南京国际青年文化中心
Nanjing International Youth Cultural Centre

项目手册
Project Brochure

Zaha Hadid Architects



项目背景　Project Background

早在2011年初，南京河西新城开发建设管理委员会即向多家享誉国际的建筑事务征集河西新城总平面规划中的会议中心设计方案以及2014年南京青年奥林匹克运动会（青奥会）的建筑设计方案。

经过激烈角逐，最终扎哈•哈迪德建筑事务所的方案在此次竞标中脱颖而出，成为本项目首屈一指的建筑设计解决方案；它不仅向客户展示了包括酒店、写字楼双塔、会议中心和位于河西新城一条主轴带末端的广场在内的全面设计规划，而且还提出了在基地与其对面的江心洲之间架起一座步行桥，从而促进南京新城二级市中心与江心洲田园自然风光之间的有效联通，使得人们可以在生态休闲与繁忙都市生活之间迅捷、自如地转换。

该工程项目的时间周期着实充满挑战：这座建筑面积达到480,000 平方米的新地标，从其构思、设计到建造需要在短短三年内完成；凭借其设计的新颖独到之处和结构的复杂多元程度，该项目被称为是中国迄今为止最为复杂的建筑结构之一；此外，由于本项目基地位于地震多发带，加之周边复杂的交通枢纽工程（包括一条跨江高速公路的兴建和随后一条河岸外环隧道的开凿），更是凸显了本工程任重而时间紧迫的特点。

鉴于上述特点，早在项目伊始就已经明确其设计与施工阶段必须同步进行的决策，以便保证项目按期完工。一方面项目施工须要尽早开始，同时还应该为设计师与工程师赢得足够的时间以便充分推进其设计与结构深化工作。

In early 2011, the Nanjing Hexi New Town Development and Construction Management Committee contacted a range of internationally renowned architects for design proposals for a central conference and meeting facility forming part of the Hexi New Town Master Plan and the building programme for the 2014 Nanjing Youth Olympic Games.

Following a competitive design bid, Zaha Hadid Architect's design emerged as the preferred solution, not only presenting the client with a design for a hotel/ office twin tower, a conference centre and a plaza at the terminus of one of Hexi New Town's major Axes, but also including a proposal to connect the Island in the Yangtze river opposite the site by means of a pedestrian bridge, establishing a link between Nanjing's new urban sub-centre and the comparably rural and natural environment on Jiangxinzhou island with the potential of linking-in a local recreation area directly into a highly urbanized new development.

At this time already, the time frame set for the project was challenging: 3 years for the inception, design and construction of a 480,000m² GFA building to highest standard, including novelty design solutions and a highly complex structure, arguably one of China's most complex structural building designs to date, set in a seismic area and in parallel to a complex traffic hub project involving a cross-river highway crossing and a subsequently tunnelled river bank bypass road.

Very early in the process it became clear that design and construction stages would have to be parallelized to achieve this schedule, allowing for construction work to start early, whilst still buying the designers and engineers enough time to adequately develop design and structure.

本工程的时间周期颇具挑战：在短短三年时间内完成从构思、设计再到建设这座总建筑面积达到480,000平方米的地标性建筑；该建筑以其创新的设计手法、高度复杂的建筑结构和高标准完成质量著称，堪称中国迄今最为复杂的建筑作品之一。

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Location 位置
Nanjing, China

Client 客户
Hexi New Town Planning Bureau

Cost 造价
Confidential

Design 设计
Zaha Hadid with Patrik Schumacher

Year 年份
2011 - 2014

Size 规模
473,010 m²

Program 所承担设计内容
2 Hotel Towers, Conference Centre, Youth Olympic Plaza, Offices and Mixed Use Areas for Youth Olympics 2014

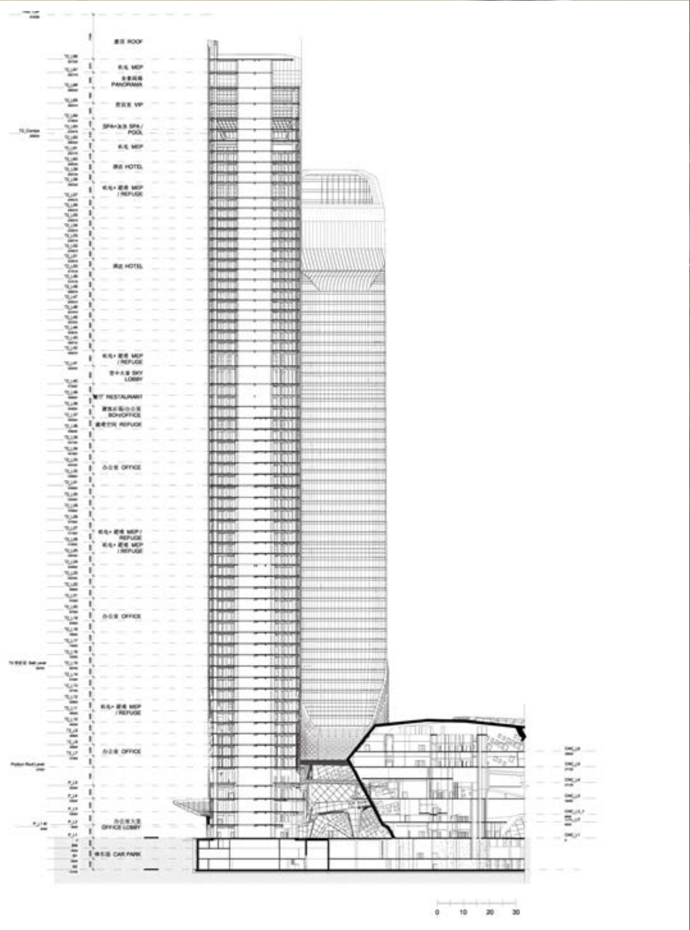
Project Director 项目总监
Nils Fischer

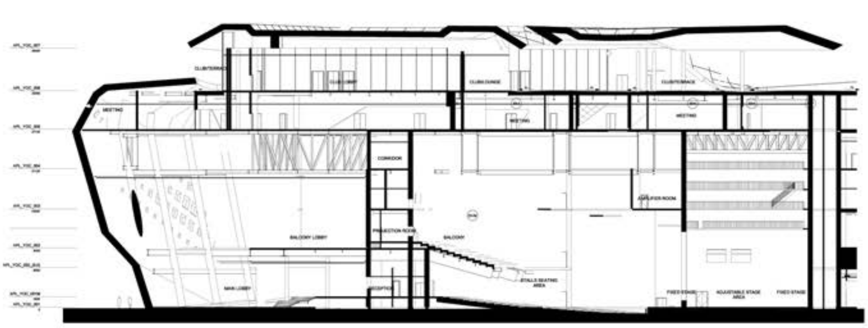
Project Architect 项目主建筑师
Shao-wei Huang
Vincent Nowak

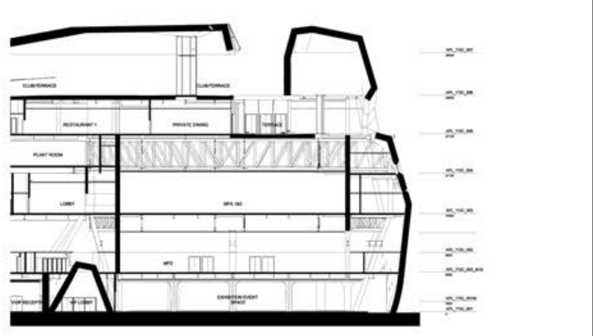
Sub-Consultants 附属设计顾问

Local Architect 地方设计院: **China Architecture Design Institute** 中国建筑设计研究院 I Structural Engineers 结构工程: **Buro Happold** 标赫 | M&E Engineering 机电工程: **Buro Happold** 标赫 I Facade Engineers 幕墙工程: **Buro Happold** 标赫 | Acoustics 声控设计: **Zhejiang University** 浙江大学 I Theatre Consultant 剧院设计顾问: **China Art Science and Technology Institute** 中国艺术科技研究所 | Lighting Design 照明设计: **BPI** 碧谱照明设计有限公司


CONFERENCE CENTRE
EXHIBITION SPACE
RETAIL
CONFERENCE CENTRE
TOWER 1
Line of Canopy & Facade Over
13m YOC Offset
PODIUM
TOWER 2
JINSHAJIANG EAST ROAD







设计概念　Design Concept

扎哈•哈迪德这一设计方案所采用的建筑语汇从本项目的地理位置中汲取灵感：项目位于南京市城市中轴线与长江江岸的交界处，优越的地理位置四通八达，连接起城市商业中心与自然景观；将在这片土地上拔地而起的地标性建筑包括一座雕塑感极强的双塔、一座会议中心、一个公共广场和一座步行桥，无论从哪个方向看，自然景观总相宜。以单一线条入手，打造出流畅的线状结构特征，贯穿青奥中心位于中央商务区的始发点与江心洲休闲区”，二者俨然”一脉相承 “。

本项目流线型设计的灵感来自迄今已有近1,600年历史起源于南京的中国传统提花丝织工艺品，云锦。云锦以其“妆金,妆银”以金线、银线织造而享誉盛名。而南京青奥中心总平面规划正是受到这一织物灵动、流畅与交织特色的触动，在这一地标性建筑中采用了类似的建筑语言，以一单程线条连接起中央商务区（CBD）周边的建筑、青奥村、滨江公园以及江心洲　，呈现出一幅连续、开放和动态的青奥会背景卷轴。整座建筑的语汇富含依傍和动态模式，象征着流水的灵动与河沙的沉淀，而河西新城也正在在此自然环境中崛起。

Zaha Hadid’s design takes the location of the site at the junction of a mayor urban axis and the Yangtze Riverbank as a primary generator for the architectural language. This strategic location, interweaving different directions, combined with the position at the interface of urban business centre and nature, is developed into an ensemble of sculptural twin tower, a conference centre, a public plaza and the pedestrian bridge as an overarching landmark framing the view to the nature, developed out of a symbolic thread and drawn in a single line, connecting the Youth Olympic Centre from its starting point at the CBD with Jiangxinzhou island’s recreational areas.

This symbolic thread is inspired and embodies the almost 1600 year old tradition of Yunjin, the traditional Chinese thread making famous for its precious golden and silver fabrics, originating and still from and centred in Nanjing. The architecture of the Youth Olympic Centre Master plan is inspired by the continuity, fluidity and connectivity of the thread, and the sculpture of buildings and landmarks is drawn as a single line that interweaves and connects the surrounding programs of CBD, Youth Olympic village, Riverside park and River island to a continuous, open and dynamic backdrop for the Youth Olympic Games. The dominant languages of swarming and dynamic patterns across the building represent the flow of water and sediment in the nearby river, the primary generator of the land Hexi New Town is built-upon.

参数化设计在建筑外表皮发展中的影响和效益
The Impact and Benefit of Parametric Design in the Envelope development

之前已经提到，本项目时间周期之紧迫，对完成质量的要求之高以及设计语言之复杂，决定了在此过程中始终坚持参数化设计，并运用软件工程工具是达成上述要求并且及时交付本项目的重中之重。该建筑几何形体外表皮的达成正是展现这一设计工具优势的最好佐证：复杂的曲面造型和蜂窝式凹进开启扇遍布整个建筑幕墙，仅会议中心就拥有85,000平方米的外表皮，涉及12,500块独立板块和3,400个窗户，没有参数化设计是很难想象的。

Now, being challenged with a tight time rame, high quality ambitions and a complex design language, the consistent usage of parametric design and engineering tools has been key to achieve a timely delivery of the project. The building's envelope is probably best illustrating where the advantages of such workflow can be found: A complex, curved envelope with swarm-like openings distributed all over the façade- the conference centre alone has a 85,000m² envelope with 12,500 individual panels, and a total of 3,400 windows scattered over the building's skin.

参数化设计往往轻松地将这些看似矛盾的目标有机地融合起来：打造地标性建筑、工程周期紧迫、树立工程复杂程度的新标杆等等；这一项目通过高效整合设计与施工制备过程，以破纪录的施工速度自豪地将这座超高层建筑力作展现于世人面前。

Parametric design allowed to bring seemingly contradicting goals together: Despite being a landmark project with a radical design agenda and setting a new benchmark for complexity in construction, this project has also set a new construction speed record for high rise buildings by tight integration of design and production.

技术平台　Technology Platform

为了在所要求的时间周期内落实生产制备与设计优化，尽早开展设计研究，从几何形体的严谨性和理性出发，探寻可行的模型设计并且对其进行优化论证是十分紧要的。

在本项目早期阶段，我们通过玛雅（Autodesk Maya）这一设计软件探寻双塔、会议中心与总平面规划的可行性模型方案。该软件最先应用于电影界，拥有非常生动直观的设计界面，使建筑师几乎可以像雕塑家一样工作，借助其强大的几何形体引擎与编程环境，可以轻松实现制模过程中几何参数的信息迭代，极大地便利了下游设计（诸如平面、曲率、模块化可行性与局部设计约束等）优化工作。扎哈•哈迪德建筑事务所在此基础上通过植入多项设计定制工具进一步扩展了此平台功能，使得设计师可以获得工程设计约束条件的实时反馈，有效提高设计优化水平，同时在最大程度上实现直观性设计体验。此外，我们还使用犀牛（Rhino）/ 草蜢（Grasshopper）等可视化编程环境中的程序性几何形体软件，使得设计师可以在雕琢建筑外表皮的同时研究板块分割策略，从而实现更加细致入微的优化设计方案。

借助上述设计关联平台，设计团队能够实现动态制模并且有效整合设计与优化参数，由此生成的设计方案不仅可以全面体现设计理念，同时作为参数化设计程序的一部分已经可以指导下游设计流程和决策，大大减少了繁冗的设计迭代工作，降低了项目周期的时间管理风险，加速了项目进程，并使得建筑师和业主在项目初期即可以得到一个非常健全的方案。

To achieve feasible production and rationalization within the project's time frame, earliest design studies needed to be carried out with geometric rigor and rationalization in mind, paralleling form finding and rationalization.

In early stage, form finding for Towers, conference centre and master plan have been carried out in Autodesk Maya, a tool originating in the film industry, combining a very intuitive design interfaces allowing the architects to work almost like sculptors, with a powerful geometry engine and programming environment, allowing to directly overlay modelling exercises with information on geometric parameters important for downstream rationalization such as planarity, curvature classes, modularization potential and area constraints. Zaha Hadid Architects has extended this platform with a number of custom built tools giving the designers real-time feedback on engineering constraints, allowing a high awareness of rationalization criteria whilst enabling a maximum intuitiveness. Additional layers of rationalization have been introduced using a parallel Rhino/ Grasshopper pipeline, a procedural geometry engine with a visual programming environment, allowing the designers to develop panelisation strategies in parallel to the sculpting of the envelope.

This interconnected platform allowed the design team to create a dynamic design model interlinking design and rationalization parameters, generating a form that is not only embodying the design concept, but that as part of the parametric design setup is already relevant to downstream processes and decisions, drastically reducing onerous design iterations which at such accelerated processes would present a considerable time risk and also allows architect and client to look at a very robust scheme at an early stage of the project.

在业主对本项目的设计概念给予充分认可之后，该项目随即导入建筑信息建模（BIM）的技术环境中，以便推进各项工作的同步展开；早在方案设计中期即可首次发布施工信息，以便启动地基设计并与跨江高速公路协调推进：全3D模型协调实现了与本项目建筑外围设计团队的同步合作，这一点对于商讨广场、公路隧道、河岸隧道和步行桥的地基布置等深地基（可达70 米）交叉作业尤为重要：通过3D模型统筹协调，公路隧道走廊可以进行调整，进而优化步行桥地基的位置，同时高度整合建筑地基与位于广场地下的隧道工程。

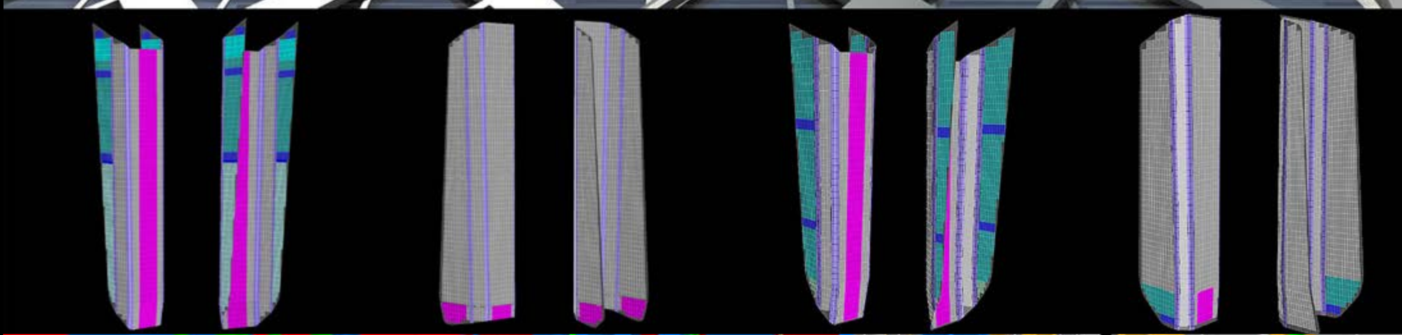
BIM环境具体分布在两个平台之上：一是利用Autodesk Revit软件进行建筑室内设计，精简文档制作数量与流程的繁琐性；二则可以利用铿利科技数字化建筑软件平台(Gehry Technologies Digital Project），即以达索系统（Dassault Systemes Catia）为基础的BIM软件，可以实现高度复杂几何形体以及大数据组的实时处理，实现建筑外表皮与结构之协调。

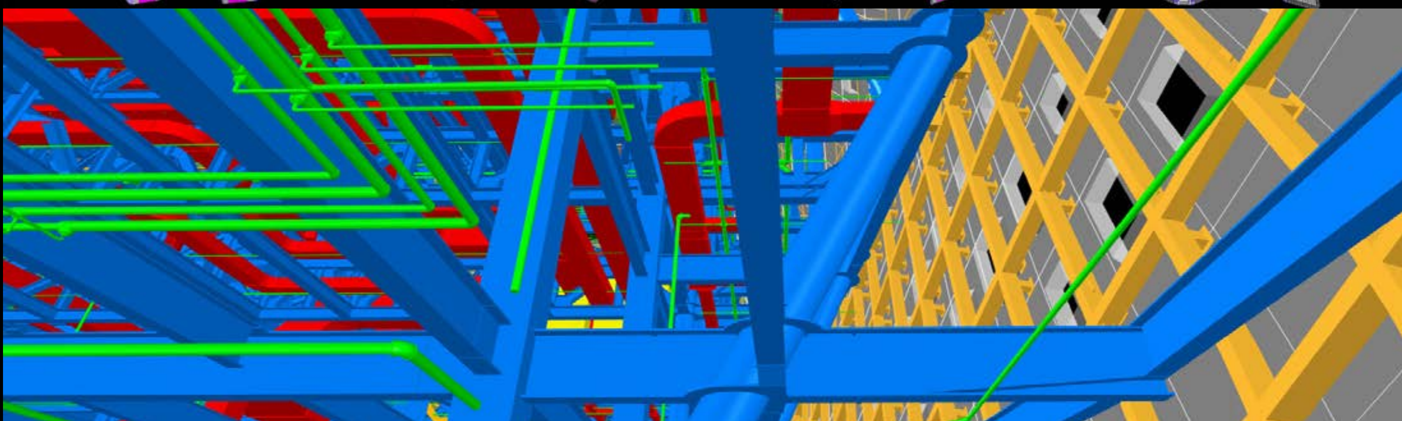
这种设置使设计团队能够根据需要快速调整并修改设计方案，迅捷地提供施工信息，而且整个设计进程较施工而言仅需提前三个月即可。

Upon full agreement of the concept, the project has then been immediately migrated into a BIM environment to allow for further parallelization of process, releasing first construction information as early as half way through Schematic Design to allow foundation design to coincide with works on the highway river crossing: Full 3D co-ordination allowed the design teams of the projects surrounding the building to work together, specifically critical when negotiating foundations of plaza, highway tunnel, riverbank tunnel and pedestrian bridge, as these elements overlap and require piling of up to 70 meters depth: Through joint 3D co-ordination the corridor of the highway tunnel could be adjusted to optimize the location of the pedestrian bridge foundations, and tight integrations of the building foundations and the tunnel projects under the plaza could be achieved.

The BIM environment has been distributed over two platforms, utilizing Autodesk Revit for the building's interiors taking advantage of a streamlined documentation and quantity take-off pipeline and Gehry Technologies Digital Project, a BIM software based-upon Dassault Systems Catia, and environment allowing for highly complex geometries and big data sets to be handled in real time for building envelope and structure co-ordination.

This setup allowed the design team to quickly adapt and modify the design where necessary and to release information to site quickly, with the design process only being three months ahead of construction on site.





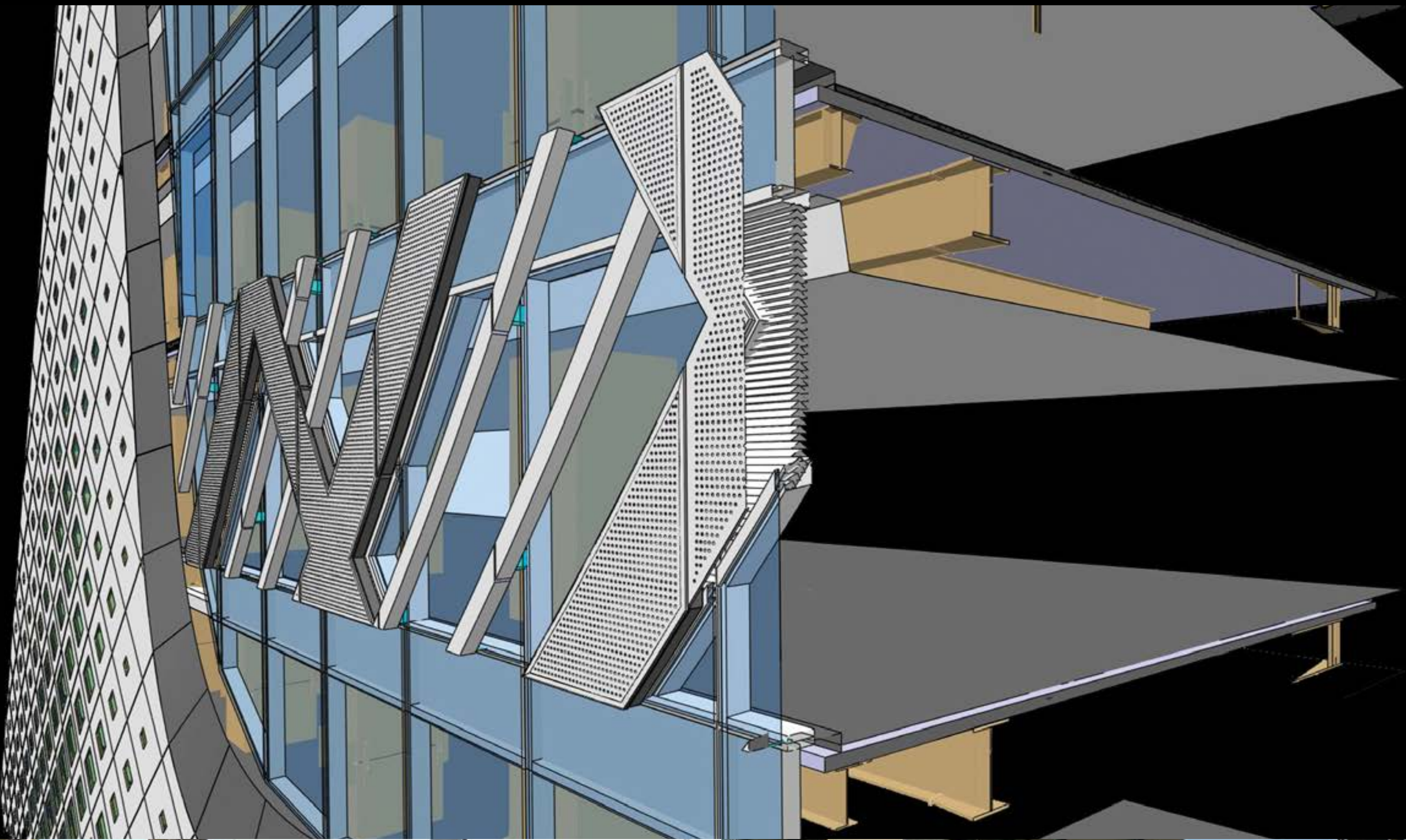
参数化设计在建筑外表皮发展中的影响和效益

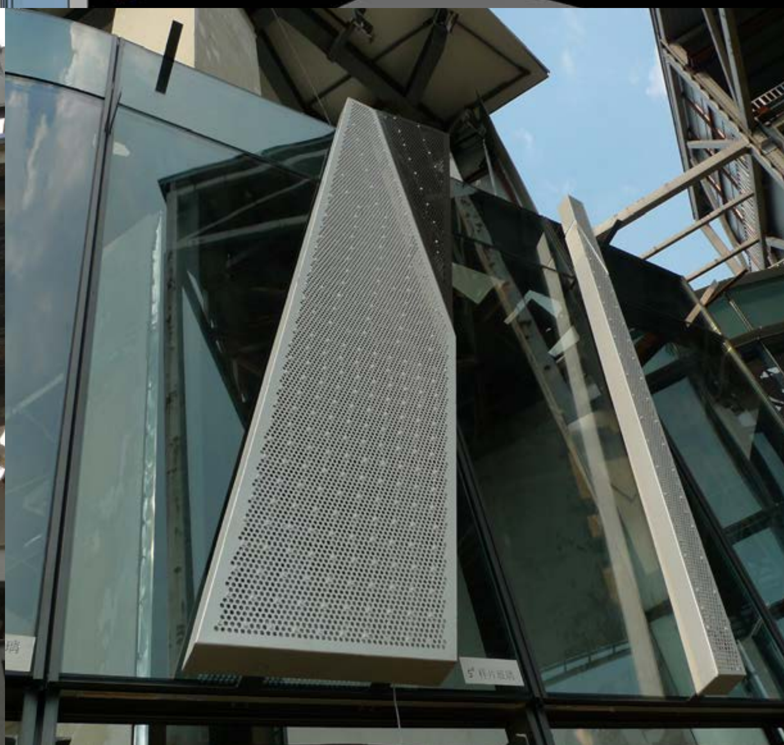
Parametric Design Advantage

之前已经提到，本项目时间周期之紧迫，对完成质量的要求之高以及设计语言之复杂，决定了在此过程中始终坚持参数化设计，并运用软件工程工具是达成上述要求并且及时交付本项目的重中之重。该建筑几何形体外表皮的达成正是展现这一设计工具优势的最好佐证：复杂的曲面造型和蜂窝式凹进开启扇遍布整个建筑幕墙，仅会议中心就拥有85,000 平方米的外表皮，涉及12,500块独立板块和3,400个窗户，没有参数化设计是很难想象的。

Apart from the aforementioned parallelization of design and construction stages through tight integration of design and documentation, the parametric design environment allowed the design team to develop the envelope detailing to a very high level of co-ordination and with production constraints in mind.

The high degree of surface rationalization achieved in concept design already allowed for efficient panelisation strategies, creating families and same-part strategies for the envelope, optimizing elements for production speed and transportability, a key factor in a high speed project where logistics can turn into a major bottleneck. As all rationalization and part logic has been developed by architects and engineers in a parametric environment, design changes could be turned around rapidly as rationalization logic becomes reusable.





项目应用　Project Application

借助于上述设计方法，建筑设计师得以开发出高度复杂的建筑形体外表皮：会议中心采用了12,500块3x2米的巨型纤维混凝土板，每个板块的造型复杂且基本上无一重复；这些生成的数据信息可供承包商直接输入模型制作程序从而准确及时地向施工现场供应这些定制材料。通过与承包商生产制备过程的紧密协调，设计团队则可以相应地冻结局部外表皮设计以供制备，同时继续优化其它部分的设计并与主、次 结构相互协调。

参数化设计环境在此项目中的重要性尤为显著：它有利于建筑外表皮、主次结构以及机电系统之间的协调与变通，实现数次数据迭代更替，进而快速达成整体方案的全面优化；与此同时，这些系统之间的全3D模型协调可以有效检测并避免结构冲突，这一点对于如此规模庞大、复杂精密的项目而言，无疑可以有效避免工程进展中可能持续产生的威胁。

打造双塔面临一项特殊的挑战，即透过塔楼的锥形造型提升该项目的“建筑视觉存在感”： 由此打造出中国首座全倾斜柱列塔楼，环其底部边缘的架构亦呈负倾斜状从而在大约70米高处的“铝带线高度”形成一个悬垂结构，继而再次小幅向内逐渐收窄形成塔尖，打造出独一无二的练达的建筑轮廓，在南京的天际线上署上了自己的名字。

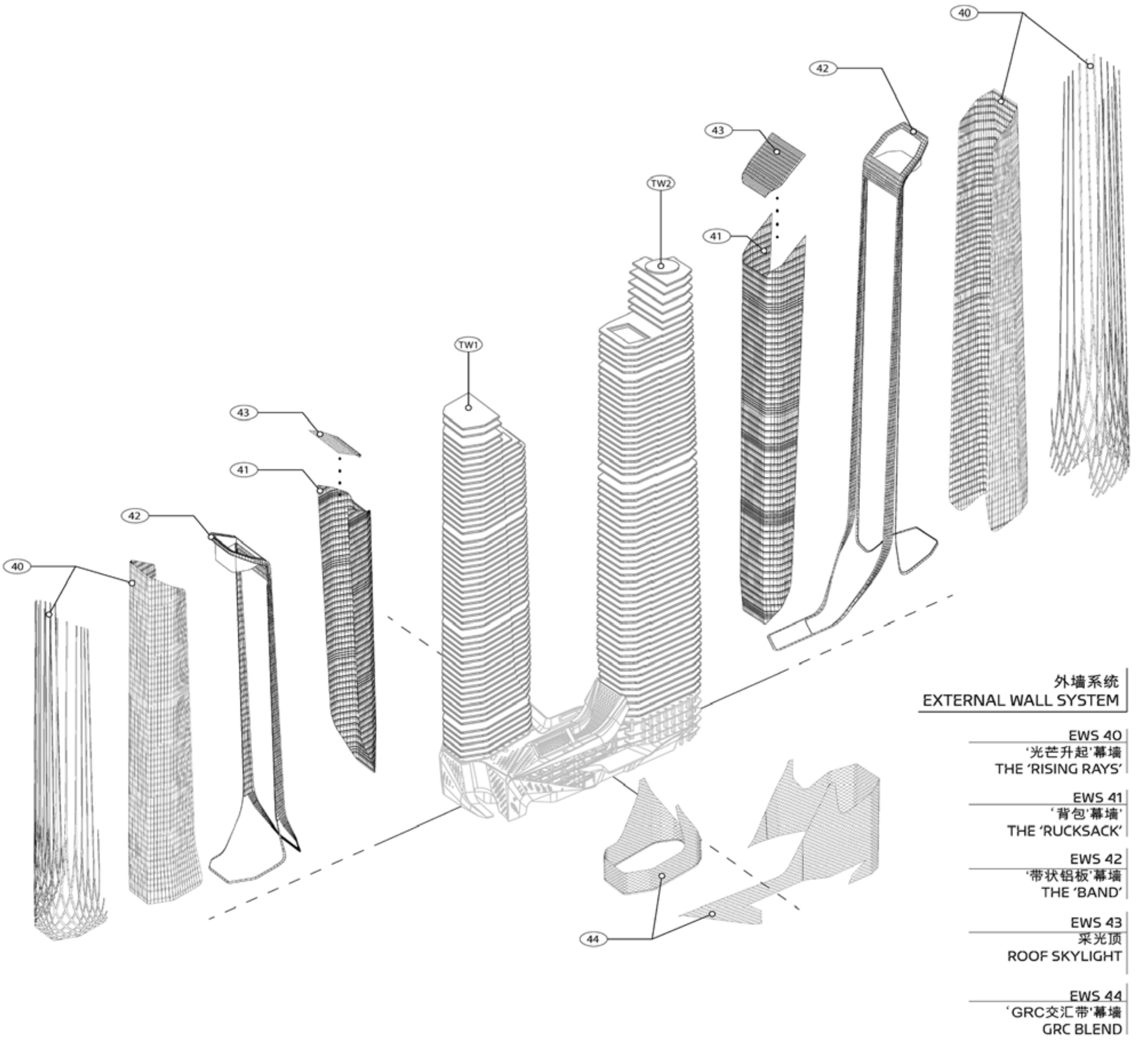
由此一来，如何实施梯形塔楼立面则成为摆在团队面前的一道难题：究竟是“切割”转角板块拼凑造型还是采用全梯形板块布置？经验证明后者才是提升建筑视觉效果的正确途径，这也同时意味着每个板块均需严格遵照塔楼整体几何造型而定。

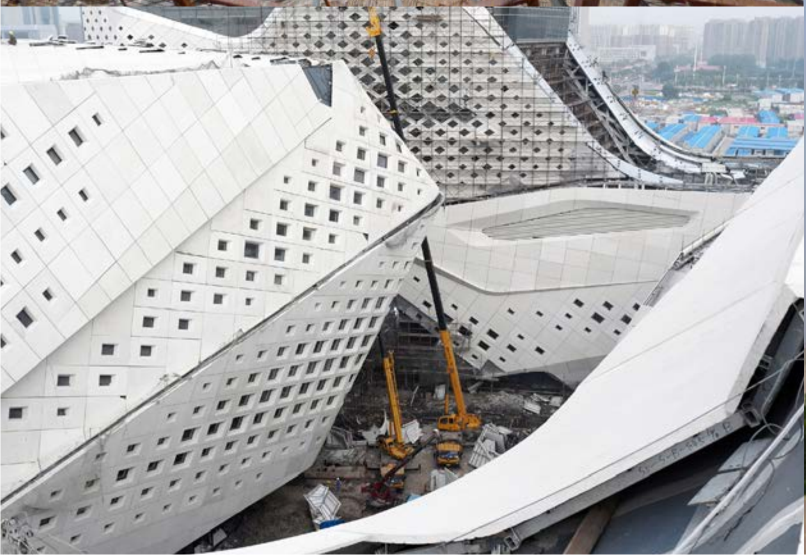
This approach allowed the architects to develop a highly complex envelope package; the conference centre consists of 12,500 3x2 meter fibre concrete panels with complex and largely non-repetitive geometries, and data generated allowed the contractors to directly feed this information into the mould making process and to deliver a steady flow of material to site. Tight integration with the contractor's production sequencing allowed the design team to partially freeze parts of the envelope for production, whilst other parts were still optimized and integrated with the engineer's primary and secondary structures.

Especially here the parametric environment became highly valuable as adjustments and negotiations between Envelope, primary, secondary and MEP systems required for numerous iterations which could be implemented quickly to achieve optimization on all levels, and full 3D co-ordination between these systems allowed for detection and prevention of clashes which at projects of this scale and complexity pose an ongoing threat to site progress.

The twin towers had a specific challenge as architecturally banking on an "enhanced perspective" effect where a tapering of the towers increases their visual standing: This lead to china's first tower with all-inclined columns, where the bottom part of the perimeter moment frame is negatively inclined to create an overhang at a roughly 70 meter "belt line level", to then gently taper inwards again to narrow out the towers at the top, creating the signature silhouette of the towers and giving them a unique standing in the Nanjing Skyline.

This presented the team with the challenge of trapezoidal tower elevations – and a choice to either "cut" panels at the corners of the tower or to go for a fully trapezoidal panel layout – the latter being the right choice to achieve the effect of an enhanced perspective, meaning each panel would have to follow the overall tower geometry.





由此需要专门开发这20,000多块造型不一的幕墙板块数据包，如果没有参数化工具将不可能实现这一过程。本项目的幕墙承包商采用了与建筑设计师一致的3D模型平台，便于建筑师直接将其生成的数据输入承包商的制备流程，从而实现这一庞大项目的“大规模定制”，因为制备参数可以直接遵循建筑师已经制定好的建筑外表皮参数，确保所有与典型矩形元件存在偏差的构件公差处于承包商生产设备的约束范围内。

参数化设计之优势在后续重新设计双塔外表皮（包括重新出具优化后的20,000块儿独特造型板块的全套施工文件）中体现得淋漓尽致：整个过程在六周内完成，既确保了施工进度，又实现了这项重要的设计变更。

此外，在参数化设计环境下，设计团队可以向制造商交付高清晰数据包，为其提供统一的细部落实细节，帮助其降低生产规划周转时间，并且可以同时与多家公司协调。鉴于该项目时间紧迫，我们将总体幕墙设计分包给了中国目前最大的两家承包商，以便提高生产效率；同时，通过对生产数据的高度统一和明确界定，也极大地降低了二者产品的差异性。

总之，参数化设计的应用贯穿了本项目的概念设计直至施工设计阶段，从而成就了众多“第一”与首创记录：该项目是中国目前最为复杂的钢结构建筑之一，中国首个采用逆施工法的项目，全倾斜式双塔结构兼具高度复杂的建筑外壳（其中包含30,000余块儿单独开发的几何造型面板），同步实施设计、工程、协调与制备，并由多家承包商同时参与工作，在破纪录的时间周期内得以成功交付。

参数化设计往往轻松地将这些看似矛盾的目标有机地融合起来： 打造地标性建筑、工程周期紧迫、树立工程复杂程度的新标杆等等；这一项目通过高效整合设计与施工制备过程，以破纪录的施工速度自豪地将这座超高层建筑力作展现于世人面前。

This created a requirement to develop datasets for more than 20,000 unique curtain wall panels – a process which without parametric tools would have been impossible to manage. The façade contractor employing the same 3D platform as the architects could directly feed the information generated into their production process, making this large-scale "mass customization" feasible as production parameters could be obeyed in the envelope generation process by the architect already, ensuring that all deviations from typical rectangular elements remained within the constraints of the contractor's production equipment.

The full benefit of the parametric design came to fruition when a full re-design the envelope of both towers including full re-issuing of construction documentation for over 20,000 unique panels was required to optimize the design: the entire process was completed within six weeks, allowing the construction schedule to stay on track whilst achieving a major design improvement.

Also, the parametric design environment allowed the design team to deliver high definition datasets to the manufacturing companies giving a consistent detail implementation and short workshop planning turnaround times despite various companies being involved; the speed of the project required to split appointments for the tower façade across two of the largest Chinese façade contractors to achieve the output necessary, and on the basis of consistent and highly defined production data co-ordination inconsistencies between them could be reduced to a minimum.

In conclusion, the application of parametric design from concept to construction allowed the team to deliver one of china's most complex streel structures to date, the first Chinese project to be built top-down / bottom-up, a twin tower with all-inclined structure and a highly complex envelope with more than 30,000 individually developed panels of complex nature, to be delivered in record-breaking time by parallelizing design, engineering, co-ordination and production processes and enabling multiple contractors to work in parallel.

项目交付策略　Project Delivery Strategy

南京国际青年文化中心，这座代表着中国国内目前最高效、最具创新特色的设计和施工解决方案的建筑，　即将向业主交付。本中心的设计充分考虑到降低采购难度，整个项目的材料采购在中国市场上较为容易。扎哈已经在中国完成交付了多个项目，深入了解在中国承接大型复杂项目的设计、招标和施工等方方面面的细节。这其中包括对建筑信息模型(BIM) 的有效利用、整合设计和施工流程以及国外设计顾问公司与中方设计单位 (LDI) 之间复杂的协作过程。

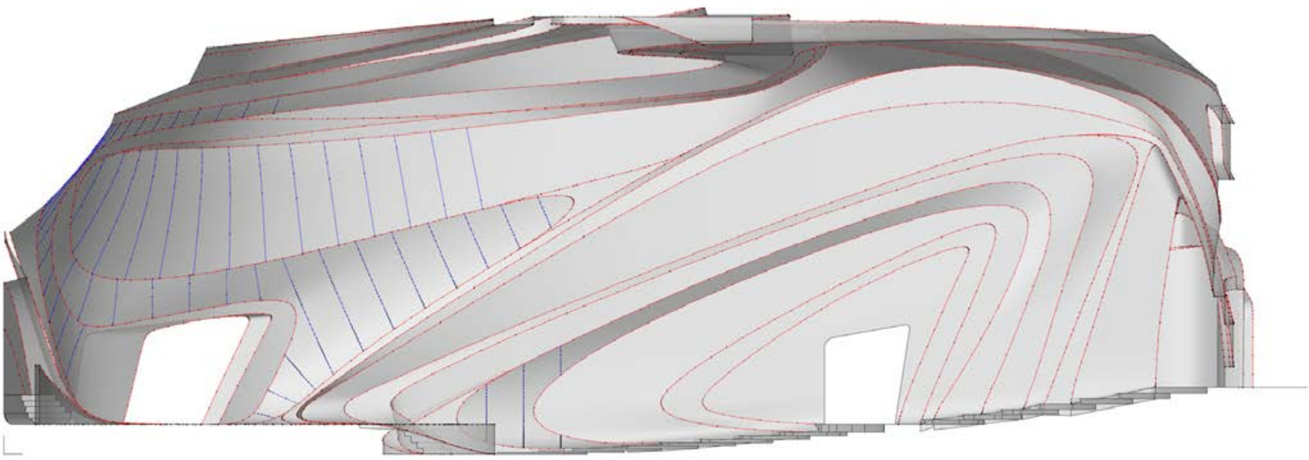
近年来，建筑信息模型（BIM）在各大规模的复杂项目中已经得到普遍实施。BIM包括关于该建筑物的3維几何信息，其中涉及所有相关的2維数据，如数量、成本和工程信息等。IPD是指对所有与生产、施工过程和设施管理等阶段相关的数字化BIM信息进行整合的过程。

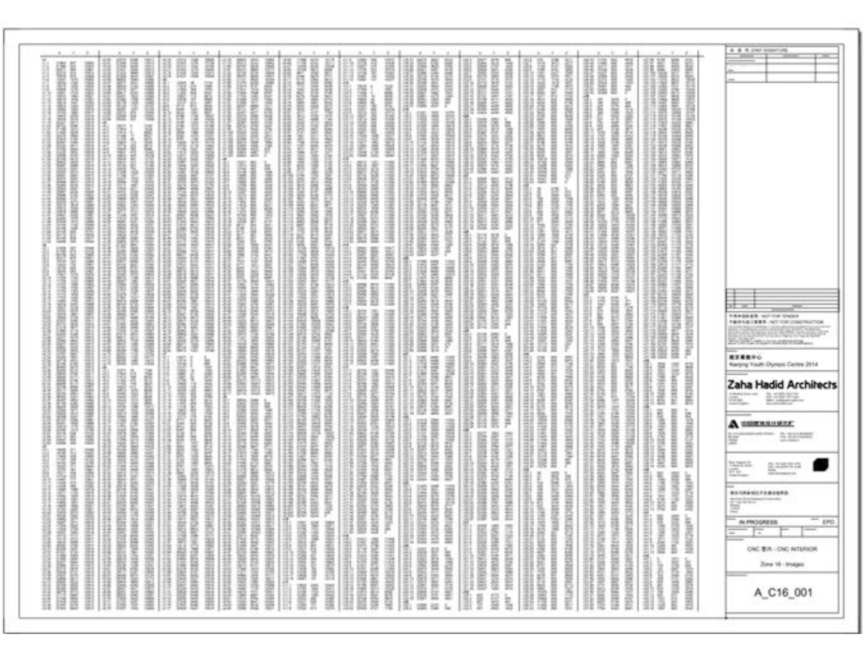
我司建议文化中心使用高质量三维模型作为规格控制、形体协调、以及文档管理的主要依据，并且纳入招标发布内容，结合图纸作为补充，从而帮助各有关方面深入、全面地了解该建筑。本项目的承包商均经过严格筛选，具备符合技术对接要求的3维模型运用能力。关注模型开发有众多好处，可以快速计算出项目几何形体建材数量，进而得出准确计价；同时也利于项目结构、机电、幕墙与室内等各专业之间建筑信息模型的充分协调，确保项目如期交付。

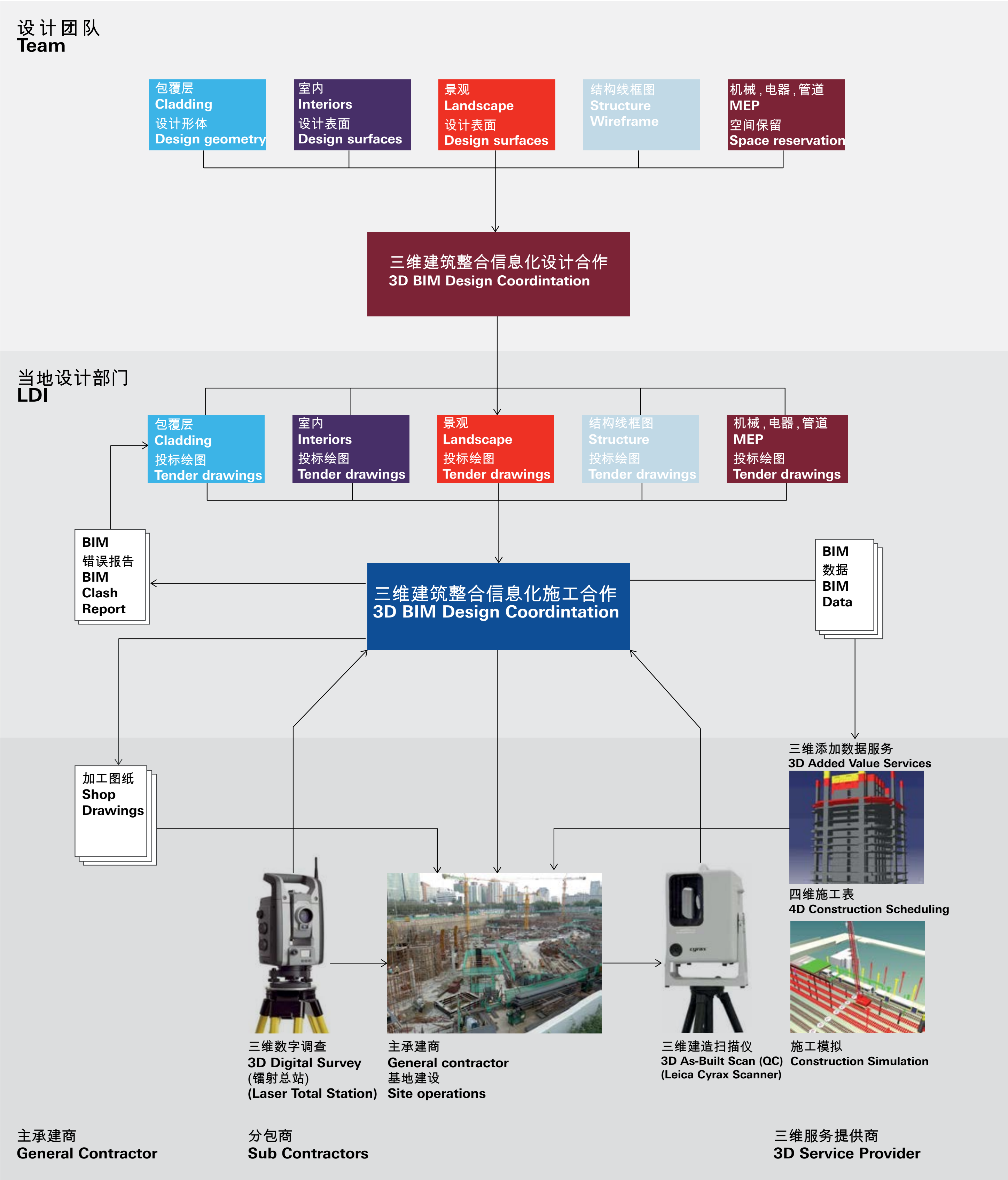
Nanjing International Youth Culture Centre is being delivered using the most effective and efficient design and construction practices available in China today. As designed, the entire project has been easily procured on the China market. ZHA has extensive experiences of project delivery in China, and understands the specifics of designing, tendering and constructing complex projects in the PRC extremely well. This includes the effective use of Building Information Modelling (BIM), integrated design and construction processes and the intricate collaboration process required between foreign design consultants and a Local Design Institute (LDI).

In recent years, the implementation of Building Information Modelling (BIM) for large-scale complex projects has become commonplace. BIM contains the 3D geometric information about the building including all of its associated 2D data such as quantity, cost and engineering information. IPD is the process that integrates all digital BIM data relating to the fabrication, construction process and facilities management phases.

NIYCC use a high-quality 3D model as the primary source of dimensional control and geometric coordination and documentation, which has been issued for tender along with supplementary 2D drawings to help the involved parties to understand the building and provide an overview of the project. Contractors have been screened for 3D capability and rejected for tender if considered of inadequate technological level. Focusing on the development of the model has many benefits, including the rapid quantification of project geometry for accurate pricing, and the overall coordination of the project for all disciplines including Structure, MEP as well as the Cladding and Interior geometry for a fully integrated, collaborative BIM process for delivering the YOC project.

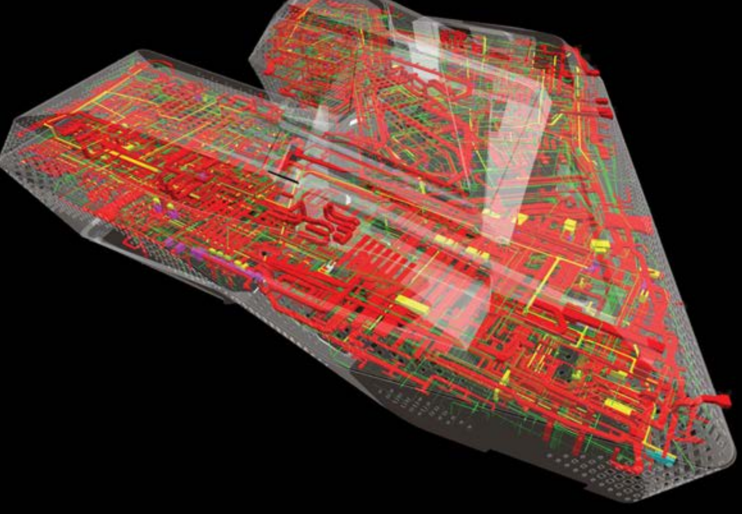


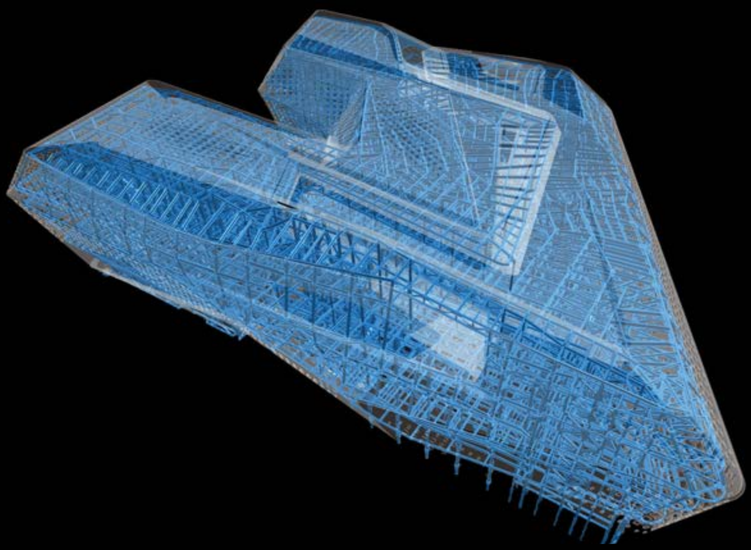


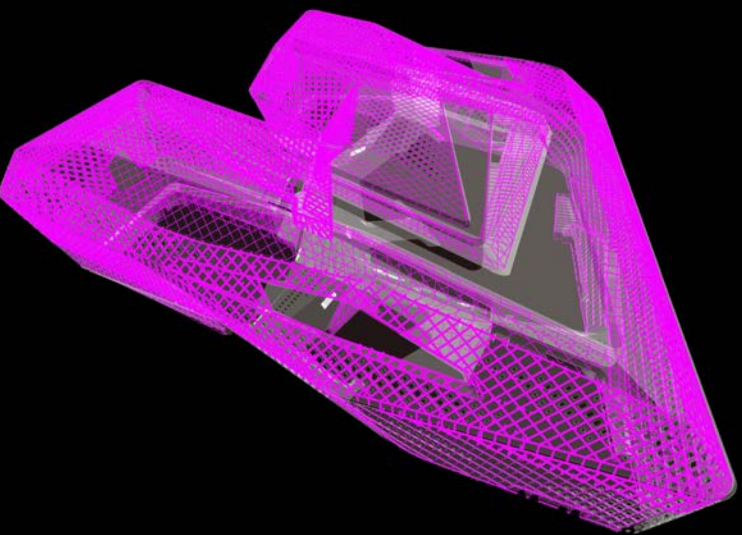


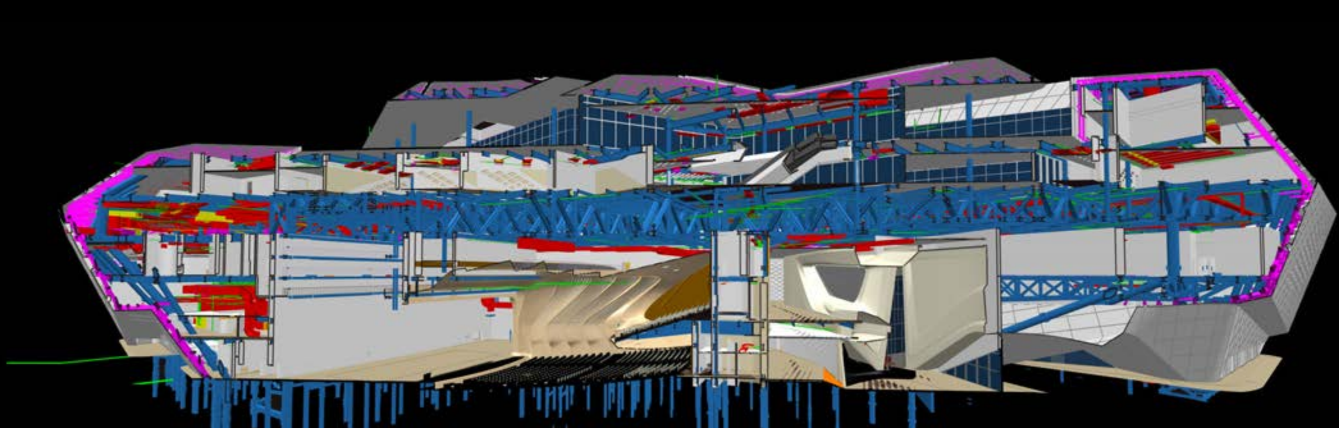
综合项目交付（IPD）
通过组织，综合项目交付系统可适应项目各种具体需求。范例展示了综合项目交付系统中建筑整合信息化各阶段过程。初期，由设计合作团队引导项目的方案设计与初步设计阶段。而后，项目将与当地设计部门作进一步合作，在施工图文件中加工图纸。在施工配合阶段，承建商可以依据基地具体情况以及客户对于建造质量的核查使用既有数据。

Integrated Project Delivery (IPD)
The Integrated Project Delivery can be organised to suit specific project requirements. This example of a distributed IPD shows a multi-stage BIM process, during which the project in the Scheme Design (SD) and Preliminary Design (DD) phases is led by the design consortium team, and then handed over to the LDI for downstream coordination and shop drawing production during Construction Documentation (CD). The contractor may subsequently use the data for on-site set-out and construction quality verification to the client during Construction Support (CS).









三维项目生命周期过程

目前，实施新技术和工程方法的趋势已经普遍渗透在建筑物的整个生命周期中——从初始设计，到协作、采购、施工，再到设施管理。

综合项目交付（IPD）在初始设计阶段就已经开始起作用，在这个阶段IPD将项目的基本信息融合到一个3維数据库中。其中包括工地几何体和现有服务、成本信息、区域信息、项目顾问团队的结构，逐渐地会有专门地"项目信息捕捉"，而该项内容是因项目而异的。通常，如果一个承包公司中经验丰富的施工咨询顾问在初始阶段就成为该团队的一员是非常有益于项目实施的。

随着项目逐渐进入设计阶段，BIM中继续增加所有关于该项目的信息。世界各地的管理机构都会朝着完全自动化、以互联网为基础、合乎规范的3維文件提交以及建筑许可执照的颁发等最终要求的方向进行。在国内，数字资料作为向政府提交文件的一部分已经越来越重要。

到招标阶段，IPD过程已经提供出了增强的协作信息、自动生成的2維施工文件、一份详细的自动工程量清单、一份初始施工日程表以及带模拟的方法论。对于与BIM完全相协调的项目，其固有风险减少，招标价格降低，进而各自分摊的成本就减少（低至1%)。

BIM模型也可以成为合同文件中的一部分。施工过程中，承包商利用BIM作为所有施工信息的中央资料库。这其中包括3維协作、供应连锁管理、成本控制、施工过程模拟与操作以及维护参考信息。项目完成后，BIM模型就转移至业主，应用于设施管理。

施工完成后，BIM资料可以连接至智能建筑管理系统（BMS）和火灾控制系统。通过使用整个系统集成，业主设施管理团队可以经网络远程对建筑设备进行监控、控制、优化和维护。同样地，建筑物信息数据库可应用于其生命周期的始末。

The 3d Project Lifecycle Process

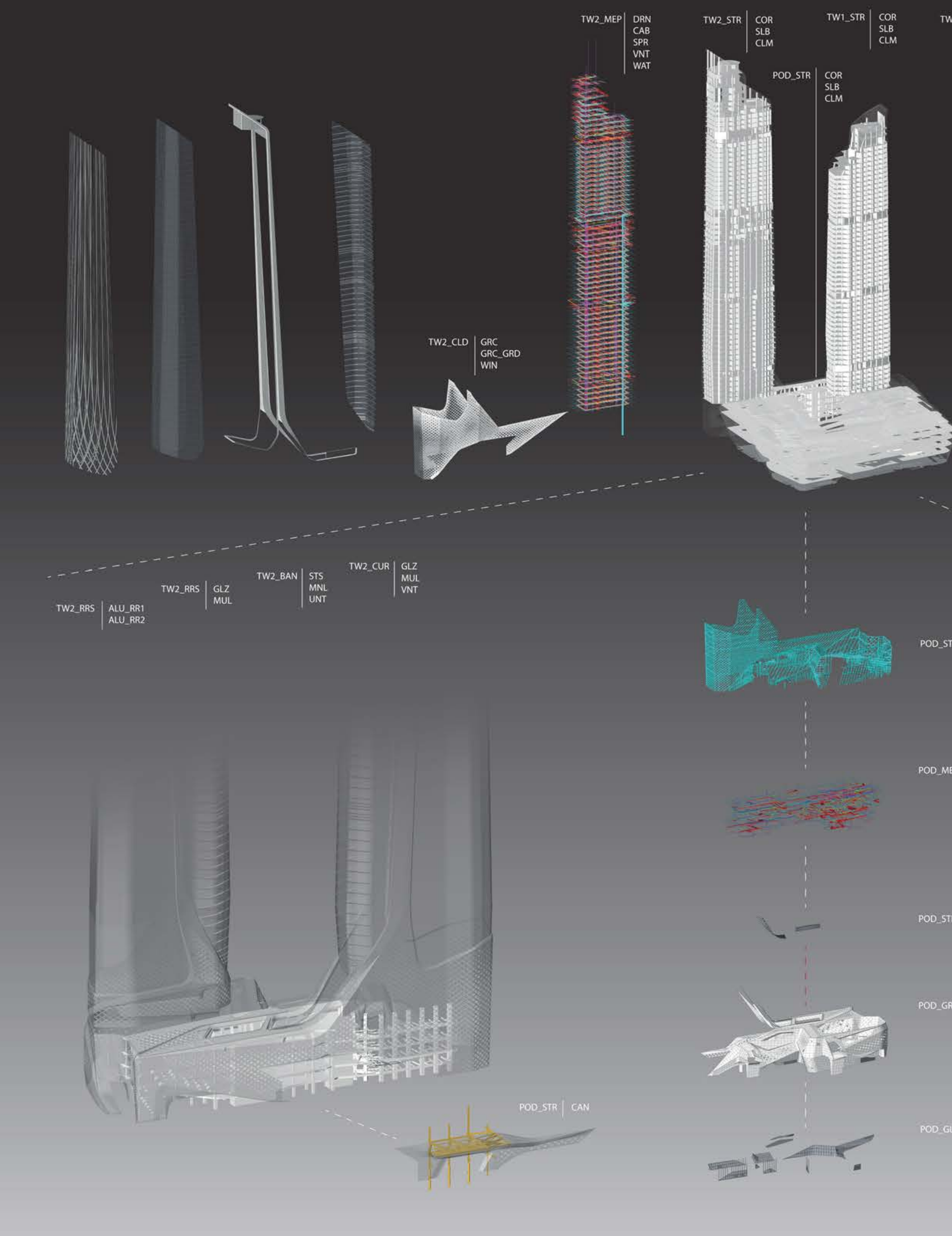
The current trend toward the implementation of new technologies and working methods is pervasive through the entire lifecycle of building – from preliminary design, through coordination, procurement, construction and into to facilities management.

IPD begins at the preliminary design stage, when the basic information about the project is integrated into one 3D data base. This may include site geometry and existing services, cost information, zoning information, the structure of the project consultant team and, increasingly, specialized "captured project knowledge," which passes from project to project. It is always beneficial to a project if an experienced construction advisor from a contracting firm is already part of the team at this preliminary stage.

As the project moves further into the design phase, all the information about the project continues to be added to the BIM. Regulatory authorities throughout the world are moving in the direction of ultimately requiring fully automated, internet-based, 3D submissions for code compliance review and the issuing of building permits. In China, the use of digital data as part of government submittals is becoming increasingly important.

By the tender stage, the IPD process has provided enhanced coordination information, automated production of 2D construction documents, a detailed automated bill of quantities and a preliminary construction schedule and methodology with simulation. Due to the reduced risk inherent to projects which have been fully coordinated with BIM, tender prices are lower, with less of a spread between them (as low as 1% of each other.)

The BIM model can also form part of the contract documents. During construction, the constructor uses the BIM as the central repository of all of the construction information. This includes 3D coordination, supply chain management, cost control, construction process simulation and operating and maintenance reference information. Upon completion of the project, the BIM model is transferred to the owner for use in facilities management. After construction, the BIM data can be connected to the Building Management System (BMS) and the fire control systems. Using this total system integration, the actual building equipment can be monitored, controlled, optimised and maintained, by the owner's facilities management team – remotely over the internet. In this way, the same building information database is used from the start to the end of the life of the building.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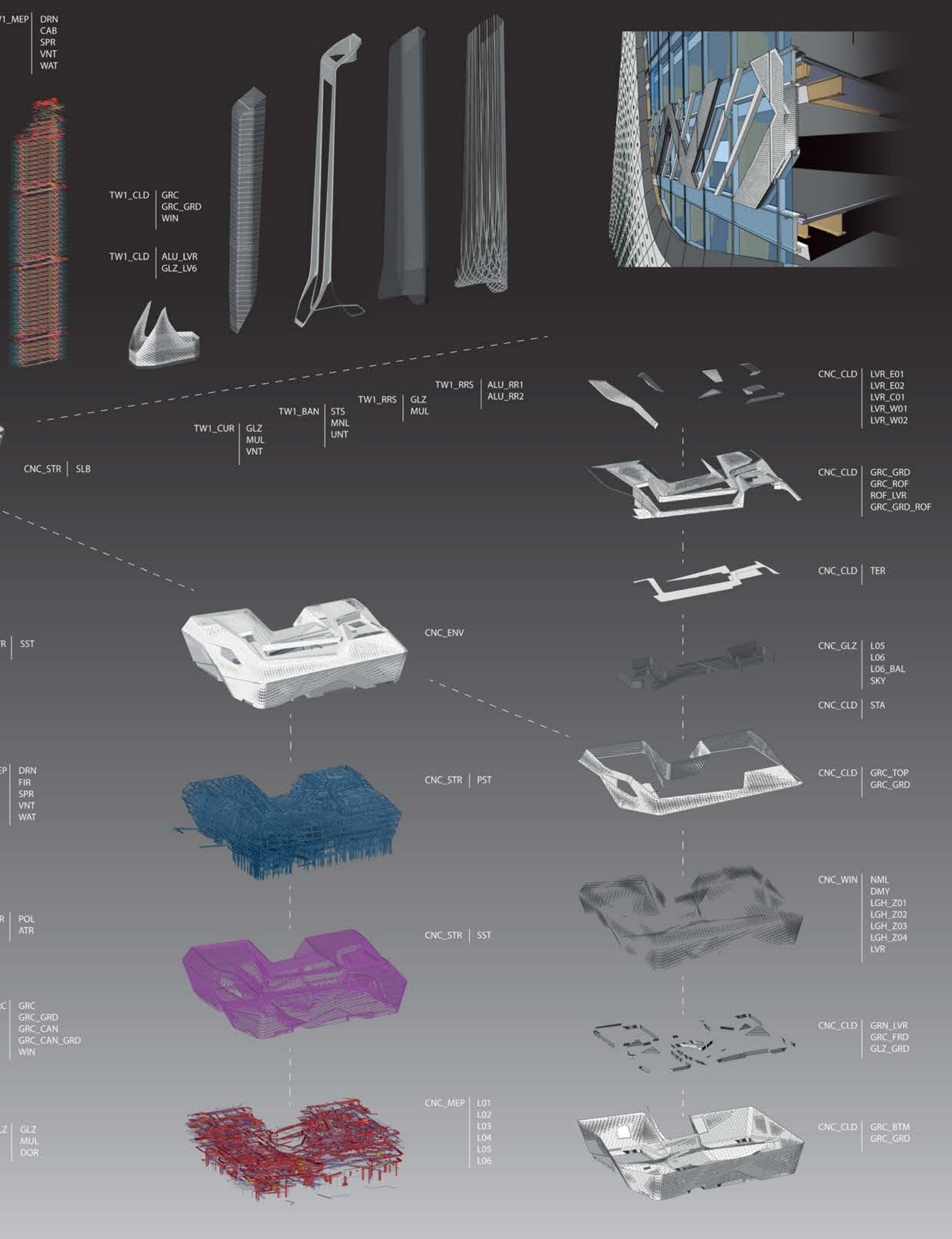

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TW1_CUR | GLZ MUL VNT
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WIN
CNC_MEP | L01 L02 L03 L04 L05 L06
GLZ
MUL
DOR
CNC_CLD | LVR_E01 LVR_E02 LVR_C01 LVR_W01 LVR_W02
CNC_CLD | GRC_GRD GRC_ROF ROF_LVR GRC_GRD_ROF
CNC_CLD | TER
CNC_GLZ | L05 L06 L06_BAL SKY
CNC_CLD | STA
CNC_CLD | GRC_TOP GRC_GRD
CNC_WIN | NML DMY LGH_Z01 LGH_Z02 LGH_Z03 LGH_Z04 LVR
CNC_CLD | GRN_LVR GRC_FRD GLZ_GRD
CNC_CLD | GRC_BTM GRC_GRD

施工数据　Construction Facts

定制加工超过20,000件钢结构原件；
More than 20,000 customized steel members;

玻璃纤维增强水泥(GRC)板幕墙面积创中国国内项目新最；
Largest GRC project in China: more than 12,000 GRC panels have been fabricated;

中国首例采用全面逆施工法建造之建筑；
First completely bottom-up/top-down tower construction in China;

717个钻孔桩柱在6个月内完成; 总计6, 325根桩柱，总量的一半以上是钢桩;
717 drilled piles completed in 6 months; 6,325 piles in total and more than half are steel piles;

桩柱最大直径达3米; 最深可达地下90米;
The diameter of the largest piles is 3 meter; the deepest piles reach below minus 90 meter;

4个月内完成541米地下连续墙施工；　最深处可达地下50米;
541 meter diaphragm wall construction completed in 4 months; the deepest part reaches below minus 50 meter;

1个月内完成80,000平方米地下B01开挖；
80,000 m^2 B01 excavation completed in 1 month;

一年之内完成塔楼地下水泥板，与此同时，塔楼地面以上已经高达17层；
Tower basement concrete slabs complete whilst Tower level reaches L17 in 1 year.


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