals are interconnected with the belt trusses at each exterior face of the building.

Architect: Kohn Pedersen Fox  
Owner: Ping An Life Insurance Company of China, Ltd.  
Total Area: 468,600 m<sup>2</sup> (5 million SF)



▶ **武汉绿地中心**  
**(636米, 125层)**  
中国, 武汉

为这座超高层塔楼我们设计的结构系统包括一个内埋钢板的组合核心筒,以增加结构强度和延性。位于机电层的外伸臂桁架连接巨柱和核心筒;环带桁架连接各巨柱。(沿竖向)逐渐缩进的体型、穹拱式的塔冠和散落在不同高度的风槽能够有效减小作用于塔楼的风荷载效应,从而达到节省结构材料用量和降低建造成本的目的。

建筑设计单位: Adrian Smith + Gordon Gill Architecture  
业主: 绿地集团  
总建筑面积: 304,000 m<sup>2</sup>

**Wuhan Greenland Center**  
**(636 meters, 125 stories)**  
Wuhan, China

Our design for the structural system of this supertall tower consists of a composite concrete core with locally embedded steel plates, a combination that increases strength and enhances ductility. Outrigger trusses, as well as belt trusses, will be placed at the mechanical levels, which will connect either to the core or to super-columns. A composite column with embedded steel provides strength and enhances ductility, and the composite floor system should shorten the construction process. The tapered body of the tower and its domed top will reduce wind resistance and vortices that typically build up around super-tall towers.

Architect: Adrian Smith + Gordon Gill Architecture  
Owner: Greenland Group  
Total Area: 304,000 m<sup>2</sup> (3.3 million SF)



台北 101大厦  
(508米, 101层)  
台北

台北 101大厦于2004年建成，是当时世界最高建筑。其建筑外观融入了中国古老的塔式建筑元素，又酷似逐层向上开放的花朵，象征着富贵和活力。大厦内设有室内观光层。幕墙所采用的透明节能材料和先进的灯光设计使整个大厦晶莹剔透、玲珑高雅。我们提供概念设计和初步设计服务，并对最终的结构设计方案进行同业审查。

建筑设计单位：C.Y. Lee & Partners  
业主：Taipei Financial Center Corporation  
总建筑面积：204,000 m<sup>2</sup>

**Taipei 101**  
**(508 meters, 101 stories)**  
**Taipei**

The world's tallest building when it was completed in 2004, Taipei 101 presents a unique profile, opening upwards to represent a blossoming flower that signifies wealth and everlasting vitality in Chinese culture. The architecture of the building is the successful realization of a concept of inwardly slanted observatories. With its transparent and high-tech energy efficient glass materials and its innovative lighting design, the building is crystal-clear and elegant. We provided concept and preliminary designs, and reviewed the final structural design by the local engineer of record.

Architect: C.Y. Lee & Partners  
Owner: Taipei Financial Center Corporation  
Total Area: 204,000 m<sup>2</sup> (2.2 million SF)

吉隆坡石油双子塔  
(452米, 88层)  
马来西亚, 吉隆坡

吉隆坡石油双子塔 于1999年建成，是当时世界最高建筑。我们为其提供结构设计服务。双塔凸显伊斯兰建筑风格，在41-42层由一个空中天桥连接。空中天桥距离地面超过150米。为了配合建筑设计方案，结构设计摒弃重型桁架而采用了轻型结构构件。当风荷载作用于整体建筑时，两栋塔楼能够相对于空中天桥独立摆动。该项目还包括一个能容纳5,143个车位的地下车库、一个高七层的商业零售区。一个拥有864个座位且声学上隔离的音乐厅跨支于入口和塔楼及商业区。

建筑设计单位：Pelli Clarke Pelli  
业主：KLCC (Holdings) Sdn. Bhd.  
总建筑面积：307,000 m<sup>2</sup>

**Petronas Towers**  
**(452 meters, 88 stories)**  
**Kuala Lumpur, Malaysia**

We provided structural engineering design for these slender twin towers, which were the world's tallest buildings when completed in 1999. Their dramatic Islamic-themed design incorporates a sky bridge at floors 41 and 42 that connects the towers and creates a visual gateway to a major public park. The sky bridge – more than 150 meters above street level – was designed with slender structural members rather than heavy trusses to be compatible with the architecture of the buildings. It accommodates the independent movement of the towers as they sway in response to wind loads. The development also includes a 5,143-space underground parking garage, a seven-story retail facility and an acoustically isolated 864-seat concert hall that spans the entryway to the towers and retail areas.

Architect: Pelli Clarke Pelli  
Owner: KLCC (Holdings) Sdn. Bhd.  
Total Area: 307,000 m<sup>2</sup> (3.3 million SF)





◀ 上海恒隆广场  
(288米, 66层)  
中国, 上海

作为上海市最高的混凝土结构建筑，恒隆广场的两座塔楼在基地面积非常有限的情况下仍然达到了相当高的建筑高度。其结构设计的难点是位于商业裙房内高7层的中庭之天窗。天窗各组成部分的剖面 and 支柱的剖面沿跨度而变化，形成了动态视觉，也增加了技术难度。高228米（749英尺）、48层的二号塔楼的设计克服了横向稳定性影响因素多、场地土条件差、地下水位高、与原有一号塔楼连接难和当地可用建材少等诸多困难。为了提高建设成本效率，结构设计采用了传统的框架核心筒体系和由厚筏板和摩擦型长桩组成的桩筏基础。

建筑师：KPF建筑师事务所  
业主：恒隆地产  
总建筑面积：214,000 m<sup>2</sup>

**Plaza 66**  
**(288 meters, 66 stories)**  
**Shanghai, China**

One of Shanghai's tallest concrete buildings complexes, Plaza 66 consists of two towers that achieve dramatic height despite small footprints. The skylight roof design that covers the seven-story atrium in the retail podium was a challenge for the concrete structural system. The cross-sections of its members vary along the roof span, as do the cross-sections of its supporting columns, creating a visually dynamic but technically challenging atrium. To enable economical construction of the second 48-story tower, and address a number of engineering challenges, we used a conventional concrete frame-shear core wall with lateral supports and a deep mat with long friction piles.

Architect: Kohn Pedersen Fox Associates  
Owner: Hang Lung Realty  
Total Area: 214,000 m<sup>2</sup> (2.3 million SF)



◀ 太古汇综合发展中心  
(212米, 50层)  
中国, 广州

太古汇位于中国南部最大的商业中心广州市，是一个多用途综合性开发项目。我们提供直至扩初阶段的结构设计服务。项目包括两栋分别高50层和33层的办公塔楼、一幢高31层的酒店和一个高6层的商业裙房。位于商业裙房内的1,000席剧院采用了独特的“盒中盒”设计，与外围结构彻底隔离，使得剧院内的声学效果不受干扰。

建筑师：Arquitectonica  
业主：太古汇发展有限公司  
总建筑面积：450,000 m<sup>2</sup>

**Taikoo Hui**  
**(212 meters, 50 stories)**  
**Guangzhou, China**

We provided structural design services through the design development of this mixed-use complex in southern China's largest commercial center. The complex, which opened in 2011, includes two office towers of 50 and 33 stories, a 31-story hotel and a six-story podium. One of the most notable aspects of the project's structural design is the 1,000-seat theater in the podium. An innovative "box-in-box" design completely isolates the theater from the surrounding structure, so that external vibrations do not compromise the theater's acoustics.

Architect: Arquitectonica  
Owner: Taikoo Hui Development Company  
Total Area: 450,000 m<sup>2</sup> (4.9 million SF)

宋腾添玛沙帝（ThorntonTomasetti Inc.）作为工程设计、工程调查和分析的领导者，为世界各地各种规模和难度的建筑工程提供最专业的工程咨询服务。宋腾添玛沙帝所提供的服务贯穿建筑物的整个生命周期，涵盖了建筑工程领域的各个方面，包括建筑设计、建筑表皮设计、建筑性能、建筑可持续化设计、施工支持和财产损失评估等。



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