

Title:	Emerging Urbanization and High-Rise Design Philosophy in China
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Subjects:	Social Issues Urban Design
Keywords:	Development Human Scale Integrated Design Sustainability Urbanization
Publication Date:	2014
Original Publication:	CTBUH 2014 Shanghai Conference Proceedings
Paper Type:	<ol style="list-style-type: none">1. Book chapter/Part chapter2. Journal paper3. Conference proceeding4. Unpublished conference paper5. Magazine article6. Unpublished

Emerging Urbanization and High-Rise Design Philosophy in China

中国正在进行的城市化以及高层建筑的设计哲学



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张俊杰先生从1986年至今，历任华东建筑设计研究总院高级建筑师、所副总建筑师、所长、院副总建筑师、总建筑师、总院院长等职务。先后主持设计上海实业大厦、解放日报新闻大楼、上海申城大厦、上海四季酒店、上海市委党校上海行政学院改扩建一期工程、上海大学体育中心、上海世茂国际广场、天津泰达图书馆、上海市高级人民法院审判法庭办公楼、上海国际航运中心洋山深水港区管理中心等重大项目。

Abstract

This paper analyzes the latest exploration of international urbanization developments, as well as the development of China's urbanization strategy and policy background. It compares the guidance and issues from the "National New-type Urbanization Plan" (2014-2020), and the "Roadmap on the Future Research Needs of Tall Buildings" (CTBUH, 2014). It also brings forward four new design concepts for the future development of tall buildings in China.

These four new concepts cover all aspects of the industrial economy, resources and environment, smart technology and social progress. This includes the following: "compact city/production planning"; "environment friendly and emissions reduction for sustainable development"; "efficiency safety and quality enhancement of the intelligent building"; "social service experience and humane care philosophy." Through the analysis of these four concepts, this paper outlines and argues that tall buildings in China should take on the mission to create a better environment for a new era.

Keywords: Chinese New Process of Urbanization, The New High-Rise Building Design Concept, The City Produced Fusion Concept, The Concept of Sustainable Development, Intelligent Building Concept, The Concept of Humane Care

摘要

这篇论文分析了国际上在城市化发展方向所做的最新研究，以及中国城市化发展方面的策略和政策背景。文章还就《国家新型城镇化规划(2014—2020年)》与CTBUH出版的《未来高层建筑研究诉求指南(2014)》中的指引方针和存在的问题进行了对比。文中还为中国未来高层建筑的发展提出了4个前瞻性的设计理念。

这四个前瞻性的设计概念包含了以下领域的所有方面，包括：经济产业领域，资源环境领域，以及智能技术和社会进步领域。具体又分为：紧凑混合的产城融合策划理念；环境友好与绿色减排的可持续发展理念；安全效率和提升品质的智慧建筑理念；社会服务与交往体验的人文关怀理念。通过对这四种理念的分析，这篇文章阐述并论证了中国的高层建筑在新时代中是否需要承担创造更美好环境的责任。

关键词：中国城市化新进展，新的高层建筑设计理念，产城融合理念，可持续化发展的理念，智能建筑理念，人文关怀理念

New Progress of Urbanization in China

China's Urbanization Process and Major Issues in the Past 30 Years

With the accelerated process of industrialization, China's urbanization has made remarkable achievements. During 1978-2013, the population of urban residents increased from 170 million to 730 million, and the urbanization rate increased from 17.9% to 53.7%, while the number of cities increased from 193 to 658. Three city groups—the Beijing-Tianjin-Hebei Area, the Yangtze River Delta Area and the Pearl River Delta Area—take up about 2.8 percent of China's territory, and yet contains 18% of the total population. This 2.8% also happens to create 36% of China's GDP.

While great achievements have been made, some contradictions and problems have gradually been revealed. There is, for instance,

中国城市化的新进程

中国30年来城市化进程和面临的主要问题

伴随着工业化进程加速，中国城市化发展过程取得的成就举世瞩目。1978—2013年，城镇常住人口从1.7亿人增加到7.3亿人，城镇化率从17.9%提升到53.7%，城市数量从193个增加到658个。京津冀、长江三角洲、珠江三角洲三大城市群，以2.8%的国土面积集聚了18%的人口，创造了36%的国内生产总值。

在取得巨大成就的同时，也逐渐显露出一些矛盾和问题。主要有产城融合不紧密，缺乏产业集聚和人口集聚的依托；建设用地粗放低效，城镇空间分布和规模不合理，与资源环境承载力不匹配；城市服务水平不高，污染、交通拥堵等问题。

no close integration of in-the-city production, a lack of industrial and population concentration, inefficient use of constructible land, irrational urban/town distribution and size (which does not match the environmental carrying capacity of resources), a low urban service level, and problems like pollution, traffic and other issues typical of highly populated areas.

The Concept and Policy of Sustainable Urban Development in China vs. Other Countries

Policy and Concept of Sustainable Cities in Foreign Countries

In 1990, the European Commission published the Green Book of Urban Environment, and proposed the “compact city” concept. This concept advocates for change in high-density and diverse cities.

In 1996, the “New Urbanism Charter” in the United States, suggested traditional neighborhood development and called for the further development of public transport.

In 2000, the “American Smart Growth Alliance” encouraged efficient, intensive and compact urban development. As a result, federal, state and local governments implemented specific guide lines.

New Exploration of Sustainable Urban Development within China Planning

On July 18, 2008, the People’s Republic of China’s Ministry of Environmental Protection, and the Chinese Academy of Sciences issued a “National Ecological Function Zoning Release.” It was created in order to further establish ecological protection and construction, natural resources and orderly development, as well as rational distribution of industry throughout China.

On October 24, 2008, the National Council issued the “National Land Use Planning” (2006-2020) to guide the protection and rational use of land resources.

On December 21, 2010, the National Council issued the “Country’s Major Functional Area Planning Notice Released by The National Council” to build efficient, coordinated and sustainable developed land.

During the 12th-13th of December 2013, “the central work conference on urbanization” established requirements to improve the efficiency of urban land use and for maintaining population density in urban areas. The importance of ecological security through the reduction of energy consumption and pollution emissions was also noted.

Policy

In 2014, the National Development and Reform Commission, the Ministry of Housing and Urban-Rural Development, and the Ministry of Land made a joint implementation of the “Three-Joined-Rules.” This policy implements working towards improving the following: National economic and social development planning; Urban development planning; Land use and ecological planning. It also aims to avoid certain issues, such as local governments lending premium land to earn a one-time disposable income. Blindly building an unreasonable construction industry which creates the so-called “New Town” or “Park,” is also of considerable concern. These are beyond the carrying capacity of the land and other natural resources and they deviate from the national and regional industry’s long-term earnings growth.

中国可持续城市发展的理念和政策

国外可持续城市的政策理念

1990年，欧共体委员会发布的城市环境绿皮书，提出“紧凑城市”的理念，提倡一种高密度而多样变化的城市。

1996年，美国的《新都市主义宪章》，提出传统邻里社区发展，倡导公共交通主导型开发。

2000年，“美国精明增长联盟”，倡导高效、集约、紧凑的城市发展模式，联邦政府、州和地方政府具体指导和实施。

中国可持续城市发展的新探索

规划层面

2008年7月18日中华人民共和国环境保护部和中国科学院颁布《全国生态功能区划》，指导我国生态保护与建设、自然资源有序开发和产业合理布局。

2008年10月24日国务院发布《全国土地利用总体规划纲要（2006-2020年）》，引导全社会保护和合理利用土地资源。

2010年12月21日国务院颁布《国务院关于印发全国主体功能区规划的通知》，构建高效、协调、可持续的国土空间开发格局。

2013年12月12-13日“中央城镇化工作会议”要求，提高城镇土地利用效率、城镇建成区人口密度；降低能源消耗和二氧化碳排放强度；高度重视生态安全，减少污染物排放总量，控制开发强度。

制度层面

2014年，国家发展和改革委员会、住房与城乡建设部、国土资源部联合实施“三规合一”，将国民经济和社会发展规划、城乡发展规划、土地利用规划统一制定；同时还进行生态规划等专项规划。避免地方政府片面为政绩和土地出让金的一次性收入，盲目建设没有合理产业依托的所谓“新城”或“园区”，超出土地等自然资源的容量和承载力，而偏离国家和区域的产业持续发展的长效收益。

试点层面

2013年底，广州市在国内特大型城市中首先完成“三规合一”试点，率先划定了全市统一建设用地规模控制线等，统筹全市城乡空间资源。

2014年，北京市开始实施“三规合一”，修编总体规划。京津冀区域进行统一布局和分工，破解该区域城乡发展二元分离的问题。

2014年1月住房与城乡建设部颁布“关于开展县（市）城乡总体规划暨‘三规合一’试点工作的通知”。依据资源环境条件容量，合理确定县（市）城镇化发展的各项目标和人均指标。

《国家新型城镇化规划（2014—2020年）》的颁布实施

2014年3月，国家发展和改革委员会发展规划司颁布了《国家新型城镇化规划（2014-2020年）》，包括8篇31章，成为中国未来城镇化发展的纲领性文件。

“规划”倡导工业化和城镇化良性互动，促进城镇发展与产业支撑相统一；倡导控制城镇建设用地规模和开发边界，优化城市内部空间结构，促进城市紧凑发展；倡导根据资源环境承载能力构建城镇化宏观布局，构建综合交通网络和信息网络；倡导推进绿色发展、循环发展、低碳发展。

Experiment

By the end of 2013, large cities in Guangzhou were the first in China that obliged by the "Three-Joined-Rules." These cities designated and unified city construction and land control lines. They also coordinated the cities' urban and rural space resources more efficiently.

In 2014, Beijing began implementing the "Three-Joined-Rules," and master planning revisions. Beijing-Tianjin-Hebei unified the layout and division of labor, as well as urban and rural developments to solve the problem of binary separation.

In January 2014, the Ministry of Housing and Urban-Rural Development issued the "Regarding the Development of the County (city) Master Plan" and the "Three-Joined-Rules." It was based on the capacity of resources and conditions and reasonably determined the goals and per capita indicators of county and city urban development.

Implementation of "National New-type Urbanization Plan (2014-2020)"

In March 2014, the National Development and Reform Commission of Development and Planning issued a "National New-type Urbanization Plan (2014-2020)," which includes eight articles (31 chapters). It has become a programmatic document for China's future development of urbanization.

The "Plan" advocates positive interaction between industrialization and urbanization while promoting urban development and industry support and unity. It advocates for controlling the scale of urban constructible land and development borders, optimizing the urban internal spatial structure, which in turn promotes compact urban development. It also advocates for urbanization to develop in proportion to the carrying capacity of local resources and the environmental macro layout. Building integrated transport and information networks and maintaining a "green" practice, through cycled materials and resources, while maintaining a low-carbon development area is another crucial aspect of the "Plan."

The New Concept of Supertall Design in China

International Trends of New Tall Building Design

100 Years of Exploration and Practice

In 1925, Le Corbusier proposed his "Radiant City," a cluster of high-rises in Paris. In the past, architects imagined the "vertical city" to create new patterns of human living and change the way in which we inhabit our environment. As of 2013, the United Arab Emirates' Burj Khalifa surpassed 800 meters in height and the Kingdom Tower in Jeddah, Saudi Arabia, will become the first 1,000-meter building in human history. While Corbusier's vision was never realized, the urban environment has certainly taken on a similar role, and has forever changed the way we use and build the urban environment.

The CTBUH Roadmap on the Future Research Needs of Tall Buildings

In 2014, the Council on Tall Buildings and Urban Habitat (CTBUH) issued the "Roadmap on the Future Research Needs of Tall Buildings." CTBUH produced 11 fields of needed studies with the assistance and cooperation of international organizations, as well as information accumulated through worldwide surveys. The Roadmap reflects the current international attention on supertall building trends and their development and concepts. It will be a great reference for the future development of China's supertall building designs.

中国超高层建筑设计的新理念

国际超高层建筑设计新趋势

100年来的探索实践

1925年,柯布西耶在巴黎伏瓦生规划,提出了集聚高层建筑的“光辉城市”畅想。近百年来,建筑师们畅想“垂直城市”,并通过高层建筑和超高层建筑,创造人类聚居的新模式。截止2013年,阿拉伯联合酋长国的迪拜哈利法塔超过了800米,沙特阿拉伯吉达市王国塔将要成为人类首座1000米大厦。

CTBUH的《高层建筑未来研究需求的路线图》

2014年,世界高层建筑与都市人居学会(CTBUH)发布了《高层建筑未来研究需求的路线图》(Roadmap on the Future Research Needs of Tall Buildings)。CTBUH与其他国际组织合作,组织研究人员通过全球范围的问卷调查,整理归纳出分布在11个领域的研究课题。《路线图》体现了目前国际上最受到关注的超高层建筑发展趋势和发展理念,对中国超高层建筑设计的未来发展具有重要的借鉴作用。

中国超高层建筑设计的新理念

根据对《国家新型城镇化规划》的分析研究,同时借鉴了CTBUH的《高层建筑未来研究需求的路线图》,归纳和梳理出中国超高层建筑设计四大新理念,这四个新理念涵盖了经济产业、资源环境、智慧技术、社会进步等各个方面,分别是:紧凑混合的产城融合策划理念;环境友好与绿色减排的可持续发展理念;安全效率和提高品质的智慧建筑理念;社会服务与交往体验的人文关怀理念。

紧凑混合的产城融合策划理念

背景

《国家新型城镇化规划》提出:“推动特大城市和大城市形成以服务经济为主的产业结构。增强中小城市产业承接能力,构建大中小城市和小城镇特色鲜明、优势互补的产业发展格局。支持资源枯竭城市发展接续替代产业。”《规划》还提出:“推进功能混合和产城融合,在集聚产业的同时集聚人口,防止新城新区空心化。加强现有开发区城市功能改造,推动单一生产功能向城市综合功能转型。”

CTBUH《高层建筑未来研究需求的路线图》在“经济和成本”专项领域提出:“高层建筑财务关系与全球经济周期条件的研究”等课题。

产城融合:差异化的产业细分类型导向,拓展超高层建筑新类型产城关系分析

一、二线城市:以金融贸易服务等第三产业为主。上海陆家嘴金融贸易区,在本世纪第一个十年里,产业规模方面,达到400家中外金融机构、100家跨国公司地区总部、100家外资研发中心、100家国内大企业集团总部。三、四线及以下城市:由于各类资源相对匮乏,又是本轮新型城镇化规划发展的重点之一,需要寻求到适合的建筑类型与当地的产业经济相匹配。

产业类型的新拓展

积极拓展第三产业其他细分类型的超高层建筑(教育、创意、科研、医疗等):案例包括东京时尚学院塔楼(204米,50层,丹下健三建筑师事务所,2008年竣工)、名古屋时尚学院塔楼(170米,日建设计,2008年竣工)、芝加哥罗斯福大学巴罗什大厦(32层,VOA事务所,2012年竣工)等。

还应积极探索第一产业(无土栽培蔬果农业、饲养业等)等产业类型的超高层建筑类型。概念包括:美国哥伦比亚大学学者提出的“垂直农场”概念,运用无土栽培技术、生物循环处理技术(人体排泄废弃物转化为水和肥料)、城市废弃物循环再利用技术、沼气和地热源等清洁能源,形成自给自足的循环经济产业类型。

The New Concept of Supertall Design in China

According to the analysis of the “National New-type Urbanization Plan,” and CTBUH’s Roadmap on the Future Research Needs of Tall Buildings, four concepts and ideas of China’s supertall building development can be summed up. They cover the aspects of the industrial economy, resources and environment, smart technology, and social progress. Respectively, they are: compact production/city planning; environment friendly and emissions reduction for sustainable development; efficiency safety and quality enhancement of the intelligent building; social service experience and humane care philosophy.

Strategies of Integrating Production into a Compact, Mixed-Used City Context

The “National New-type Urbanization Plan” states the importance for China “to promote mega-cities and metropolitan areas into an industrial structure which focuses on a service economy; to enhance the ability of small and medium cities’ industrial undertaking abilities; to turn small/medium/large cities and small towns into a distinctive, complementary industrial development pattern; to support resource-exhausted cities by creating alternative industries.” The “Plan” also makes the suggestion “to promote functional mixing and production integration of the city while doing industry gathering; that population agglomeration should take place at the same time in order to prevent the emptiness of new city districts; that the transforming of existing town districts should be strengthened and that single-producing industries should be promoted towards a more comprehensive one.”

In the “Economic and Cost” section of the *Roadmap on the Future Research Needs of Tall Buildings*, specialist experts highlighted the importance of subjects such as “Relations between the high-rise’s financial condition and the global economic cycle.”

Production Integration of the City: Different Types of Industry Segments Oriented; Development of New Types of Supertall Buildings Production/City Relationship Analysis

First and second-tier cities are prominently composed of financial trading services and other tertiary industries. The Shanghai Lujiazui Finance and the Trade Zone—during the first decade of this century on the industrial scale—has 400 Chinese and foreign financial institutions, in addition to 100 regional headquarters of multinational companies, 100 foreign R&D centers and 100 large domestic cooperation headquarters. Third and fourth-tier, as well as other cities below this level, have a relative scarcity of resources and are the current focus of new urban planning and development. Therefore, they are in need of more appropriate building types to match the local industrial economy.

Developing New Industry

New types of tertiary industries in high-rises should be further explored. Education, creative ventures, research and medical facilities are industries to consider for high-rise settings. Some current examples include: Tokyo College of Fashion tower—204 meters, 50 floors; Kenzo Tange Architects (completed in 2008); Nagoya Fashion Institute Tower—170 meters (Nikken, completed in 2008) Roosevelt University, Chicago, Campus Tower—32 floors (VOA, completed in 2012)

Primary industries, such as agriculture which utilize soilless cultivation of fruits and vegetables and other forms of indoor farming, should be actively explored within the high-rise environment. Columbia University scholars, who have been developing the “Vertical Farm” concept, provide a strong example for this application. The concept is defined in part by: the use of soilless cultivation techniques; a biological circulation process technology—converting human body excrement waste into

还应积极探索第二产业细分类型拓展: 包括先进制造业和节能环保、新一代信息技术、生物、新能源、新材料、新能源汽车等新兴产业。

紧凑混合: 城市综合功能区和超高层建筑综合体

城市空间布局的紧凑化和城市功能布局的混合化模式, 为超高层建筑提供了展示巨大发展潜力的舞台。为了最大化地节约土地资源、为了高效率地满足多样化的社会功能和生活方式, 超高层建筑以及由超高层建筑集群形成的“城市综合功能区”、“区域地下空间整体开发”等显示出旺盛的生命力。北京CBD东扩、天津滨海新区于家堡金融区(图1)、武汉王家墩中央商务区(图2)、上海世博园区A地块“绿谷”(图3)等均是知名的案例。天津滨海新区于家堡金融区, 规划用地386万平方米, 120个地块, 总建筑面积950万平方米, 第一期起步区整体开发, 占地100万平方米, 总建筑面积350万平方米, 12个地块的办公、酒店超高层建筑。

“超高层建筑综合体”也持续涌现。这种类型的总建筑面积都在数十万平方米以上, 相当于一个中小型的城镇建筑规模。建筑内部集成混合业态和竖向叠合, 形成功能齐全、布局合理的业态, 并实现智能管理。天津高银117金融大厦(图4, 建设中、597米、117层, 国际级标准办公楼、六星级酒店、高档商场、商务公寓、会展中心、剧院等综合体)、上海国际金融中心(北座: 2010年、259.9米、56层; 南座: 249.9米、53层; 包含甲级办公楼、丽思卡尔顿酒店、商业等)。目前正在建设中的武汉绿地长江中心(图5, 建设中, 636米, 125层)和苏州中南中心(图6, 建设中, 700米)将成为新的地标。

环境友好与绿色减排的可持续发展理念

背景

《国家新型城镇化规划》提出: “节约集约利用土地、水和能源等资源, 促进资源循环利用”、“完善和强制执行绿色建筑标准及认证体系”等要求。

CTBUH《高层建筑未来研究需求的路线图》在“经济和成本”、“围护和表皮”、“建筑材料和产品”、“可持续设计、建造和运营”、“能源: 性能、计量和再生”等专项领域, 提出“高层建筑全生命周期成本分析的研究”、“提升高层建筑外立面保温性能的材料和策略研究”、“高层建筑复合材料和系统研究”、“高层建筑碳中和或零碳技术和策略的研究”、“运营阶段高层建筑能耗和水利用实测后评估的研究”等相关课题。



Figure 1. The Tianjin Binhai Yujiabao New Area Financial District
图1.天津滨海新区于家堡

water and fertilizer—a municipal waste recycling technology; the utilization of biogas and geothermal sources as clean energy. Together, these create a self-sufficient and circular economic industrial form.

Secondary industries should also be actively explored. Advanced manufacturing, energy-saving and environmental protection technologies, new generations of information technology, biology, new and renewable energy technologies, new materials and other energy vehicles are some examples which may be practical.

Compact Hybrid: The City's Comprehensive Functional Areas and High-Rise Building Complex

Mixed patterns of urban space layout and compact urban functions layout provide great potential for high-rise development. In order to maximize the conservation of land resources, it is necessary to efficiently archive the diverse social function and lifestyle. The high-rise and its clusters form the “city's comprehensive functional areas” and “underground space development,” which contains a city's vitality. Successful cases include: The Beijing CBD east expansion; The Tianjin Binhai Yujiabao New Area financial district (Figure 1); Wuhan Wangjiadun Central Business District (Figure 2); Shanghai Expo Park Lot A “Green Valley” (Figure 3). The Tianjin Binhai Yujiabao New Area Financial District has a planned 3.86 million square meters of land, including 120 plots with a total construction area of 9.5 million square meters. The first phase of the overall development covers 100 square meters with a total construction area of 3.5 million square meters. This includes 12 plots for offices and a hotel high-rise.

The high-rise complex has continued to emerge in urban environments. This building type has a total construction area of hundreds of thousands of square meters, and its size is equivalent to a small/medium-scale city. Inside, the building has an integration of mixed functions which overlap vertically, thus yielding rational layouts and intelligent management. A good example of this is the Tianjin Goldin 117 Financial Tower (Figure 4). It is currently under-construction and is proposed to be 597-meters with 117-stories. It will include a world-class six-star hotel, upscale shopping malls, commercial apartments, a convention center, and a theater complex. The Shanghai International Financial Center's (completed in 2010) North Tower is a 56-story building at 260 meters, and the South Tower is a 56-story building at 250 meters. They are composed of an office building, a Ritz-Carlton Hotel and other commercial spaces. Two buildings which are currently under construction are the Wuhan Greenland Yangtze River Center (Figure 5, under construction, 636 meters with 125 stories) and the Suzhou Zhongnan Center (Figure 6, under construction, and proposed at 700 meters) which will become a new landmark.

Development of Environment-Friendly and Sustainable Green Reduction Concept

Context

The “National New-type Urbanization Plan” states the necessity for: “economical and intensive use of land, water and energy resources while promoting the recycling of resources,” “improvement and enforcement of green building standards and certification systems” as well as other requirements.

Sections from the *Roadmap on the Future Research Needs of Tall Buildings*, like “Economy and Cost,” “Building Envelope and Skin,” “Building Materials and Products,” “Sustainable Design,” “Construction and Operation,” “Energy: Performance Measurement and Regeneration,” also provide guidelines and suggestions which are in alliance with China's “Plan.” CTBUH has published studies regarding “high-rise's full

技术特征

中国超高层建筑的可持续发展指标，包含城市环境(区位、密度、交通)、区域微气候(采光、遮阳、通风)、建筑策划(产业支撑、混合社区)、功能布局和竖向布置(垂直分区、电梯流线、人员疏散)、室内环境品质(利用日光和风，减少机械设备的使用和能耗、引入生态系统)、能源和材料再生利用(可再生能源、可循环材料)等各个维度。

评价体系

中国超高层建筑的可持续发展评价体系正在两个方面进行扩展：一方面从通用方式的评价体系(如：绿色星级标准、美国LEED等)，逐步向针对不同地域气候环境的各个建筑性能化分析的评价体系扩展。另一方面，从单一设计阶段的评价体系，逐步向全生命周期的完整评价体系(如：全生命周期成本LCC)扩展。同时，中国学者也在着手研究美国BEE、欧盟能效指导EPBD2002/91/EC等各种标准。

计量工具

随着评价体系从定性向定量拓展，计量工具也相应地从常规的节能判别向碳排放计算转变。全生命周期碳排放测评技术，通过对设计、施工、运营、拆除等阶段的碳排放来源进行盘查，进行总量计算，并实现实时监控。碳排放计量工具，一方面将能源、材



Figure 2. Wuhan Wangjiadun Central Business District
图2.武汉王家墩CBD



Figure 3. Shanghai Expo Park Lot A “Green Valley”
图3.上海世博园区A地块“绿谷”

life-cycle cost analysis;“high-rise façades to enhance the insulation properties of the material and strategy;“high-rise complex materials and systems research;“high-rise carbon neutral or zero carbon technology research and strategy;“post-operational phase of high-rise energy consumption and water use measuring assessment.” These and future studies will help lead the way to make tall and supertall buildings a more efficient and sustainable space in the urban environment while fully supporting China’s new “Plan.”

Technical Characteristics

Indicators for sustainable development in China’s high-rise buildings include: The urban environment (location, density, traffic); Regional microclimate (lighting, shading, ventilation); Construction planning (industry support, mixed communities); Functional layout and vertical layout (vertical partitions, elevators flow lines, evacuation); Indoor environmental quality (use of daylight and wind, reducing the use of machinery and equipment and energy consumption, the introduction of eco-systems); Energy and material recycling in various capacities (renewable energy, recycled materials)

Evaluation System

Sustainable development of Chinese high-rise evaluation systems are being extended on two aspects. The general evaluation of the system (e.g. green-star standard, U.S. LEED, etc.), and gradually extending the analysis of building performance with various climatic conditions in different regions is one aspect. The other is from a single design stage, and the gradual extent of the full life-cycle assessment system (such as, whole life cycle cost LCC). Meanwhile, Chinese scholars have also started studying the BEE of the United States, as well as the EU energy efficiency EPBD2002/91/EC standards and other guidance.

Measurement Tools

As the evaluation system develops qualitatively to quantitative, measuring instruments accordingly changes from conventional energy determinations to determine the carbon emissions calculations. The full life-cycle of carbon emissions assessment technology works through design, construction, operation, and the dismantling phases of carbon emissions inventory sources, so as to gain the total calculation and achieve real-time monitoring. The carbon emissions measurement tools integrate various forms of energy, materials, and the production processes them into a unified measurement platform to enhance the applicability of quantitative evaluation. It also reveals the inherent objectives of sustainable development and policy.

Safety Efficiency and Quality Improvement of the Intelligent Building Concept

Context

The “National New-type Urbanization Plan” asserts that we need “to promote networking, cloud computing, new generations of innovative applications for information technology and other big data,” as well as improving “information management, facilities intelligence, facilitation services,” in addition to other requirements.

In the *Roadmap on the Future Research Needs of Tall Buildings*’ sections worth regarding “construction and project management;“structural performance, multiple anti-disaster design” and other special areas, CTBUH brings related topics, such as “BIM software technology development in design, construction and logistics of high-rise,” and “Research on real-time monitoring technology of built high-rise, development and practices.”

System Principles

The intelligence system principles for high-rises in China can be summarized as “four unities.” The first being a Unified Platform System,

料、生产过程等各种形态的评价维度整合到统一的计量平台，提升了定量评价的适用性，另一方面，也揭示出可持续发展的内在目标和规律。

安全效率和提升品质的智慧建筑理念:

背景

《国家新型城镇化规划》提出:“推动物联网、云计算、大数据等新一代信息技术创新应用”、“管理信息化、设施智能化、服务便捷化”等要求。

CTBUH《高层建筑未来研究需求的路线图》在“建设和项目管理”、“结构性能、多重防灾设计”等专项领域，提出“BIM等软件技术在高层建筑设计、建造和后勤方面发展的研究”、“已建成高层建筑的实时结构监测技术实践和发展的研究”等相关课题。

体系原则

中国超高层建筑的智慧体系原则可概括为“四个统一”:“统一的平台体系”，即基于末端传感设备的物联网、建筑信息模型 (BIM)、私有云协同构建的物理平台。“统一的信息传送”，即各系统大数据传输的通信协议和设施编址。“统一的计量实施”，即采集数据与原有标准指标之间的分析校核、诊断计量并进行调整实施。“统一的评估反馈”，即实施调整之后的评估机制和效用反馈。

新兴的物联网技术通过传感设备和互联网结合起来，可以覆盖从超高层建筑的外部环境到内部结构，从结构材料到建筑设备的所有领域，形成自动化的识别和管理。按照协议的约定进行信息的识别和分配，实现智能化的识别、定位、跟踪和管理。

系统范围

根据上述体系原则，智慧超高层建筑将整合各个应用系统资源，实现最优化配置和调度管理。这些智慧应用系统主要包括:既有



Figure 4. Tianjin Goldin 117 Financial Tower
图4.天津高银117金融大厦

which is based on the end of a networking sensing device. The second is, Building Information Modeling (BIM), which is used to build a private cloud for a collaborative physical platform. Unified Messaging refers to addressing the facilities for each large data transmission system and communications protocol. This is done through a “unified metering implementation.” Here an analysis is made between the original standard indicators and diagnostic measure so as to adjust the implementation in order to check the performance of data collection. Last is the Uniform Evaluation Feedback, where adjustment mechanisms and the effectiveness of the evaluation feedback are evaluated after implementation.

Emerging networking technologies are able to combine sensing devices and the Internet, which can cover the high-rise from the external environment to the internal structure. This includes a structure’s materials from all areas to the construction equipment itself. Automated identification and management technologies can also be formed and utilized. According to the agreed protocol to do the data identification and allocation, and archive intelligent identification, positioning, tracking and management.

Systems Scope

According to the system principles mentioned above, the intelligent high-rise will integrate various systems resources to achieve the most optimal allocation and scheduling management. These smart applications include: Real-time monitoring for high-rises’ current structural condition; also taking seismic and wind-load effects into consideration; Security, disaster prevention, and anti-terrorist attacks; Vertical transport systems; Smart devices (smart grid, smart lighting, smart air-conditioning, etc.); All aspects of network communications and integrated property management.

Operation Characteristics

All application systems that are built on the intelligent physical platform have four advantageous features for the life-cycle process when the systems are operating. Real-time dynamism refers to the information which is collected via a networking platform sensor, in addition to dynamic identification and real-time control. Synergy precision integrates all applications and collaborative systems based on the full-life cycle for a building’s large information data systems, as well as the maintenance of quantitative calibration. Customize difference, according to various user segments and different subdivision applications, customizes different high-quality life in the physical environment. Updating flexibility means that in the whole life-cycle processing, the application can update itself with flexibility in accordance to external changes.

Humane Care Concept of Social Services and Exchanges Experiences

Context

The “National New-type Urbanization Plan” proposes “encouraging the development of urban cultural diversity, promoting traditional and modern culture, as well as local and foreign cultures, the formation of multiple open modern urban cultures,” as well as “adapting to changes in the social structure of new urban trends.” Also notably important is to “create an innovative social management system to achieve self-governance and social regulation, which should encourage the maintaining of cordial interaction between the residents themselves.”

超高层建筑结构工况实时监测(抗震和风荷载效应)、安防防灾和反恐怖袭击、电梯运输系统、智能设备(智能电网、智能照明、智能空调等)、网络通讯以及综合物业管理等各个方面。

运营特征

所有建立在智慧物理平台上的各应用系统, 在全生命周期的运营过程中, 优势特征体现为“四个化”: “实时动态化”, 即基于物联网平台传感器的信息采集、动态识别与实时控制。“协同精细化”, 即基于全生命周期建筑信息模型内所有应用系统的大数据体系的集成和协同、以及量化的维护校准。“定制差异化”, 即根据各



Figure 5. Wuhan Greenland Yangtze River Center
图5.武汉绿地长江中心



Figure 6. Suzhou Zhongnan Center
图6.苏州中南中心

In the *Roadmap on the Future Research Needs of Tall Buildings*, its sections on “urban design and social impacts” and “architecture and interior design,” provide information on “research on enhancing the experience of the social interaction for occupants in a high-rise” as well as “the needs of the elderly and disabled people living in high-rises” and other related topics. These sections also suggest the importance of humane care and social service within tall buildings.

Basic Support

High-Rises should be reasonable environments for setting various special security facilities in order to practice its social attributes and social benefits for its occupants and surrounding community. Also, the high-rise should promote human care based on different social groups. Particularly for people with disabilities, the elderly, children with disabilities and other vulnerable groups. It should be based on characteristics of different groups, including aspects based on physiological, psychological, life quality, infringement protection and social inclusion factors. High-Rises should also set goals to provide special supporting facilities and public services products in order to fully embody its responsibilities in serving the urban infrastructure.

Communication Convergence

Once the basic support mentioned above is achieved, high-rises should make further efforts to create an open and diverse public atmosphere. Different classes of people can work together to blend indoor and outdoor public environments. Also, people with different cultural backgrounds and regional ethnicities can gather in these spaces and share with each other.

Exclusive Customization

While having the integration of basic security and communication, we should also be fully aware of the specificity of cultural differences, and differences in environmental needs for different groups. High-Rise buildings can also provide people with different ethnic, religious, artistic, cultural and high-life experiences with exclusive and special environments customized to meet their psychological and spiritual needs, while supporting their diversity and high-quality of life goals.

Conclusion

Human beings were born from nature, and at the same time they make use of the materials from their surrounding environment to create a new physical environment which changes the natural environment. People have even achieved the goal of building a 1000-meter skyscraper, and in the near future, we will use the latest technological advancements and ideas to create a “sustainable vertical city.” Tall and supertall buildings are, and will continue to make advancements in regards to function and the habitability of urban space; creating a new generation of living.

细分用户和细分应用系统的差异化需求，定制差异化的高品质工作生活物质环境。“更新弹性化”，即在全生命周期过程中，各应用系统具备可根据外部变化进行自我更新的弹性余量。

社会服务与交往体验的人文关怀理念

背景

《国家新型城镇化规划》提出：“鼓励城市文化多样化发展，促进传统文化与现代文化、本土文化与外来文化的交融，形成多元开放的现代城市文化。”《规划》还提出：“顺应城市社会结构变化新趋势，创新社会治理体制。实现政府治理和社会自我调节、居民自治的良性互动。”

CTBUH《高层建筑未来研究需求的路线图》在“城市设计和社会影响方面”、“建筑和室内设计方面”专篇中，提出“提升高层建筑居住者社会交往体验的研究”、“老年人和残障人生活在高层建筑中的需求研究”等相关课题。

基础保障

超高层建筑应合理设置各种保障专项设施，实践其社会属性和社会效益。根据社会人群的身心年龄差异，体现人文关怀。特别是对残障人群、老龄人群、儿童人群以及其他失能弱势人群，应根据不同人群的各自需求特征，包括生理、心理、生活品质、侵害防护、社会融入等方面，针对性地提供差异化的专项保障设施和社会公共服务产品，充分体现超高层建筑在城市基础保障层面的服务职责。

沟通融合

在落实上述基础保障职责的前提下，超高层建筑还应进一步努力营造交流开放、风格多样的公共环境氛围。不同职业阶层、不同社会阶层的人群可以共同融合这种室内外公共环境之中，相互交流。不同文化背景、不同民族地域的人群也应可以集聚在这种室内外公共环境之中，彼此分享。

专属定制

在基础保障和交流融合的同时，也应充分认识到各种文化差异的专属性，以及不同人群的差异化空间环境需求。超高层建筑还可以为这些不同民族宗教、艺术鉴赏和高端生活体验的人群，提供专属定制的特殊空间环境，满足他们的心理需求和精神寄托，承载他们的多样化与高品质的生活愿景。

结束语

人类来源于自然，同时通过创造自身所处的物质环境，来改变自然。今天的人们已经通过建造超高层摩天楼实现了达到千米的梦想，在不远的将来，人们还将运用创新理念和技术，建设“可持续的垂直城市”，创造并实践新一代的生存方式。